

The 8<sup>th</sup> General Conference of Balkan Physical Union,

Constanta, Romania  
July 5-7, 2012

# **Book of Abstracts**

**Editors:**

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ExPonto Press,  
Constanta, 2012

ISBN: 978-606-598-181-2

*Technical editing: Iuliana M. Stanescu*



8<sup>th</sup> BPU, the 8<sup>th</sup> General Conference of Balkan Physical Union,  
5-7 July 2012

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## I01

### Magnetic and Resistive Properties of Manganese Perovskites

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The  $\text{La}_{1-x}\text{Pb}_x\text{MnO}_3$  perovskites with  $0.24 = x = 0.40$  crystallize in a rhombohedral structure having  $5^2F$  space group. The saturation magnetizations, at 4.2 K, increase as the Pb content is higher. A gradual transition from spin glass to ferromagnetic ordering was shown when increasing lead content. The resistivities increase with temperature and a metallic to semiconducting transition is shown at temperature smaller than the Curie points. The temperature and field dependences of the magnetoresistivities were analysed considering the intergrain as well intragrain contributions. The spin polarizations, at 4.2 K, increase from 0.75 ( $x=0.24$ ) to 0.86 ( $x = 0.40$ ). The resistive properties were analysed considering the contributions of double exchange, small polarons and Jahn-Teller distortions, in addition to thermally driven reorientation of Mn spins, at temperatures lower than the Curie points.

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## I02

### BALKAN COUNTRIES PRESENCE IN SCIENCE CITATION INDEX AND SCOPUS IN THE FIELDS OF PHYSICS AND CHEMISTRY

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We examine the research output from the Balkan Countries in the fields of physics and chemistry registered in the databases of Science Citation Index and SCOPUS for the years 1996-2010. Over the years, the relative contribution from the area has increased on average by approximately 50% and has reached almost 4% of the world overall production. However, the diversity of the Balkan peninsula is also reflected in the performance of individual countries. Although each of them shows growth in absolute terms, relative downturn is evident in several cases. Data are provided about cooperation among Balkan countries.

Key words: Physics and chemistry publications, Balkan countries, scientometrics

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**I03****Vibronic spectra of Frenkel excitons in a two-dimensional simple lattice**

I. J. Lalov and I. Zhelyazkov

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Vibronic spectra of Frenkel excitons (Fes) in a two-dimensional (2D) lattice with one molecule per unit cell have been considered and their manifestation in the linear absorption has been simulated. We use the Green function formalism, the vibronic approach (see Lalov & Zhelyazkov, *Phys. Rev B* **75** (2007) 245435, doi: 10.1103/PhysRevB.75.245435), and nearest-neighbor approximation for treating two types of Frenkel excitons: (i) non-degenerate FEs and (ii) degenerate FEs whose transition dipole moments are parallel to the layer plane. We find expressions of the linear optical susceptibility using complete elliptic integrals of the first kind. The linear absorption coefficient has been calculated for the following 2D models: (a) vibronic spectra of polyacenes (naphthalene, anthracene, tetracene) and (b) vibronic spectra of a simple hexagonal lattice. Two types of vibronic states manifest themselves in the linear absorption, notably many-particle exciton-phonon states and one-particle states. The two mechanisms of exciton-phonon coupling (linear and quadratic coupling) exhibit in a cumulative or a competitive action.

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**I04****LIQUID CRYSTALS IN THE BIOLOGY AND MEDICINE**

Alexander G. Petrov

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In this talk the following points will be addressed:

- ? Liquid crystals: definition
- ? Thermotropic and lyotropic liquid crystals
- ? Cholesteric LC thermography
- ? Liquid crystals in the living matter: biological membranes
- ? Application of liquid crystal structures from amphiphilic molecules
- ? Magnetic nanoparticles for the medicine coated by amphiphile liquid crystals
- ? Decoration of biological objects by means of liquid crystals

Results of the author as well as a review of the literature will be reported.

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**I05**

## **DOSE OF EXPOSURE TO BE IN MAMMOGRAPHY**

Drilona Kishta, Antoneta Deda, Krenar Preza

*Head of Protection from Ionizing Radiation, University Hospital Centre "Mother Teresa" Tirane Albania, [drilonakishta@yahoo.com](mailto:drilonakishta@yahoo.com), University Hospital Centre "Mother Teresa" Tirane Albania*

The last years, mostly lobby for mandatory controls (mamaografia) After age 35 years in time to catch breast tumors are statistically Higher Increase That Rhyme .. object is to study the topic ketsaj skin Doses Different patients receiving two digital devices and even a link Between These dosage staff working with devices. For this topic are taken into 25 two digital devices Cases of Different Types, Where images are taken with the Same Parameters. Likewise, the Doses of Radiation That These devices give us the Same Conditions Was Done by Means of PMMA dosimeter Same and That Which is Made Possible comparison of Doses Between the two devices, Which Values are compared with reference published by IEAE and ESTRO. Comparison of Dosës demonstration of These devices not That Every digital device delivers a low dose and a good image. As a result of this comparison reached the conclusion That if the Patient dose is due to the great staff That Will Be high on Care Must Be Taken in Selecting the ordinance diagnostic X-ray and mammography in particular, a diagnosis is required That After age 35 . Given the diagnostic protocolls in the dose Which Should be limited to the image taken Suggest tell you to use Caution in certified Metering.

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**I06**

## **High Power Laser Beam Interaction with Materials for Thermonuclear Applications**

C. P. Lungu<sup>1</sup>, C. Porosnicu<sup>2</sup>, D. Ursescu<sup>1</sup>, R. Banici<sup>1</sup>, C. Luculescu<sup>1</sup>, A. Marcu<sup>1</sup>, R. Vladiu<sup>2</sup>,  
A. Marin<sup>3</sup>, P. Osiceanu<sup>3</sup>, I. Feraru<sup>4</sup>, C. Grigorescu<sup>4</sup>

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Materials foresee to be used on the first wall of the fusion reactor (Be, C, W) deposited as thin films on graphite and silicon substrates were deposited from pure vapour plasma produced by the Thermionic Vacuum Arc (TVA) method The samples were irradiated with single or multiple terawatt laser beam pulses programmed to have durations of pico or femtoseconds, in order to obtain duration and power densities compared to the thermonuclear plasma instabilities.

Surface roughness, atomic composition and chemical bonds of atoms at the surface and inside the deposited films were analysed for different substrate positions of the samples. X-ray photoelectron spectroscopy analyses (XPS) have suggested tungsten-carbide formation.

The plasma produced by the laser breakdown was studied using VUV and visible spectroscopy and the irradiated films were characterized using transmission electron microscopy (TEM), scanning electron microscopy (SEM), XPS and Raman spectroscopy.

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**I07****Rare nuclear event research in small laboratories**

I. Bikit, K. Bikit

Nowadays, many scientists believe that maximum energies that can be achieved using modern accelerators are not sufficiently high to enable the discovery of new physical phenomena beyond the Standard Model. Thus, the search for processes beyond the Standard Model is partly focused on rare spontaneous nuclear decays. Large scale underground laboratories are developed and they search for so far unregistered new processes that can break the Standard Model. In this way, physics of rare nuclear processes is getting a more significant role in the development of modern physics. Rare nuclear event research in our laboratories shows that this area of research is open even for smaller laboratories, without exclusive locations deep below ground surface, and exceptionally expensive, specially constructed, detection systems. Some examples of rare nuclear event research performed in our laboratories will be presented in this paper.

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**I08****A possible electromagnetic origin for dark energy, dark matter and the Newton gravitational constant**

Metin Arik

*Bogazici University*

In a Brans-Dicke-Jordan type of gravitational theory where the Jordan scalar field is related to the norm of the electromagnetic potential it is possible to explain dark energy, dark matter and the Newton gravitational constant in terms of the cosmological background value of the electromagnetic scalar potential. Advantages and shortcomings of such a model will be discussed in relation to Type I supernovae data, time variation of the gravitational constant and possible relation to the Standard Model.

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**I09****Ferroelectric transition and peculiar relaxation of pure TGS crystals**

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The ferroelectric crystals triglycine sulphate undergoes a typical second order transition, of order-disorder type. A peculiar instability of both components of permittivity appears in the ferroelectric phase, crossing up and down the Curie Point (C.P.~49 °C). The ferroelectric domains, which were erased in the paraelectric phase, appear again in ferro phase, immediately after crossing down the CP. At the first moment, there appear a huge number of minute domains, nucleated on several charged defects in the lattice. These domains coagulate, having a long period of relaxation (more than one week). On the other hand, it was estimated that about 80% of the dielectric constant value is related with the ferroelectric domain walls oscillation. The complicated ferroelectric domains evolution apparently makes unpredictable the temperature dependence of the dielectric constant, during this relaxation period.

Dielectric dispersion of pure TGS crystal was investigated on a large frequency range of 1 Hz ? 10 MHz and on the temperature range -120 to +65 °C, crossing up and then down the Curie Point. Samples of ~1 mm thick and ~0.5 cm<sup>2</sup> surface, cleaved from TGS crystals grown in paraelectric phase, by slow solvent evaporation (54 Celsius), have been used. Samples were polished and silver electrodes were painted.

Two type of ferroelectric relaxation, were found in Cole-Cole representations. The higher frequency relaxation time  $\tau_H = (3-4) \cdot 10^{-7}$  seconds is almost constant on -40 / +45 °C temperature range. This relaxation related to “the critical slowing down” mechanism, reflect a long distance order in the lattice, which is not affected by the thermal energy (it has non-Arrhenius temperature dependence). The lower frequency relaxation ( $\tau_L \sim 10^{-3}$  sec) is related with ferroelectric domain cropping and has an important thermal evolution, with the activation energy of 0.7 eV (~28 k<sub>B</sub>T).

An unusual mid frequency relaxation time of  $\tau_M \sim 10^{-5}$  seconds, was clearly discerned in some temperature range of the ferroelectric phase. However, this middle relaxation mechanism do not appears to have a specific physical support and was clearly evidenced for the first time in the literature. Other peculiar effect evidenced by the dielectric spectroscopy on the frequency range 1 Hz-10 MHz (seven orders of magnitude) shall be presented on a large temperature range, in the ferroelectric range.

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## I10

### GLASS FORMING RANGES IN TERNARY METALLIC SYSTEMS CALCULATED USING SEMI-EMPIRICAL MODELS

Z. Sniadecki, J. W. Narojczyk, B. Idzikowski

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A method based on the semi-empirical Miedema's and geometric model was used to calculate the glass forming ranges (GFR) and glass forming abilities (GFA) in ternary rare earth based systems and its sub-binaries. The formation enthalpies of amorphous alloys, of their crystalline (solid solution) counterparts and the difference between both energies were calculated, as well as the

normalized entropy change  $\frac{S_2}{k_B}$ , and the  $P_{HS}$  parameter, which takes into account both, the enthalpy and entropy. Both mentioned parameters indicate the stoichiometric ranges with the highest GFA [1].

Results of calculations are the basis for further experimental works concerning synthesis of metallic glasses. Structural and magnetic properties of different rare earth-transition metal amorphous and annealed alloys were also investigated. For instance, latest results evidenced the cluster-spin-glass behavior in pseudo-ternary Dy-(Mn,Ge)<sub>6</sub>-(Fe,Al)<sub>6</sub> alloys [2]. It was found also that the presence of YCu nanocrystallites in the amorphous matrix enhances the elastic moduli values. The amorphous and two-phase composite Y<sub>50</sub>Cu<sub>42</sub>Al<sub>8</sub> forms are, like the YCu single crystal, non-brittle materials [3].

In view of possible applications it is compelling to discover alloys with new compositions of a high GFA. This parameter is crucial for bulk metallic glasses (BMGs), which gain increasing interest due to the outstanding combination of properties e.g. ductility, wear or corrosion resistance.

[1] Z. Sniadecki, J.W. Narojczyk, B. Idzikowski „*Calculation of glass forming ranges in the ternary Y-Cu-Al system and its sub-binaries based on geometric and Miedema's models*”, *Intermetallics* **26** (2012) 72

[2] Z. Sniadecki, J.-M. Grenèche, B. Idzikowski „*Mictomagnetic behavior of structurally disordered melt-spun DyMn<sub>6-x</sub>Ge<sub>6-x</sub>Fe<sub>x</sub>Al<sub>x</sub> (0 = x = 6) alloys*”, *J. Appl. Phys.* **109** (2011) 123921

[3] B. Idzikowski, S. Mielcarek, P. Misiuna, Z. Sniadecki, A.C. Branka „*Mechanical properties of amorphous and partly crystallized Y<sub>50</sub>Cu<sub>42</sub>Al<sub>8</sub> alloys*”, *Intermetallics* **21** (2012) 75-79

## I11

### Studies on Ancient Gold Metallurgy using micro-PIXE and micro-SR-XRF - A Survey

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In ancient times - and until the Middle Age, placer deposits were the most important gold source. Panned occurring gold contains several impurities as quartz, cassiterite, chalcopyrite, pyrite. For the authentication of ancient gold artefacts (jewellery and coins) found on Romanian territory, the most likely use of Transylvanian unrefined gold must be considered.

We present the analysis of 40 micro-samples (1-2 mg) from most famous Dacian gold items: “Koson”-type staters and spiraled bracelets recuperated between 2006 and 2011 by Romanian authorities from the international market of antiquities, performed by micro-PIXE at AGLAE accelerator, Paris, and by micro-SR-XRF at BESSY Synchrotron, Berlin. Their elemental compositions featuring relatively large amounts of silver (10% on average) and small amounts of copper (1% on average), fit the pattern for native gold, which contains up to 40% silver and up to 1% copper, indicating there was no intention to refine the employed gold. Moreover, each analyzed item showed a rather inhomogeneous composition. An explanation for this relative inhomogeneity

of the ingot can be given through the fact that the manufacturers were not using an advanced technology: most likely, a mixture of gold nuggets and gold dust was melted down without being perfectly homogenized. Both cold working and sintering of gold concentrates are expected to conserve in the final product many mechanical impurities, like isolated minerals and inclusions. Traces of tin were observed in practically all the items. The explanation for this phenomenon is the following: cassiterite ( $\text{SnO}_2$ ) and gold can simultaneously occur in the same vein or placer deposit. Despite all possible precautions taken during gold panning in ancient times, some cassiterite grains could still be found in gold-rich concentrates. When such a naturally occurring gold-rich concentrate was melted in a reducing atmosphere, the cassiterite was reduced to metallic tin, which entered into liquid primary gold phase. Copper concentration in artefacts is higher than in Transylvanian native gold, related to the presence of accompanying gold minerals in gold dust and nuggets - e.g. chalcopyrite ( $\text{CuFeS}_2$ ) "fool's gold" and pyrite ( $\text{FeS}$ ) - due to probably confusion made by Dacian "miners" and to the primitive processing of the raw material.

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## **II2**

### **From Supermassive to Massive Black Holes**

Micic Miroslav, Martinovic Nemanja

*AOB*

It has been firmly established that massive galaxies host supermassive black holes (SMBH) at their centers. This is the consequence of the structure formation in the framework of LCDM universe where galaxy mergers trigger dynamical processes which combine black hole seeds into binaries. Through consecutive episodes of gas accretion and mergers, black holes at the centers of massive stellar systems (e.g. elliptical galaxies) grow to be extremely massive (million - billion solar masses). These are supermassive black holes (SMBH). Meanwhile, entire populations of lower mass massive black holes (less than million solar masses: MBH) are formed in lower density regions and smaller galactic systems, usually in the outskirts of galaxy clusters. Typical representative of such environment is the Local Group of galaxies which consists of spiral and dwarf galaxies mostly. Since they are hard to observe, MBH populations are usually theoretically predicted, either by analytical or numerical simulations. At the same time, we live in the part of the Universe heavily populated with MBHs, giving us an unique opportunity to observe them with the future ground and space telescopes. We classify MBHs into three major populations: central, rogue, and ejected. Central: In massive elliptical galaxies properties of the central SMBH are closely related to the properties of the stellar spheroid. This is a direct consequence of the AGN feedback which stops the black hole growth by pushing the gas away from the galactic center. Stars formed or moved along during this process carry the information about the SMBH properties in their velocity profiles. In this manner, SMBH mass is tied to the velocity dispersion of the stars that make the stellar spheroid ( $M - \sigma$  relation). In a less violent smaller systems (bulgeless spiral or dwarf galaxies) star formation might outcompete the black hole gas accretion as they are "fighting" for the same gas reservoir, which leaves a large uncertainty in the mass of the central black hole. The uncertainty is even larger due to gravitational wave recoil which follows the black hole mergers at the galactic centers. The low gravitational potential of these galaxies might not retain the central

black hole after the kick. As the result, a population of Kicked MBHs might form. These MBHs are expected to wander through galactic halos or inter galactic medium (IGM). Those that stay inside the host galaxy will join the population of Rogue MBHs which are the remnants of "failed" galaxy mergers (when the incoming galaxy disperses as its tidally stripped by the host potential). We investigate possible mechanisms for the formation of rogue, kicked, central MBH in the Local Group, and the formation of 4.2 million solar mass black hole behind the Sgr A\* source at the center of our Galaxy. We use merger trees from a cosmological N-body simulation known as Via Lactea 2 (VL-2) as a framework for merger-driven, semi-analytic recipes for black hole growth that include dynamical friction, tidal stripping and gravitational wave recoil in over 20 000 merger tree realizations. We present results on the possible ways of creating SgrA\*, distributions of various MBH populations, and the contribution of massive black hole binaries to the growth of Sgr A\* over Hubble time.

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**I13****Spontaneous Magnetization and Free Energy of O(3) Heisenberg Ferromagnet in Lattice Regularized Effective Field Theory**

Radosevic Slobodan, Pavkov Hrvojevic Milica, Pantic Milan, Kapor Darko

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An effective Hamiltonian for the lattice magnon fields is obtained, starting from the effective Lagrangian for a D-dimensional O(3) ferromagnet. Two dominant contributions that describe magnon-magnon interactions are identified as a usual gradient term for the unit vector field and a contribution originating in the topological term of effective Lagrangian. By calculating one-loop correction to the magnon propagator, correction of order  $T^4$  in low-temperature expansion of the order parameter is obtained. Free energy of interacting lattice magnons is found and a comparison with existing continuous field theoretical calculations is given. Analysis of the free energy of Heisenberg ferromagnet showed that spurious  $T^3$  term in the low-temperature expansion of spontaneous magnetization is consequence of explicit violation of internal O(3) symmetry of the system.

ACKNOWLEDGMENTS This work was supported by research Grants No. 171009 from the Ministry of Education and of the Republic of Serbia.

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**I14****Rapidly solidified amorphous nanowires and submicron wires**

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Ferromagnetic nanowires are aimed for novel spintronic applications such as racetrack memory, magnetic domain wall logic devices, domain wall diodes and oscillators, and devices based on field driven domain wall motion. These applications require nanowires with characteristics that can be accurately controlled and tailored, and with large domain wall velocities, since the device speed depends on domain wall velocity.

Recently, the large values of domain wall velocity reported in amorphous glass-coated microwires have offered new prospects for the use of these much cheaper rapidly solidified materials in spintronic applications, subject to a significant reduction in their diameter. The amorphous nanowires are composite materials consisting of a metallic nucleus embedded in a glass coating prepared in a single stage process, the glass-coated melt spinning, at sample lengths of the order of  $10^4$  m. In order to overcome the experimental difficulties related to the fabrication of such ultra-thin wires and to drastically reduce the typical transverse dimensions of microwires (1 to 50  $\mu$ m for the metallic nucleus diameter), the apparatus used for the preparation of the rapidly solidified nanowires has been significantly modified. These efforts have led to the successful preparation and characterization of rapidly solidified submicron wires with the metallic nucleus diameter of 800 nm, reported less than 2 years ago [1]. These results have opened up the opportunity to develop nanosized rapidly solidified amorphous magnetic materials for applications based on the domain wall motion.

This first success has been shortly followed by the preparation and characterization of amorphous glass-coated submicron wires with metallic nucleus diameters down to 350 nm [2], in which domain wall velocity measurements have also shown very promising results [3].

Following the same path, we have been able to produce rapidly solidified amorphous nanowires through an improved technique. The diameters of the as-quenched nanowires were ranging from 90 to 180 nm [4]. A new method for measuring the domain wall velocity in a single, ultrathin ferromagnetic amorphous wire with the diameter down to 100 nm has been developed in order to measure such novel nanowires

Besides the spintronic applications, the investigation of rapidly solidified amorphous submicron wires and nanowires is aimed towards the understanding of the changes in the magnetic domain structure, which makes the bistable behavior possible, and in the switching field, at submicron level and at nanoscale.

#### References:

- [1] H. Chiriac, S. Corodeanu, M. Lostun, G. Ababei, and T.-A. Óvári, "Magnetic behavior of rapidly quenched submicron amorphous wires," *J. Appl. Phys.* 107, 09A301 (2010).
  - [2] H. Chiriac, M. Lostun, G. Ababei, and T.-A. Óvári, "Comparative study of the magnetic properties of positive and nearly zero magnetostrictive submicron amorphous wires," *J. Appl. Phys.* 109, 07B501 (2011).
  - [3] T.-A. Óvári, S. Corodeanu, and H. Chiriac, "Domain wall velocity in submicron amorphous wires," *J. Appl. Phys.* 109, 07D502 (2011).
  - [4] H. Chiriac, S. Corodeanu, M. Lostun, G. Stoian, G. Ababei, and T.-A. Óvári, "Rapidly solidified amorphous nanowires," *J. Appl. Phys.* 109, 063902 (2011).
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**I15****Thermal Properties of Coiled Carbon Nanotubes**

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As has been shown that carbon nanotube array thermal interface conducts several times more heat than conventional thermal interface materials, carbon nanotubes are promising candidates for commercial applications within miniature cooling technologies and therefore understanding their thermal properties is essential for the future applications.

Here, coefficients of thermal expansion and thermal conductivity in helically coiled carbon nanotubes are calculated and the results obtained are compared to those for straight carbon nanotubes. The study is based on molecular dynamic. The Brenner inter-atomic potential for carbon is used.

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**I16****MAGNETO-THERMOELECTRIC EFFECTS IN MAGNETIC FLUIDS**

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The thermoelectric effects in magnetic fluids are presented and particular attention is devoted to the Seebeck effect and thermal conductivity, both in the presence and in the absence of the magnetic field. For measurements we have used two magnetic fluids with magnetite particles dispersed in kerosene (sample A) and in water, respectively (sample B).

For both samples, we have analyzed the magnetic field effect on the Seebeck coefficient  $S$ , on the thermal conductivity  $\kappa$ , on the electrical conductivity,  $\sigma$  and on the thermoelectric figure of merit ( $ZT$ ).

Preliminary results suggest that these materials are potential candidates for incorporation into advanced thermoelectric devices used in energy recovery applications.

**Keywords:** Magnetic fluids, Seebeck coefficient, thermal conductivity.

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**I17****Properties of SiC and TiC nanostructured thin films growth by Thermionic Vacuum Method**

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In this work, we have explored the properties of titanium and silicon carbide thin films deposited by TVA (Thermionic Vacuum Arc) method of TiC powder and SiC grains as an alternative to other conventional deposition techniques (sputtering, CVD, etc.).

Thermionic Vacuum Arc (TVA) is an externally heated cathode arc which can be established in high vacuum condition, in vapors of the anode material. The arc is ignited between a heated cathode provided with a Wehnelt cylinder and the anode which is a crucible containing the material to be evaporated. Moreover, the discharge can be ignited in high vacuum condition, ensuring high purity and deposition of hydrogen free carbon based thin films.

Titanium carbide is one of the most commonly used industrial coating materials in many tribological applications because of its outstanding wear resistance, high hardness, high strength and rigidity, good stability at high temperatures and low friction coefficient.

Silicon carbide (SiC) is an important non-oxide ceramic which has several industrial applications. In fact, it has exclusive properties such as high hardness and strength, chemical and thermal stability, high melting point, oxidation resistance and high erosion resistance. All of these qualities make SiC a perfect candidate for high power, high temperature electronic devices as well as abrasion and cutting applications.

Characterization of the obtained titanium and silicon carbide thin films has been made by Transmission Electron Microscope (TEM) with high resolution (1,4 Å) and Atomic Force Microscopy (AFM). The AFM measurements have proved the smoothness of the deposited films with peak to valley roughness in the range of 31-38 nm.

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## I18

### MODELING OF CRYSTAL FIELD PARAMETERS AND SIMULATION ENERGY LEVELS SCHEME FOR (Na,Li)CrSi<sub>2</sub>O<sub>6</sub> CLINOPYROXENES

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In the present paper detailed and consistent crystal field analysis of the (Na,Li)CrSi<sub>2</sub>O<sub>6</sub> clinopyroxenes absorption spectrum is performed at normal pressure. We modeled the crystal field parameters in the frame of exchange charge model [1], taken into account the effect of the charge of ligands and covalence bonding between Cr and oxygen anions, in the cluster approach. Using the crystal structure, with low site symmetry of chromium ions and overlap integrals between wave functions of the Cr<sup>3+</sup> ions and oxygen ligands, we calculate the crystal field

parameters in the crystallographic axes system. With the obtained values we simulate the scheme of energy levels of  $\text{Cr}^{3+}$  ions by diagonalizing the Hamiltonian of the crystals. The obtained energy levels and estimated Racah parameters  $B$  and  $C$  were compared with the recent experimental spectroscopic data [2]. Good agreement was demonstrated which justifies the model and simulation scheme used for the minerals systems.

**Keywords:** clinopyroxenes, exchange charge model, energy levels.

#### References

- [1]. B.Z. Malkin, in: A.A. Kaplyanskiy, B.M. Macfarlane (Eds.), Spectroscopy of solids containing rare-earth ions, North-Holland, Amsterdam, 1987, pp. 33–50.  
 [2]. M.N. Taran, H. Ohashi, K. Langer, A.A. Vishnevskiy, Phys. Chem. Minerals **38** (2011) 345.

### I19

#### Time resolved tunable diode laser spectroscopy in pulsed discharges. Application to high power pulsed magnetron discharge

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Laser spectroscopy using diode lasers is commonly used in plasma diagnostics for measuring the density and temperature of absorbing species [1], or velocity distribution functions [2]. Most of the diagnostics described in the literature focus on the use of diode lasers for the investigation of steady state regimes [2,3] or refer to time averaged results [4].

The investigation of time evolving discharges and especially repetitive discharges requires a different approach, and different techniques have been employed to obtain the time resolved evolution of particle density and temperature [5,6,7,8,9].

In this contribution the basic principles of time resolved-direct absorption profile (TR-DAP) measurement method by TD-LAS Tunable Diode-Laser Absorption Spectroscopy are presented. The use of this method for the characterization of high power pulsed magnetron discharge is emphasized, by describing the time and space evolution of density and temperature of metal atoms (Ti, Al) and neutral gas atoms (Ar metastables). The high dynamics of metal atoms parameters are mainly related to transport phenomena, while the dynamics of metastable gas atoms is mainly related to the production and loss mechanisms through electron impact.

#### References:

- [1] M. Wolter et al., J. Phys. D: Appl. Phys. **38** (2005), 2390  
 [2] L. de Pouques et al. Europhys. Lett. **82** (2008) 15002  
 [3] N. Beverini et al. Laser Phys. **8**, 574 (1998).

- [4] J. Olejnicek et al. Jap. J. of Appl. Phys. 45, No. 10B (2006), 8090  
[5] G. D. Stancu, et al, J. Chem. Phys. 122, 014306 (2005).  
[6] R. Cazan et. al. Plasma Sources Sci. Technol. 17, 035020 (2008).  
[7] I. Stefanovic et. Al. J. Phys. D. Appl. Phys. 43, 152003 (2010).  
[8] B. Clarenbach et. al Plasma Sources Sci. Technol. 12, 345 (2003).  
[9] C. Vitelaru et. Al. Journal of Applied Physics 109, 053307 (2011)

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**I20****Development of Laser-Produced Plasma Technology. Fundamentals and Applications**

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Laser produced plasma (LPP) is a topic of growing interest in different fields such as material processing diagnostic techniques and space applications. The possibility of producing species in LPP with electronic states far from chemical equilibrium enlarges the potential of making novel materials that would be unattainable under thermal conditions.

Various (cw and pulsed) lasers have been used to irradiate a large array of samples, ranging from simple model targets (Cu, Al) to chalcogenide glasses (with high potential in developing wavelength conversion devices, all-optical switching or modulation, Raman and parametric amplification, laser sources for mid-IR, etc.) or ceramics used as dielectric walls in Hall Effect Thrusters for space propulsion [1-3]. On the other hand, the effects induced by laser irradiation on the solid samples were investigated through a variety of techniques, as scanning electron microscopy, profilometry, IR thermography etc. We will present an overview of this work, with some hints also on the theoretical efforts developed in parallel [4, 5] to account for the experimental findings.

During the last several years, we developed systematic studies on these issues, both experimental, using optical (space- and time-resolved emission spectroscopy, fast ICCD imaging) and electrical (Langmuir probes, mass spectrometry) methods, and theoretical, in the frame of a fractal hydrodynamic model developed in a non-differentiable space-time [5, 6].

Studying the dynamics of this plasma presents fundamental interest, as getting better insight on the complex laser-matter interaction and subsequent elementary processes taking place in the transient expansion, but is also of significant importance for application fields like analytical or materials sciences.

**References**

1. C. Ursu, S. Gurlui, C. Focsa, G. Popa, Nucl. Instr. and Meth. B, 267, 446 (2009).

2. C. Focsa, P. Nemeč, M. Ziskind, C. Ursu, S. Gurlui, V. Nazabal, *Appl. Surf. Sci.*, 255, 5307 (2009)
3. C. Focsa, M. Ziskind, C. Ursu, S. Gurlui, D. Pagnon, S. Pellerin, N. Pellerin, M. Dudeck, *J. Optoelectron. Adv. Mater.*, 10, 2380 (2008).
4. S. Gurlui, M. Agop, P. Nica, M. Ziskind, C. Focsa, *Phys. Rev. E* 78, 026405 (2008)
5. P. Nica, P. Vizureanu, M. Agop, S. Gurlui, C. Focsa, N. Forná, P. D. Ioannou, Z. Borsos, *Jpn. J. Appl. Phys.* 48, 066001 (2009)
6. M. Agop, P. E. Nica, S. Gurlui, C. Focsa, V. P. Paun and M. Colotin, Implications of an extended fractal hydrodynamic model, *The European Physical Journal D - Atomic, Molecular, Optical and Plasma Physics*, 56 (3), 405 (2010).

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**I21****Characterisation of organosilicon composite thin films deposited in dusty plasma**

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The aim of the present paper was to prepare transparent nanocomposite protective coatings on polycarbonate substrate from mixture of hexamethyldisiloxane (HMDSO) and oxygen. The deposition conditions used for preparation of the presented samples (i.e. relatively high oxygen to HMDSO flow rate ratio) led to the creation of dusty plasma. Because of the relatively low applied power and high HMDSO to oxygen ratio the fragmentation of HMDSO molecules during the deposition process is low. The dissociative ionization of the HMDSO molecule and the electron attachment followed by consecutive ion-neutral reactions led to the creation of high mass anions. These anions were trapped in the plasma and homogeneous reactions finally caused a growth of solid amorphous particles which were incorporated into the growing amorphous film. The composite character of the produced films improved their mechanical stability, however the particles embedded in the amorphous  $\text{SiO}_x\text{C}_y\text{H}_z$  matrix increased also the film roughness. On the other hand, the high roughness and the low surface free energy improved the hydrophobic character of the film surface. This effect eliminates the hydration caused changes of the surface properties, which are known to be responsible for the degradation of thin films based on polymer materials, thus improving the long term stability of the film studied in this work.

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I22

**Polymer/Fullerene Blends and Hybrid Organic/Inorganic Heterojunctions Promising Structures for Low Cost Solar Cells.**

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In the last decades the third and fourth generations of photovoltaic cells based both on the organic thin films and hybrid nanostructured inorganic/organic materials structures have attracted a great deal of interest due to the low-cost of organic materials, their origin from non-toxic precursors and the simplicity of producing technologies. Among the organic semiconductors envisaged to be used in such structures, the small molecules like metal-doped phthalocyanines and polymers are the most studied. Their optical absorption in the visible range of the solar spectrum is strong, but based on an excitonic mechanism. Taking into account that the diffusion length of the exciton in organic semiconductors is of 20-80 nm, one way to improve the extraction of the charge carriers will consist in significantly increasing of the area of the interface between the two components of the heterostructure, expecting to take place in the third and fourth generation of solar cells.

In this work are summarized the electrical and photoelectrical properties of the organic photovoltaic cells based on the polymeric thin films and hybrid inorganic/organic structures.

In the case of third generation of solar cells, the polymer (P3HT, PCBM or MEH-PPV, PCBM and their blend, respectively) based photovoltaic cells were produced by spin-coating technique. The structures based on the P3HT: PCBM (1:1) or MEH-PPV:PCBM(1:4) blend shows a promising photovoltaic response, with a power conversion efficiency increased of about two order of degree, with respect of those measured in the case of structures based on a single polymer used as photoactive layer. Such as above shown, one way to improve the extraction of the charge carriers will consist in significantly increasing of the area of the interface between the two components of the heterostructure, then reducing the dimensions of D/A heterojunctions to the dimension of exciton diffusion length in the organic absorber. In this way the driving forces, due to potential difference between Donor LUMO and Acceptor LUMO, will acts efficiently for exciton dissociation and photo charge carrier generation in photovoltaic cells based on polymeric blends.

The same idea is used in the case of fourth generation solar cells where a nanostructured inorganic thin film is sensitized with a good organic absorber, generally a dye leading to solid Dye Sensitized Solar Cells.

In this case we report two kind of prepared and characterized structures: i) hybrid structures based on nanostructured ZnO electrode, photosensitized by CuPC; ii) hybrid structures based on CdTe nanowires arrays/ZnO or TPyP.

Three types of hybrid structures based on nanostructured ZnO were prepared: a) Nanostructured ZnO thin films/CuPc; b) ZnO nanowires array/CuPc; c) ZnO nanotubes array/CuPc. EQE of ZnO wire arrays/CuPc structures was 4 time larger than that of ZnO nanostructured film/CuPc structures and EQE of ZnO nanotubes arrays/CuPc structures was about one order of magnitude higher than that of ZnO nanostructured film/CuPc structures.

For second type, hybrid cells based on the heterostructure at the interface between wire arrays of CdTe, and the organic film ZnPc and TPyP, were produced and characterized. EQE of CdTe nws/CdTe (200nm)/ZnPc structures was two order of magnitude higher than in the case of CdTe nws/ZnPc.

Currently, work is in progress to improve the efficiency of these structures, by optimizing the density of the nanowire or nanotube arrays, and improving the quality of the inorganic/organic interfaces.

*Keywords: nanostructured materials for photovoltaic applications, „Bulk Heterojunction” photovoltaic cells, hybrid inorganic/organic photovoltaic cells*

## I23

### High Performance Magnets with Reduced Rare-Earth Content

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Permanent magnets as well as the easy controllable magnetic materials are of permanently increasing importance becoming crucial components in many devices and advanced technologies. There exist some families of permanent magnets; each ones with specific properties, but the most powerful magnets are based on rare earth - 3d transition intermetallic compounds: Sm-Co and Nd-Fe-B type magnets. A major drawback of rare-earth based magnets consists in the high cost as consequence of scarce available resources of rare-earth and mainly the global distribution of them, the major resources of rare-earth minerals being located in very few places on the world, mainly in China. The develop of free rare-earth magnetic materials, tetragonal distorted Fe-Co materials, Fe-N, Fe-Co-N etc, and exchange-spring nanocomposite magnets are very promising. Nanocrystalline/nanocomposite ferromagnetic materials exhibit magnetic properties which are interesting both from fundamental research of magnetism as well as for applications. Exchange-spring magnets are formed of soft and hard magnetic phases dispersed at the nanometric scale and coupled by exchange interaction. The interphase exchange coupling is strongly influenced by the microstructure. Different methods: mechanical milling/alloying (powders), rapid quenching and sputtering (thin films), combined with thermal treatments are used to control the structure and microstructure. Aside from the optimal microstructure, the performances of nanocomposite materials coupled by exchange interactions can be influenced by the type of soft and, mainly, hard magnetic phases. Groups of hard/soft magnetic phases, adequate for obtaining of a nanocomposite with good coercivity and high remanence will be presented. Another promising group of materials are the tetragonal distorted Fe based alloys or Fe-Co materials. Theoretical first-principles calculations for Fe or Fe-Co films predicted high saturation magnetization and high uniaxial magnetic anisotropy energy for specific values of the lattice distortion  $c/a$  and the alloy composition. For the new  $Fe_{16}N_2$  phase obtained by chemical methods or in thin layers, the iron



magnetic moment was reported to be  $3.0\mu_B/\text{Fe}$ . The problem which rest to be solved is given by the rather low coercivity and thermal stability.

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**I24****Organometallic materials for low energy consumption OLED devices**

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The synthesis and photophysical study of a cyclometalated mixed-ligand iridium (III) complex are reported. The iridium complex (called  $\text{IrQ}(\text{ppy})_2-5\text{Cl}$ ) has two cyclometalated 2-phenylpyridine (ppy) ligands and one 8-hydroxyquinoline (Q) ligand, where one of the H atom is substituted by Cl atom. Absorption and photoluminescence spectra are studied for the neat film and films of  $\text{IrQ}(\text{ppy})_2-5\text{Cl}$  doped in 4,4'-N,N'-dicarbazolebiphenyl and polystyrene, together with the electroluminescence spectra using multi-layer light emitting devices. Emission bands are observed at 502 and 660 nm, which arise from ppy and Q ligands, respectively.

Electronic states and their energies are calculated for a mixed-ligand Ir(III) compound,  $\text{IrQ}(\text{ppy})_2-5\text{Cl}$  using time-dependent density function theory (TD-DFT) calculations and compared with experimental result. A good agreement is obtained between the calculated and measured absorption spectra. The  $d-d^*$  molecular orbital transition gives the lowest-energy triplet state absorption band. Its energy is estimated at 1.84 eV (671 nm), which is close to the absorption band position of 1.86 eV (666 nm) observed for  $\text{IrQ}(\text{ppy})_2-5\text{Cl}$  doped in 4,4'-N,N'-dicarbazole-biphenyl (CBP) host and of 1.88eV (660 nm) observed for  $\text{IrQ}(\text{ppy})_2-5\text{Cl}$  doped in polystyrene (PS).

Mechanisms of the charge transfer between Ir 5d and C 2p orbitals were discussed, concerning the hybridizations and metallic character between Ir and the two ligands.

Comparison between electroluminescence and photoluminescence of  $\text{IrQ}(\text{ppy})_2-5\text{Cl}$  (6%wt) dispersed in CBP were presented in a typical devices were configured as ITO/PEDOT:PSS or NPB (40 nm)/Ir-compound (6%) doped in CBP (10 nm)/BCP(6 nm)/Alq<sub>3</sub> or TPBI (40 nm)/LiF (1 nm)/Al (150 nm).

The electroluminescence measurements allow us to conclude the possibility of obtaining dual emitters OLEDs with low energy consumptions due to the low voltage and currents regimes in which these devices can work.

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**I25****Physical and chemical characterisation applications for cultural heritage artefacts at the new "Laboratory of Qualification at Irradiation" from IFIN-HH. FT-Raman characterization of artificially degraded Romanian and Baltic reference ambers.**

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In the quest for non-destructive methods useful in tracking the geological origins of archaeological ambers, Raman spectroscopy was considered for characterization and fingerprinting purposes [H.G.M. Edwards et al., 1996; R.H. Brody et al., 2001; W. Winkler et al., 2001; J. Jehlicka et al., 2004, Teodor et al. 2010].

However, because of extensive degradation of amber beads as a result of chemical interaction with the archaeological environment, main analytical problem that arises from here being related with the fact that spectra of archaeological samples and geological samples are extremely difficult to match even with advanced multivariate data analysis techniques as Principal Components Analysis or Cluster analysis [Teodor et al. 2010, Virgolici et al. 2010]. There are two problems to be solved from here: how Raman spectra of reference geological ambers are changed after similar ageing and which spectral features can still be clues to attribute the geological origin of archaeological amber artefacts.

For this purpose, it was designed an artificially induced degradation experiment of Romanian (Romanite) and Baltic amber specimens. The accelerated degradation experiment included different environmental conditions as humidity, salinity and pH. Two small groups of samples were also subjected to gamma irradiation for analytical purposes [Virgolici et al. 2010] and UV LASER irradiation for surface induced artificial degradation.

The experiment focuses on the degradation effects of Romanite and Baltic amber, as the two raw materials were the most probable sources to be used in the manufacturing of amber artefacts from Romanian Museum collections [Teodor et al. 2010, Virgolici et al. 2010].

**Keywords:** fossil resins; Gamma Irradiation; UV Irradiation; artificially induced degradation; Fourier Transformed Raman spectroscopy; chemometrics.

**Acknowledgements.** Parts of this work have been financially supported by the ANCS Romania, through several research grants, most important being contract no. 91-091/2007 (PN-II ROMANIT project, "Prestige and Power. Romanian Museums' Antique Items of Trade. Non-metallic adornments, with an archaeometrical study regarding the origin of amber beads."), followed by contr. no 99/05.01.2012 (PN-II-RU-PD-2011-3-0274, Establishing an archaeometrical method for discrimination of Romanite - Romanian amber - by chromatography and mass spectrometry).

#### References

1. H.G.M. Edwards, D.W. Farwell, *Spectrochimica Acta Part A* 1996; 52:1119
  2. R.H. Brody, H.G.M. Edwards, A.M. Pollard, *Spectrochimica Acta Part A* 2001; 57:1325
  3. W. Winkler, E.C. Kirchner, A. Asenbaum, M. Musso, *J. Raman Spectrosc.* 2001; 32: 59
  4. J. Jehlicka, S.E. Jorge Villar, H.G.M. Edwards, *J. Raman Spectrosc.* 2004; 35: 761
  5. E.S. Teodor, E.D. Teodor, M. Virgolici, M. Manea, G. Truica, S.C. Litescu, *Journal of Archaeological Science* 2010; 37: 2386
  6. M. Virgolici, I. Petroviciu, E. Teodor, S. Litescu, M. Manea, C. Ponta, G. Niculescu, C. Sarbu, A. Medvedovici, *Revue Roumaine de Chimie* 2010; 55: 349
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I26

**MOLECULAR SELF-ASSOCIATION INVESTIGATED BY SPECTROSCOPIC AND CALORIMETRIC TECHNIQUES**Ioan Turcu, Mihaela Mic and Mircea Bogdan*Molecular and Biomolecular Physics Department, National Institute for Research and Development of Isotopic and Molecular Technologies, 400293 Cluj-Napoca, Romania.*

Molecular self-assembly denotes the spontaneous organization of molecules under thermodynamic equilibrium conditions into structurally stable arrangements through a number of noncovalent interactions. Although each of the bonds is rather weak, the collective interactions can result in very stable supramolecular structures. Molecular self-assembly is ubiquitous in nature; the molecules undergoing self-association due to two key elements: the chemical complementarity and the structural compatibility. The materials built by self-association allow for a higher structural tunability, their bulk properties being imposed by the specific characteristics of individual building blocks. Molecular self-assembled systems lie at the interface between molecular biology, chemistry, polymer science, materials science and engineering, being of great interest today due to the wide range of applications in molecular electronics, self-structured molecular systems with controlled architecture and functionality, smart materials, high-performance and high-selective molecular sensors and so on.

A self-association process in solution seems to be extremely often encountered in the case of organic molecules that have aromatic rings. The tendency is to aggregate into stacking structures which reduce the potential energy related to  $\pi$ - $\pi$  interaction and also the hydrophobic energy which depends mainly on solvent accessible surface area.

The equilibrium size distribution of  $n$ -mers depends on the association constants  $K_n$ , which govern the step-wise self-association processes where a monomer is captured by an aggregate with  $n-1$  monomeric units. Depending on their particular field of interest, different research teams use a variety of models which they consider appropriate for describing such processes.

The main aim of our contribution is to develop an alternative rigorous theoretical approach based on statistical mechanics able to describe the molecular self-association. The theoretical predictions were tested on the  $^1\text{H}$  NMR and calorimetric (Isothermal Titration Calorimetry - ITC) data obtained from ciprofloxacin self-association experiments.

Among other effects, the appearance of stacked aggregates is reflected also by the strong concentration dependence of proton chemical shift. Therefore  $^1\text{H}$  NMR spectroscopy is one of the simplest ways to quantify the degree of self-association.

ITC is one of the most relevant calorimetric techniques designed to investigate the physical basis of molecular interactions. A single well-designed experiment can provide complete thermodynamic characterization of a binding reaction, including the equilibrium constant  $K$ , the Gibbs free energy  $\Delta G$ , the reaction enthalpy  $\Delta H$ , and the entropic effect  $\Delta S$ .

Our theoretical predictions are able to fit very accurately the measured data, but we consider that more important than the accuracy of the data fit is the robustness of the proposed model and the well-fundamented approach.

*Keywords: molecular self-association; stacking molecular aggregates;  $^1\text{H}$  NMR, isothermal titration calorimetry.*

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**I27****AMS measurements of deuterium captured in tungsten layers deposited by magnetron sputtering**

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The paper presents the upgrading of the Accelerator Mass Spectrometry (AMS) facility of NIPNE-Bucharest performed in order to measure depth profile of hydrogen isotopes concentration in various host materials.

Results are also presented concerning the retention of deuterium in different tungsten layers deposited by magnetron sputtering procedure.

The layers of tungsten were deposited on a silicon substrate simultaneously with the capture of deuterium.

Our AMS measurements have shown that deuterium is very deeply penetrating into materials and it is easily captured below layers of tungsten.

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**I28****Nanoglasses: an alternative route for controlling the properties of glassy materials.**

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"For crystalline materials it is a well-established concept to tune the material's properties by varying the grain size. While in case of crystalline materials the concept of grain boundary is well-defined, for the case of glasses, in contrast, there is no established concept of grain boundaries due to the lack of translational symmetry and long-range order. Nevertheless in bulk metallic glasses it has been proven that planar defects do exist, namely in the form of shear bands induced by plastic deformation. These planar defect exhibit an enhanced free volume and a modified local order and affect the properties of bulk metallic glasses. An alternative route for controlling in a systematic way the fraction of planar defects, and therefore, the properties of glassy materials, is by

compacting glassy nanopowder. The resulting structure consists of glassy grains separated by glass-glass interfaces and is called a nanoglass.

This talk will illustrate a complete description of the structure of planar glass-glass interfaces and present how mechanical and vibrational properties of nanoglasses change when compared to those of a homogeneous bulk metallic glass."

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## I29

### ATOMIC AND NUCLEAR METHODS APPLIED TO THE STUDY OF HEAVY METAL POLLUTION

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For the assessment of element pollution levels and identification of their sources, which are a prerequisite for studying effects of contaminants on the environment and human health, a multivariate data base containing as many pollutant elements should be generated. Therefore, multielement methods are usually used for such studies. The analysis of environmental samples for their elemental content is governed by the sample type, the element of interest, the sensitivity, precision and accuracy needed and the availability of the technique. The choice of multielement methods available includes inductively coupled plasma atomic emission spectrometry (ICPAES), inductively coupled plasma mass spectrometry (ICPMS), X-ray fluorescence spectrometry (XRF), ion beam analysis (IBA) [i.e. particle-induced X-ray emission (PIXE) and proton-induced gamma-ray emission (PIGE)], nuclear activation analysis [neutron activation analysis (NAA), prompt gamma neutron activation analysis (PGNAA), charged particle activation analysis (CPAA)], and several other methods, which are seldom used on a routine basis. Some of these methods can be complemented by the use of monoelement techniques such as anodic stripping voltammetry (ASV) and atomic absorption spectrometry (AAS). Neutron Activation Analysis (NAA), Atomic Absorption Spectrometry (AAS), Energy Dispersive X-Ray Fluorescence (EDXRF) and Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) combined with biomonitoring methods were applied for determination of pollutant heavy metals. These high sensitivity analysis methods were used to determine the elemental composition of some samples of mosses and lichens, used as bioindicators, placed in different vision areas from Dambovită county with different pollution industrial sources. We have studied the presence of elements such as Cd, Cr, Cu, Co, K, Fe, Mn, Ni, Pb, and Zn in these environmental samples.

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I30

**QUARTZ CRYSTAL MICROBALANCE: NANO-SENSOR FOR CYANIDE DETECTION**

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The extremely high level of potassium cyanide toxicity makes its effects to be important even in low concentrations. Quartz crystal microbalance (QCM) allows the determination of these values due to the high sensitivity of resonant crystal frequency. The sensitivity of the method increases with the alkaline pH values and for this reason in this study it has used two sets of solutions with pH 9 and 12. The obtained experimental results lead to the conclusion that the QCM method can be successfully used to obtain an accurate quantitative and qualitative analysis of cyanides in drinking water in real time.

**Keywords:** quartz crystal microbalance, cyanide, analytical method, sensor.

I31

**METALLIC NANOSTRUCTURES WITH SPECIAL PROPERTIES**

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The paper presents the synthesis and characterization of some metallic nanostructures having special magnetoresistance properties. The structures have been obtained using the Termionic Vacuum Arc and Physical Vapor Deposition methods. The structures have been characterized by Transmission Electron Microscopy technique, Electron and X-ray Diffraction among the others. Temperature dependence of magnetoresistance has been performed.

I32

**FINE STRUCTURE OF RADIATION SPECTRUM OF ELECTRONS MOVING IN SPIRAL IN MEDIUM**

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Lorentz self-interaction method complemented by Dirac hypothesis (1938) was generalized by Schwinger (1949) for a charged particle moving in a spiral in vacuum and by Konstantinovich and Nitsovich (1973) for a charged particle moving in a spiral in medium. In the thesis, using this method (see also Konstantinovich et al (2000, 2007)) we investigate the spectral and spectral-angular distributions of averaged in time radiation power of system of electrons moving in an arbitrary defined trajectory in electromagnetic field in transparent medium.

The fine structure of the synchrotron and synchrotron-Cherenkov radiation spectrum of the one, two, three, and four electrons moving in a spiral in transparent medium is investigated combining analytical and numerical methods.

In non-relativistic, relativistic and ultra relativistic case we obtain the fine structure of radiation spectrum of one electron moving along the spiral in transparent medium. These investigations confirm the fact that a single point charge moving with acceleration emits electromagnetic radiation in vacuum and in medium (see also Larmor's formula (1897)).

For the small time shifts between electrons, in radiation spectra of two, three, and four electrons moving one by one along the spiral in vacuum and in transparent medium we have found the existence of the coherent radiation at low harmonics with  $S_N \approx N^2$  ( $S_N$  is the coherence factor of  $N$  electrons) in the case when the dimension of this system is smaller comparing to the radiation wavelength.

We established the conditions at which the radiation power of system of point electrons moving one by one along spiral in vacuum and in medium is smaller comparing to the radiation power of single electron for defined times shifts and non-relativistic components of velocity (see also Konstantinovich et al (2006)). The obtained results complement well with the investigations of [Schott](#) (1933, the surprising discovery that charged sphere in accelerated motion can have radiationless orbits) and [Goedecke](#) (1964, the general condition of non-radiation for an extended charge-current distribution).

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## I33

### Some Inequalities in the Fidelity Approach to Phase Transition

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## I34

### CADUCITY OF THE IDEA ABOUT WAVE FUNCTION COLLAPSE

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Idea about Wave Function Collapse (IWFC) is a [agreement](#) germinated from the [opinion](#) that, for a state of a quantum system, a measurement of a specific observable gives an unique value, generated by a single sampling done (through interaction) by an [observer](#). The respective [agreement](#) [ignore](#) the following observations which depict physical realities:

- (i) In itself the state of a quantum system is a probabilistic concept (characterized by a probability amplitude known as wave function),
- (ii) Consequently an associated observable is a random variable characterized in its integrity by an entire spectrum of eigenvalues,
- (iii) Then the measurement of such an observable requires information about the whole mentioned spectrum, in its completeness,
- (iv) So, for a true experimental approach, the mentioned requirement claims to operate with a statistical evaluation through adequate sets of samplings,
- (v) The possible influences in the mentioned evaluation of the observer (through its interaction with the measured system) must be regarded as processings of statistical data. Such processings have to be done as separate description, distinct of usual picture (in terms of Hilbert spaces, Schrodinger equation a.s.o) of quantum systems.

A reliable taking into account of the above alluded realities oblige to assume an entirely new vision about quantum measurements and to [declare](#) the caducity IWFC [agreement](#).

A materialization of the announced vision can be done by regarding the measurement of a quantum observable according the above noted observations (i) and (ii). Also for the description of a quantum system in itself must be separated of some (imaginable) elements regarding the measurements of quantum observables. The processing of statistical data, alluded in observation (v) can be depicted as a transmission of information, which [1,2] transforms the expression of the wave function but leave unchanged the mathematical expressions of quantum operators. The thoroughly plausibility of a materialization of the mentioned kind reveals directly the caducity of IWFC.

#### References:

- [1] S. Dumitru, *Reconsideration of the Uncertainty Relations and Quantum Measurements - SPECIAL REPORT*, PROGRESS IN PHYSICS (USA), , Volume 2 April, 2008, pp.50 – 68. Volume 2 , pp.50 – 68; [http://ptep-online.com/index\\_files/issues.html](http://ptep-online.com/index_files/issues.html).
- [2] Dumitru, A. Boer , “*On the Measurements Regarding Random Observables*” , Romanian Journal of Physics Vol. 53, Nos. 9–10, P. 1111–1116 , Bucharest, 2008

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I35

**Seismicity patterns in Romania: clues for modeling of the seismotectonic processes**

M. Popa, [M. Radulian](#)

Seismic activity in Romania is concentrated along the orogen system with a strong cluster of earthquakes at the Carpathians Arc bend, in the Vrancea region. The most important seismic energy is released at intermediate depths (60 – 170 km) beneath Vrancea, where 2-3 strong events (magnitude above 7) are generated per century. The coupling with the seismic activity in the shallow layers manifests specific seismicity alignments in the outer side of the Carpathians Arc and in the inner side, as well. They correlate with a well-developed complex system of crustal faults to the SE and episodic volcanic activity to the NW (South Harghita Mountains). Tomography images, obtained using different kind of waveform data (local, teleseismic phases, seismic noise), reveal significant anomalies in the crustal and subcrustal domains which correlate well with the specific seismicity patterns. Consequences and perspectives upon the modeling of the seismotectonics and physical processes at depth are discussed.

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## I36

### **Modulation of $\alpha$ -helical antimicrobial peptides activity in reconstituted lipid bilayers by membrane electrostatics**

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Naturally occurring antimicrobial peptides represent one of the first evolved forms of chemical defense of eukaryotic cells against bacteria, protozoa, fungi, and viruses and they are present throughout all kingdoms of life, from fungi, plants, insects to superior vertebrates [1]. With the current increase in resistance to conventional antibiotics, the high degree of selectivity possessed by antimicrobial peptides makes them promising candidates for the development of future antibiotics. Since the interfacial region of a membrane is where water-soluble peptides first come into contact with the bilayer, it can play an important role in membrane association of proteins and peptides so that the interactions of a soluble peptide with the membrane – water interface will strongly depend on its physical and chemical properties.

Based on extensive electrophysiological studies of interaction between selected antimicrobial peptides (e. g., alamethicin, magainin 2, HP (2-20) analog) and planar lipid membranes, we extend the idea that the membrane dipole potential could be used to manipulate the in-vivo susceptibility of cells towards antimicrobial peptides, since the membrane dipole potential was shown to play a central role for the peptides insertion and functioning [2]. Moreover we propose a new paradigm according to which asymmetric changes in the monolayer dipole and surface potential extend their effects spatially by altering the intramembrane potential, whose gradient is sensed by distantly located peptides [3].

Thus, when working in synergy with various agents able to alter controllably electric features of the bacterial membrane interface, our studies emphasize the practical possibility of devising protocols aimed at rapid killing of bacteria by specific antimicrobial peptides whose extracellular concentration could be kept at even lower levels than their MIC's.

**Keywords:** antimicrobial peptides, dipole potential, electrophysiology

**Acknowledgments:** The financial support from the Grant **POSDRU/89/1.5/S/63663** is highly acknowledged.

**References**

- [1] Melo, M. N., et al., Recent Pat. Anti-Infect. Drug Discov. (1), 2006, 201–207
- [2] Tudor Luchian, Loredana Mereuta, Langmuir 22(20), 2006, 8452-8457
- [3] L. Mereuta, A. Asandei and T. Luchian, PLoS ONE 6(9), 2011, e25276.

**I37**

**ELECTRONIC AND MATHEMATICAL NEURON MODELS**

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The paper presents the most usually used models for neural cell. These models will be approached both as mathematical objects and as electronic circuits.

**Keywords:** neuron, cell, action potential

**Aknowledgements:** This work was partially supported by the strategic grant POSDRU/CPP107/DMI1.5/S/78421, Project ID 78421 (2010), co-financed by the European Social Fund – Investing in People, within the Sectoral Operational Programme Human Resources Development 2007 – 2013.

**References:**

- [1] Computational Cell Biology, ed. by C. P. Fall, E. S. Mar-land, J. M. Wagner, J. J. Tyson, Springer, 2002.
- [2] C. Morris, H. Lecar, Voltage oscillations in the barnacle giant muscle, Biophys. J., 35:193-213, 1981.
- [3] H. Wilson, J. Cowan, Excitatory and inhibitory interactions in localized populations of model neurons, Biophys. J., 12:1-24, 1972.

**I38**

**High School Class for Gifted Pupils in Physics and Sciences New Development -**

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The high school class for students with special abilities in physics was founded in Nis, Serbia ([http://tesla.pmf.ni.ac.rs/f\\_odeljenje/](http://tesla.pmf.ni.ac.rs/f_odeljenje/)) in 2003. The basic aim of this project has been introducing of a broadened curriculum of physics, mathematics, computer science, as well as chemistry and biology. Now, nine years after establishing of this specialized class, and 3 years after the previous report, we present new results of our continuous follow-up of this pedagogical experiment. This time, emphasize will be on their results an National and International Contests.

Analysis of achievement data should clarify what are benefits of introducing in school system track for gifted students. Additionally, item analysis helps in understanding and improvement of learning strategies' efficacy. We make some conclusions and remarks, may be useful for the future work that aims to increase pupils' intrinsic and instrumental motivation for physics and sciences, as well as to increase the efficacy of teaching physics and sciences.

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**I39****NEW ACCELERATORS SYSTEM FOR ADVANCED RESEARCH FROM IFIN-HH, BUCHAREST-MAGURELE, ROMANIA**

D.G.Ghita, M.S.Dogaru, M.M.Gugiu, S.Dobrescu, C.I.Calinescu, Gh.Cata-Danil, M.Enachescu, P.Ionescu, I.O.Mitu, D.V.Mosu, A.Pantelica, D.Pantelica, A.Petre, I.V.Popescu, B.Savu, T.B.Sava, C.A.Simion, C.Stan-Sion, M.Statescu, N.V.Zamfir

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The upgrade of the 9 MV Tandem accelerator at IFIN-HH started in 2006. Remarkable work was done in the last 6 years that can be seen in the improved performance and reliability of the machine. Using original preparation techniques, some new beam species were tested for the firsttime in our laboratory. This opened the door to new experiments. A major improvement for the laboratory is the installation of 1 MV Tandetron accelerator dedicated to ultra sensitive Accelerator Mass Spectrometry (AMS) measurements of  $^{14}\text{C}$ ,  $^{10}\text{Be}$ ,  $^{26}\text{Al}$  and  $^{129}\text{I}$ , and 3MV Tandetron accelerator dedicated to Ion Beam Analysis (IBA). The main directions of the research activity in the laboratory will be shortly presented.

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**I40****TECHNOLOGY TRANSFER OF R&D RESULTS IN BASIC RESEARCH**

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In the broadest sense, the technology transfer is a communication process that leads to the introduction of the research results into practice. It is the transfer of know-how from the basic research to applied technology. Technology transfer is essentially a problem of knowledge transfer between researchers or group of researchers.

In nuclear physics this process is rather complex relative to the other fields. In this presentation we give a couple of potential transfer of high performance resistive plate chambers (RPC), developed for the new generations of experiments in hadron physics, to field where high resolution scanning of objects of any dimension is required.

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**I41****STATE OF THE ART IN PHYSICS TEACHERS TRAINING. BALKAN AND WEASTEARN EUROPEAN COUNTRIES STRATEGIES AND TRENDS**

Evangelos G. VITORATOS, Ovidiu Florin CALTUN

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**O01****Influence of ZnO nanoparticles on the photovoltaic performances of polymeric blends**

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Polymeric blends based on MEH-PPV:PCBM(1:4) were prepared on optical glass and flexible substrates, respectively. Different amounts of ZnO nanoparticles were added in PEDOT:PSS solution, from 0.1 mg to 0.3 mg. The "customized" cells ITO/PEDOT:PSS + (x)ZnO nanoparticles/MEH-PPV:PCBM(1:4)/LiF/Al were electrical and photoelectrical characterized and the obtained results were compared with those for samples without ZnO nanoparticles. The current-voltage curves were drawn both in dark and AM 1.5 conditions, at room temperature. The photovoltaic cells parameters, fill factor, external quantum efficiency, short-circuit current and open circuit voltage were calculated and compared. Photoelectrical measurements indicate that the ZnO nanoparticles have a positive influence on the conversion efficiency, reducing the serial resistance of the structure and improving the stability of the cells.

Keyword: polymeric blend, photovoltaic cells, ZnO nanoparticles

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**O02****SYNTHESIS AND CHARACTERIZATION OF FREE-STANDING FILMS OF POLYMER/NANOCARBON COMPOSITES BASED ON CARBON NANOPOWDER'S BUOYANCY**

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In this work we report the synthesis of free-standing films and sandwich layers of polymer/nanocarbon composites through an original approach called the inverse stamping method, which consists in forming a thin film of carbon nanoparticles onto the water's surface. Through the free infiltration of the polymer between the nanoparticles which form the film, after the polymer is cured, we obtain free-standing films of polymer/nanocarbon composites. The structural properties and electrical resistivity of the films were measured.

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O03

**Bismuth alkali based ceramics - synthesis and characterization**

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Lead Zirconate Titanate family ceramics are widely used for piezoelectric applications. Various compositions are used around Morphotropic Phase Boundary (MPB) because of their enhanced properties. However, because of the Lead toxicity, in the last decade other systems with similar properties are investigated. Among them Bismuth alkali based ceramics with general formula  $(1-x)\text{Bi}_{1/2}\text{Na}_{1/2}\text{TiO}_3-x\text{BaTiO}_3$  or  $(\text{BNT}-\text{BT}_x)$  seems to be a promising alternative. Some compositions around MPB, with  $x = 5, 8$  and  $11$  mole % were synthesized employing the sol-gel method. The obtained powders were calcinated at various temperatures in the  $200-700$  °C range. Further sintering of the  $\text{BNT}-\text{BT}_x$  sol-gel powders in the  $800-900$  °C temperature range by Spark Plasma Sintering (SPS) process were performed. SPS sintered ceramics showed structures having over 98.95 % from theoretical density values. Scanning Electron Microscopy showed average grains dimension of about 30 nm for sol-gel synthesized ceramics and a small increase of average grains dimensions by applying SPS method. X-ray Diffraction technique revealed the structural changes, from amorphous to crystalline phase obtained by calcinations of sol-gel powders at various temperatures or by applying SPS method with crystallite dimensions under 100 nm. Selected Area Electron Diffraction and High Resolution Transmission Electron Microscopy investigations revealed the presence of tetragonal and orthorhombic structures for  $\text{BNT}-\text{BT}_x$  ceramics. Dielectric measurements performed in the 40 Hz–5 MHz and 25–400 °C temperature ranges showed the relaxor behavior of the samples. Piezoelectric measurements revealed very high values for the mechanical quality factor due to the nanodimension character of the structures.

Keywords: sol-gel  $(\text{Bi}_{0.5}\text{Na}_{0.5})\text{TiO}_3-x\text{BaTiO}_3$  ceramics, Spark Plasma Sintering (SPS), dielectric properties

O04

**BASIC ELEMENTS OF A PHYSICAL THEORY OF INFORMATION ABOUT THE COMPLEX SYSTEMS. UNIVERSE vs MULTIVERSE**

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Starting from the “classical” (mathematical) theory of information (C. Shannon, W. Weaver), this work has replaced the definitions of the: a) apparent information as a decrease of the non-determination (uncertainty) degree, by means of the overlap area of the true and found probability distributions, respectively, b) agreement of a theoretical relation with the experimental data using the correlation coefficients, by means of the error risks at the compatibility rejection, etc, taking into account also the basic notions of the complex systems: (i) the uniqueness parameters, (ii) the similitude criteria, (iii) the universality classes, (iv) the numerical phenomena intervening in the computer simulations of such systems evolution, etc [1].

The accomplished analysis pointed out the existence of some surprising co-relations relating the fundamental interactions and particles. The interpretation of these findings by means of the anthropic principles (leading to the notion of designed Universe) or by means of some recent theoretical models (“of quantum gravitation”, “self-reproducing inflation”, “quantum cosmology with loops”, etc, leading to Multi-verse models) was also analyzed by this work (see also [2]).

1. a) DOBRESCU R., IORDACHE D., eds, *Complexity Modeling* (in Romanian), Politehnica Press Printing House, Bucharest, 2007; b) DOBRESCU R., IORDACHE D., *Complexity and Information*, Romanian Academy Printing House, 2010.
2. IORDACHE D., *Main complexity features of the thermo-mechanical evolution of the universe*, chapter 5 in *Research Trends in Mechanics*, vol. 2, pp. 109-140, Romanian Academy Printing House, 2008.

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## O05

### Advanced Methods to Extract Electron Diffraction Data

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Electron diffraction studies of materials are less used for accurate measurements in lattice parameters determination. Contributions of unwanted effects, such dynamical effects, influence of beam-sample geometry and presence of amorphous sample/substrate, are large compared with X-Ray diffraction and results are compromised. For these reasons, we expect larger errors for electron diffraction results compared with X-Ray diffraction. Another infringement are magnitude of diffraction angle, very small in case of electron diffraction with maximum magnitude about 3-5 degree .

Data mining in electron diffraction study can be improved by means of software techniques. The Hough or Cos transform are example of such techniques. We use a Radon transform to evaluate more precisely peak position, and check misalignment of diffraction pattern. The results are indexed and used to evaluate lattice parameters from Cohen method with modified Nelson-Riley function for small angles that includes approximation of  $\cos^2 = 1$ .

We use this technique to evaluate data from cubic(Au) and hexagonal(ZnO) structures. Diffraction patterns was acquired on CM120ST microscope at 100KeV. Gold samples are nanocrystalline powder on amorphous carbon film obtained by evaporation, and used for calibration of electron diffraction patterns. ZnO samples are synthesized by three methods: doctor blade, spin coating and electrochemical deposition.

Keywords: electron diffraction, Radon transform, Cohen, Nelson-Riley

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**O06****Characterisation of PLD deposited Al<sub>2</sub>O<sub>3</sub> thin films for electronics**

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Al<sub>2</sub>O<sub>3</sub> is widely used in electronics as dielectric gate for transistors due to its very good electrical properties and compatibility with virtually any type of substrate, including polymeric ones. Thin Al<sub>2</sub>O<sub>3</sub> films of 800 nm thicknesses were obtained by pulsed laser deposition (PLD) method. The structure and morphology of as grown films were investigated by Energy Dispersive X-ray spectroscopy (EDX), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM) and optical transmittance spectroscopy (OTS) techniques. EDX results show a stoichiometric transfer between target and substrates. SEM and AFM images show a typical morphology for PLD deposited films. Bandgap energy and refractive index obtained by OTS were found to be in good agreement with the bulk values.

For dielectric characterizations, Al<sub>2</sub>O<sub>3</sub> films were deposited on Ti electrodes (100 nm). After thermal treatments at 300 °C for ½ hour, a top Al electrode was deposited and dielectric measurements were carried out on Ti-Al<sub>2</sub>O<sub>3</sub>-Al capacitors, by using a RLC automatic bridge (Hioki 3532). The temperature dependence of permittivity and dielectric losses of capacitors have been measured between 123 - 423 K at selected frequencies in the 42 Hz - 5 MHz ranges. The dielectric constant of Al<sub>2</sub>O<sub>3</sub> determined from capacitance measurements was found to be around 8.3 at 273 K. Lower dielectric losses values under 1 % were found at 10 kHz. A good stability of the permittivity and loss values was found in the investigated temperature and frequencies ranges.

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**O07****LEARNING FROM EXPERIMENT. WHY AND HOW?**

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The falling interest of young people in pursuing careers in key science areas was connected with the less effective teaching strategies used in day-to-day classroom such as instructional activities. A lot of girls are afraid to undertake science studies at postgraduate level especially in subjects such as mathematics, physics and informatics. In some regions in the rural area of underprivileged social classes encounter difficulties integrating into the educational system especially in science, despite their capacity to undertake science studies.

The paper intends to examine best practices identified in the region that can reverse these trends. It is necessary that the teacher have a good grounding in Science education (goals, methods and contents). A special attention must be done to the inquiry and experimental based methods impact on student's inclination towards taking up a career in science. In training or mentoring initial Science or Physics teachers is very important to help new teachers to implement these methods and teaching tools in their activities.

The important actors in the training and exchange of experience must be professional teachers extracting from their curricular and extracurricular activities most efficient approach. One of the challenges is to adapt resources and guidelines for successful physics experiment to a national context especially in social and cultural aspects (diversity of student learning process, teaching context, educational system). The teachers must be directly involved in the development of materials (guidelines and resources) and will get the opportunity to adapt them to their own pedagogical strategy. The teacher-to teacher education process will enable them to convince inexperienced teachers to use new techniques. This transfer of knowledge can be carried out during the mentoring and/or training sessions and symposia for teachers trained at interregional level. The strong involvement of mentors and teachers at different stages of the interpersonal relation is crucial and will allow spreading easy-used materials without the necessity of a strong background in inquiry and teaching tools.

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**S1\_P01****Determination of linear and mass attenuation coefficients of shielding materials**

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The photon attenuation coefficients of clay, barite, concrete and concrete containing barite have been investigated. The linear attenuation coefficients have been measured using ionization chamber with Co-60 gamma ray source and the total mass attenuation coefficients have been calculated using photon cross section database program at photon energies 1 keV- 100 GeV. Additionally, Monte Carlo neutron-particle transport code (MCNP) was used to calculate these coefficients at 662, 1173 and 1332 keV energies. The measured and calculated results were found to be in good agreement with one another.

**Keywords:** Shielding; photon attenuation, thermal neutron, Monte Carlo, concrete.

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**S1\_P02****A Comparative Study of Neutron Reflection Cross Sections of Some Hydrogenous Materials**

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Neutron reflection property of a material is conventionally characterized by a parameter named neutron reflection cross section. This quantity has found useful applications in assessing hydrogen content of bulk samples and is determined by measuring neutron intensities with ( $I$ ) and without ( $I_0$ ) the reflecting sample in place. In this study, four different hydrogenous samples, namely water, ethanol, glycerol and acetone, are investigated. A volume of 1.5 l from each sample is placed in a cylindrical holder (diameter: 9.3 cm) and a point-like Am-Be source with an activity of 3 Ci that is surrounded by a moderator provides the necessary neutrons. A  $\text{BF}_3$  proportional counter (with an active area of diameter 12 cm) positioned between the sample and the source detects the neutrons. The relative number of counts ( $R$ ) is then determined from the equation  $(I-I_0)/I_0$ . Monte Carlo simulations of the whole system are also performed and the measurement results are compared with the computational data.

**Key Words:** Neutron reflection; neutron flux determination; bulk hydrogen analysis

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## **S1\_P03**

### **Dijet production at the LHC**

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We investigate the production of new gauge bosons ( $Z'$  boson) predicted by the extensions of the Standard Model in the production of jet pairs (dijets) at the LHC. The study is done using Monte Carlo generators Pythia6 and Pythia8. A study of different kinematic variables and the mechanisms of the  $Z'$  boson production is investigated.

**Keywords** : heavy quarks, gauge bosons, Beyond Standard Model

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## **S1\_P04**

### **“Altitude Dependence of Radon Specific Activity”**

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Everyone is exposed to radon, a chemically inert radioactive gas, present in atmosphere everywhere. Using a competitive AlphaGuard instrument we measured the specific activity of radon in Constanta Maritime University establishing its altitude dependence.

**Keywords**: radon, specific activity

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## **S1\_P05**

### **Elemental Concentrations in Root Vegetables and Host Soil Determined by Instrumental Neutron Activation Analysis (INAA)**

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This paper presents an application of Instrumental Neutron Activation Analysis (INAA) to determine elemental concentrations in some edible root vegetables and corresponding host soils collected from industrial and control zones in Romania. This study is part of a larger investigation of possible foodstuff contamination with toxic elements originated from industrial activities. Phosphorous fertilizer production, as well as non-ferrous (Pb-Zn) metallurgy industries, besides two agricultural areas with no specific type of pollution were considered. Root vegetables examined were: carrot (*Daucus carota*), potato (*Solanum tuberosum*), garlic (*Allium sativum*), onion (*Allium cepa*), celery (*Apium graveolens*), parsnip (*Pastinaca sativa*), and radish (*Raphanus sativus*). INAA was applied at Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH) in Bucharest-Magurele, Romania for long-lived radionuclides, as well as at Joint Institute for Nuclear Research (JINR) in Dubna, Russia for short-lived radionuclides in some of the samples. Neutron irradiation in INAA was carried out at the TRIGA nuclear reactor of the Institute of Nuclear Researches (RAAN-SCN) Pitesti, Romania, as well as IBR-2 reactor of JINR Dubna. The elements determined were: Al, Ag, As, Au, Ba, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, Eu, Fe, Hf, K, La, Mn, Mo, Na, Ni, Rb, Sb, Sc, Se, Sm, Sr, Ta, Tb, Zr, and Zn (33 elements). Concentration ratios to control samples both for soil and vegetables as well as concentration factors of vegetables to host soil were assessed. The results for Na, Mg, Cl, K, Ca, Mn, Fe, Zn, As, and Hg were compared with Romanian norms for alimentary products, as well as with literature data. This work was supported in part by the PNCDI II Project No. 72-172/2008 in Romania and Joint Research Project No. 3871-4-08/10 between JINR Dubna and IFIN-HH.

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### S1\_P06

#### **Retardation, multipoles and relativistic kinematics effects on Rayleigh scattering amplitude by K-shell electrons in hydrogenic atoms.**

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In the present work we investigate the retardation, multipoles and relativistic kinematics effects on the Rayleigh scattering of photons by the K shell electrons of hydrogenic atoms. The right scattering amplitude calculated in the non-relativistic limit [1] is expressed in a simple form as an expansion in which the retardation, multipoles and relativistic kinematics effects are evidenced as corrections to the nonrelativistic dipole amplitude [2].

As it is known [1], a part of the retardation effects is compensated by taking into account relativistic kinematics such that the result is free of the spurious poles in the imaginary part that the old nonrelativistic result with retardation contained [3]. For this reason the validity of our result and the numerical accuracy extends for larger values of the photon energy and nuclear charge  $Z$ .

Comparisons we made with the relativistic numerical calculations based on the multipole expansion of the second order  $S$  matrix element evidence a good agreement for atoms with small

and intermediate nuclear charge  $Z$ , for a large energy range, both below the ionization threshold and above it, for any scattering angle.

In the mean time, the conjugated effects of the retardation, multipoles and relativity are highlighted as important corrections to the nonrelativistic dipole amplitude [2]. The numerical results show, as expected, an improvement of the evaluation of the scattering amplitude, especially of the imaginary part for photon energies above the ionization threshold of the K shell.

**Acknowledgements** The work of C. Stoica was supported by the strategic grant POSDRU/89/1.5/S/58852, Project "Postdoctoral programme for training scientific researchers" cofinanced by the European Social Found within the Sectorial Operational Program Human Resources Development 2007 - 2013.

1. A. Costescu, S. Spanulescu and C. Stoica, J. Phys. B : At., Mol., Opt. Phys. **40**, 2995 (2007);
2. M. Gavrilă, Phys. Rev. **163**, 147–155 (1967)
3. A. Costescu, P. M. Bergstrom Jr., C. Dinu, and R. H. Pratt, Phys. Rev. A **50**, 1390–1398 (1994)

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### S1\_P07

#### Neutron Activation Analysis for Life Sciences and Materials Science at the Joint Institute for Nuclear Research, Dubna, Russia

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Experience in applying conventional and epithermal neutron activation analysis for some challenging areas of the life sciences is reviewed. For more than 25 years of its operation the radioanalytical complex REGATA at the IBR-2 reactor in Dubna has become a source of analytical data for the environmental studies, marine geology, bio-nano-technology and medicine, etc. In spite of competing non-nuclear analytical techniques (AAS, ICP-ES, ICP-MS, etc), the reactor neutron activation analysis (NAA) as a primary (ratio) method continues to be the most powerful multi-element analytical technique providing quantification of trace elements at ultra low levels. Combined with modern statistical data treatment of large arrays of data, GIS (geographic information system) technologies, electron scanning microscopy, tomography, and others, NAA serves to obtain practical results resumed in the review. The perspectives of using the upgraded reactor IBR-2M for analytical investigations after the reconstruction held in 2007–2011 are discussed.

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### S1\_P08

#### Rapidity and energy dependence of high $p_T$ hadron suppression in Au+Au collisions at 200 GeV and 62.4 GeV

Catalin Ristea for BRAHMS Collaboration



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Transverse momentum spectra of produced hadrons in ultrarelativistic nuclear collisions provide valuable information on particle production mechanism as well as dynamics and properties of the produced matter. The intermediate  $p_T$  region is considered to have both soft and hard hadron production mechanisms. Soft part includes hydrodynamic collective flow, parton recombination, and hard part includes jet fragmentation and its quenching. The suppression observed in the high  $p_T$  yields relative to the p+p collisions is understood as the energy loss of high  $p_T$  partons into the thermalized partonic matter and therefore can significantly enhance our understanding of the energy loss mechanism, in-medium fragmentation mechanism and medium property.

Using the unique feature of BRAHMS experiment to measure hadron production at forward rapidities, we will present results from Au+Au collisions at  $\sqrt{s_{NN}} = 62,4$  GeV and  $\sqrt{s_{NN}} = 200$  GeV on charged and identified hadron production from midrapidity to most forward rapidities. The 200 GeV p+p reference data are collected also with the BRAHMS experiment, too. The (pseudo)rapidity and energy dependence of nuclear modification factors ( $R_{AA}$ ) and the central-to-peripheral factors ( $R_{CP}$ ) in Au+Au collisions will be shown. For the most central 200 GeV Au+Au collisions the high  $p_T$  suppression persists over 3 units in pseudorapidity for charged hadrons. At  $\sqrt{s_{NN}} = 62,4$  GeV, around midrapidity ( $\eta = 0$ ,  $\eta = 1$ ) the nuclear modification factors suggests a smaller degree of high  $p_T$  suppression than in the same reaction at higher energy.  $R_{AA}$  for identified particles from  $\sqrt{s_{NN}} = 200$  GeV Au+Au collisions experimental data shows that mesons are strongly suppressed compared to peripheral Au+Au collisions or p+p collisions experimental results, while baryons show no suppression at intermediate  $p_T$ , leading to an anomalous p/p ratio for  $2 < p_T < 4.5$  GeV/c. An explanation of the effect could be quark recombination or strong radial flow. We will investigate the rapidity evolution of baryon enhancement relative to mesons determined by the nuclear modification factor. We will present these results indicating significant nuclear medium effects on high  $p_T$  hadron production at high rapidities and discuss the implications for understanding the hadronization in the hot and dense matter created in RHIC collisions.

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### **S1\_P09**

#### **Space-time evolution in nucleus-nucleus collisions at relativistic energies**

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In the high-energy nuclear collisions at RHIC, it has been clear evidenced the formation of the hot and dense matter with strong collectivity developed at the partonic stage of the collisions. We will present measurements of identified charged hadron production at different rapidities from Au+Au

and p+p collisions at  $\sqrt{s_{NN}} \approx 200$  GeV and  $\sqrt{s_{NN}} \approx 62,4$  GeV. Midrapidity and forward rapidity experimental results on particle rapidity densities ( $dN/dy$ ), as well as average transverse momentum ( $\langle p_T \rangle$ ) for each particle species (charged pions, charged kaons, protons and antiprotons) are investigated as a function of collision centrality, number of participant nucleons,  $N_{part}$ , and center of mass energy. The rapidity densities decrease at higher rapidities for all particles except for protons. For a thermodynamic system, the average transverse momentum  $\langle p_T \rangle$  can be an approximate representation of the temperature of the system and  $dN/dy$  may represent its entropy. The mass and centrality dependence of  $\langle p_T \rangle$  reflects the radial collective expansion. The results are also compared to previous measurements at various energies. The rapidity and  $N_{part}$  dependence of pion and kaon enhancement factors, considered as the yield per mean number of participating nucleons,  $N_{part}$ , in heavy-ion collisions divided by the respective value in pp, are shown and discussed. An enhancement of kaon production with respect to pions may provide information about strangeness production, due to the fast and energetically favorable process of gluon-gluon fusion into strange quark-antiquark pairs, and therefore sensitive to the initial gluon density, or may be related with other physics mechanisms, for example, additional entropy production. Coulomb effects on pion spectra in relativistic nuclear collisions at RHIC energies will be investigated, too. The rapidity, centrality and energy dependencies of Coulomb "kick" will be presented. Predictions for CBM collisions at FAIR energies are given. The results from the BRAHMS experiment - where it is very probable the formation of quarks and gluon plasma in central Au+Au collisions at the top RHIC energy - will be compared with the results of the SKM experiment from IUCN-Dubna because through the strong asymmetry of the mass partners, the small number of participant nucleons and the incident energy which exclude the existence of quarks and gluon plasma, the SKM collisions can be chosen as a reference for the analysis of Au+Au collisions.

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## S1\_P10

### Study of radioactive precipitates cemented matrix by the XRD phase identification

Nicu Mihaela, Ionascu Laura, Turcanu Corneliu, Dragolici Felicia, Rotarescu Gheorghe

*National Institute of Research and Development for Physics and Nuclear Engineering - Horia Hulubei*

The aim of this work is the XRD application for the phase identification of matrix that simulates the conditioned radioactive waste. The selected matrices for the study are Ordinary Portland Cement with iron precipitates.

The results obtained by this analysis give information about the chemical reactions between the radioactive precipitates and the hydrates, hydrolysis products of the cement.

The structural stability of conditioned radioactive waste is the main request because a structural stable waste form will maintain the geometrical dimensions during the disposal, including factors as weight of material, water presence and internal factors as radiation and chemical reactions.

The obtained data, by structural analysis, are necessary to follow the modification appearing in the conditioning matrix as a result of radioactive precipitates embedding.

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**S1\_P11****Chemical composition of radioactive waste and mechanical performance of the embedding matrix**

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The mechanical characterization of the radioactive waste conditioning matrix is very important during the final disposal stage in the radioactive waste management cycle. The conditioning products should be a monolith with acceptable mechanical, chemical and physical properties that are maintained over an appropriate time such that the release of radioactivity from the waste form in the environment is minimised.

The stability of matrix – radioactive waste system is an essential condition to assure the radiological safety during the final disposal and is directly connected with physical-chemical reaction between the system components and structural modifications which lead to performance parameters imposed by the waste acceptance criteria in repository.

The embedding of radioactive waste in Portland cement matrix is the most used method, applied in the world by the countries developing nuclear energy programs.

The conditioned matrix of radioactive waste must have good mechanical properties to assure the material integrity during handling, storage, transport and long term stability in the final disposal environment.

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**S1\_P12****Analytical Applications of Instrumental Neutron Activation Analysis Technique in Industry**

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Trace and minor elements existing in the raw materials used in iron and steel industry (ores, coal and secondary resources) can remain in the final products as residual elements and influence their properties, so that their transfer during metallurgical operations must be thoroughly investigated. Due to the increased demand for ultrapure metals and alloys and requirements for knowledge of toxic emissions, along with the increasing use of new sources of raw materials (new deposits, industrial by-products, wastes), it is necessary to carefully analyze the distribution of impurity

elements between the main products and by-products of metallurgical processes. The work presents some applications in ferrous metallurgical industry of instrumental neutron activation analysis (INAA), using both thermal (reactor) neutrons and fast (14 MeV) neutrons from neutron generators based on D-T  ${}^3\text{H}(d,n){}^4\text{He}$  nuclear reaction.

Thermal neutron INAA was applied at Horia Hulubei Institute of Physics and Nuclear Engineering IFIN-HH, Bucharest-Magurele, Romania, to investigate the compositional scheme of raw materials, auxiliary materials and final products involved in metallurgical industry at Iron and Steel Works at Galati (Romania) and the transfer efficiency of minor and trace elements during ironmaking and steelmaking processes. The INAA results for steels obtained at IFIN-HH are compared with those obtained by Ion Beam Analysis techniques Particle-induced X-ray (PIXE) and Gamma-ray (PIGE) Emission, in terms of number of elements detected, sensitivity and matrix effects. Also, the complementarity with Scanning Electron Microscopy with energy-dispersive X-ray microanalysis (SEM-EDX) is discussed, based on the performed analyses at ‘Dunarea de Jos’ University of Galati, Romania.

A study of the capabilities of 14 MeV INAA for alkali determination in ores used in iron and steel industry with respect to the interferences of all useful nuclear reactions has been accomplished. A calculus relation is presented for the first order reaction interferences which appear in alkali determination from raw materials using the pertinent nuclear reactions of 14 MeV neutrons on Na and K isotopes. The ore samples were irradiated with the aid of the neutron generator facility from Activation Laboratory, Nuclear Unit, Iron and Steel Works of Galati. Also, there have been studied the spectral interferences which appear in the determination of alkali in iron ores, due to the other elements present in the samples, with the aid of the original field spectrum of gamma-rays emitted by the irradiated sample in the absence of any ambient interaction, considered as a radiation field produced in vacuum by a point source, which maintains the energetic and angular characteristics of the disintegrations taking place in the source. This spectrum depends on the resulted radionuclides from the nuclear reactions between the fast neutrons and the existing elements in the ore sample, their concentrations and the experimental times (activation, cooling and measuring).

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## **S1\_P13**

### **ESTIMATION OF RADON CONCENTRATION IN SCHOOLS AND WORKPLACES IN TIRANA, ALBANIA**

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Measurements of indoor radon concentration have been carried out using passive bare detectors based on CR -39, in 12 schools and 12 workplaces in Tirana.

The measurement of passive detectors was performed also in the Centre of Applied Nuclear Physics, Tirana.

Exposure in schools and the workplaces is one of the main radon exposures for the general population after that in dwellings. These schools and workplaces are generally at the ground and /or first floor, where radon concentration is generally higher than at upper floors.

These schools are attended by children, a population generally considered more sensitive to ionizing radiation although a few data are available for radon exposure.

The exposure time of detectors is in the range 3-4 months, respectively (autumn – winter).

Based on the results of the measurements, the minimum value of radon concentration found is 24 Bq/m<sup>3</sup> and the maximum radon concentration is 405 Bq/m<sup>3</sup> in schools and 53 to 237 Bq/m<sup>3</sup> in workplaces, while the reference levels 200 – 400 Bq/m<sup>3</sup> of UNSCEAR.

For all results is calculated the effective dose due to the radon contribution (mSv/y).

**Keywords:** radon, detectors CR-39, schools, workplaces monitoring

### S1\_P14

#### DETERMINATION OF RA RADIOACTIVITY IN DRINKING WATER SAMPLES IN ALBANIA

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As a consequence of the ICRP 65 recommendations the European Community in their directives 98/83 EC in 1998 demands for the control of radioactivity levels in water for human consumption. This has been extended in 2001 as well to Radon and long lived daughter nuclides. As a consequence the member states are enforced to transfer these directives into national legislation. An action level of 0.1 mSv/a for total natural radiation exposure from drinking water has been fixed.

The **Radium** in ground water under oxidizing conditions co precipitates with Mn- and Fe-oxi-hydroxides and thus it is trapped. Fresh waters having been in a longer contact with such geological formations (>10 to 20 days) are enriched with its daughter Radon with 3,8 days half-life. Under reducing conditions and in saline waters, <sup>226</sup>Ra and <sup>228</sup>Ra usually remain dissolved and waters have higher concentrations. <sup>226</sup>Ra as member of the Uranium-Series is a long lived α-emitter. As such it plays a dominant role in drinking water radioactivity and is considered a key nuclide and a tracer for natural radioactivity.

In this study we present the measurements of <sup>226</sup>Ra and <sup>228</sup>Ra in some drinking water sample from different regions of Albania. The values for <sup>226</sup>Ra range from 15 mBq/L to 32 mBq/L and for the <sup>228</sup>Ra from 6.2 mBq/L to 16 mBq/L.

**Keywords:** Radioactivity monitoring, Radium isotopes, Uranium series, water sample

### S1\_P15

#### Detector efficiency determination and first measurements with lead free neutron monitor at BEO Moussala

A. Mishev, A. Bouklijski, I. Penev, L. Visca, O. Borla

The recently developed lead free neutron monitor at Basic Environmental Observatory Moussala (BEO Moussala, 2925 m. above sea level) is presented. The detector response is obtained on the basis of theoretical studies and corresponding Monte Carlo simulations. The expected counting rates are obtained on the basis of MCNP(x) code simulations. The detector efficiency is experimentally obtained using neutron source and cross-measurements with He proportional neutron counter. Several preliminary measurements are shown. Comparison between Monte Carlo simulations and experimental counting rates is made.

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## **S1\_P16**

### **Lead free Neutron Monitor at BEO Moussala – scientific potential and detector design**

A. Mishev, L. Visca, O. Borla, I. Penev

The lead free neutron monitor at Basic Environmental Observatory Moussala (BEO Moussala, 2925 m. above sea level) is described. The detector is related to complex aerospace monitoring at BEO Moussala, namely to cosmic ray variations, space weather and cosmic ray impact on atmospheric physics and chemistry. The device represents new design for lead free neutron monitor. The monitor consists of six BF<sub>3</sub> tubes type SNM-15. The moderator is glycerin filled cylindrical tanks. The detector design with corresponding Monte Carlo simulations is presented. The Monte Carlo simulations are carried out with MCNP(x) code. The geometry of the detector complex is optimized in order to reject the neutrons product of interaction in detector surroundings. The scientific goals of the described lead free neutron monitor are widely discussed.

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## **S1\_P17**

### **Airborne Trans-Continental Transfer of Radioactive Isotopes from Fukushima. NPP Failure**

Ilia Penev<sup>a</sup>, Stefan Georguiev<sup>a</sup>, Hristo Angelov<sup>a</sup>, Ivo Kalapov<sup>a</sup>, Nina Arhangelova<sup>b</sup>, Hristo Hristov<sup>b</sup>, Nikolay Uzunov<sup>b</sup>.

Measurements of the airborne transfer of the radioactive isotopes from Fukushima reactor incident over the part of Bulgaria have been conducted. Air sampling of the atmospheric air has been conducted at two points: at the Basic Environmental Observatory (BEO) Mousala, situated at the peak of Mousala(2925m) at Rila Mountain, and at University “Konstantin Preslavsky”, Shumen,. Values of the activities of radioactive isotopes <sup>131</sup>I, <sup>134</sup>Cs, and <sup>137</sup>Cs in the atmosphere for the period March 3 – April 16 have been analyzed. A maximum of measured activity of the isotopes has been detected for the period April 2 – April 5 in BEO Mousala, while the maximum of the isotope’s activity accordingly the measurements, conducted in Shumen is in the interval of April 6 – April 12. It has been noted that the measured activities are thousands times lower than the corresponding permissible values according the IAEA standards.

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**S1\_P18****Parity violations effects for thermal neutron scattering on  $^{35}\text{Cl}$** 

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Parity non conservation effects in (n,p) reaction on  $^{35}\text{Cl}$  nucleus for thermal neutrons were evaluated in theory and experiment. For  $^{35}\text{Cl}$  nucleus the PNC effect is of order of  $10^{-4}$  and this correspond to a weak matrix element  $W_{\text{SP}} = 0.056$  eV.

Due to the non zero weak matrix element it is of interest to evaluate other parity violation effects (PV) in neutron scattering for  $^{35}\text{Cl}$  nucleus. It is proposed to evaluate theoretically and to measure in experiment for thermal neutrons range the asymmetry of emitted neutrons, the neutron spin rotation and longitudinal polarization of neutrons. For theoretical evaluation the Flambaum – Sushkov formalism of mixing states of the compound nucleus with the same spin and opposite parities in the two – levels approximation will be used.

By comparison between theoretical and experimental evaluation it is possible to verify the obtained values for the matrix elements as well as to obtain new data on resonance energies and widths.

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**S1\_P19****Calculation of the double differential neutron production cross-section in reactions induced by high-energy ions**

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In this work the double differential cross-section of the reaction induced by proton and carbon ions of energies above hundred MeV/nucleon on carbon target was evaluated. At this high incident energy a lot of channels will be open and a model of direct interaction with coupled channels is used. The number of neutrons produced in the case of incident protons per particle is a not higher then 2 and about 8 - 10 neutrons per particle for incident carbon ions. For enough high intensity of incident ions millions of neutrons with energy distribution from thermal to MeV were obtained.

The results of this study are intended to improve the researches in cancer hadron therapy at JINR facilities.

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## **S2\_P01**

### **Finite size effects and interfacial interactions in magnetic nanoparticulate systems**

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The development of advanced magnetic nanomaterials, of deep technological impact in our days, was related to both the refinement of the processing methods as well as to the improvement of the investigations tools. In addition, many efforts have been devoted to the comprehension of new physical phenomena specific to such nanosized magnetic systems. The remarkable new phenomena observed in magnetic nanostructures derive from the interplay between the intrinsic properties of the components, finite size effects and interphase interactions.

Finite size effects and interfacial interactions as well as their influence on the magnetic properties of nanoparticulate systems is discussed. A summary of the most important technological applications of such effects together with some of the most powerful techniques employed for their characterization will be also provided. Finite size effects dominate the magnetic behavior of individual nanoparticles, the mostly studied effect being the superparamagnetic behavior. The superparamagnetic limit influences the magnetic response of the nanoparticles and has direct implications in the thermal and time stability of the magnetic bits in recording media. Moreover, due to the different atomic configuration and compositional gradient at the particle surface or at the surface/interface of layered systems, their magnetic properties are different as compared to the bulk. This is another size effect with influence on the magnetic response of the nanosized system, leading to high field irreversibilities, high saturation fields, extra-anisotropy contributions, etc. Temperature/field/frequency dependent magnetometry techniques, combined with the powerful Mossbauer spectroscopy method provide relevant information in this respect. Suitable methodologies for answering to delicate issues regarding the case of multiphase nanoparticles versus the case of nanoparticles of different phases, specific spin structures in case of multiphase nanoparticles, magnetic coupling of interfaced phases inside the same nanoparticle versus interparticle interactions, etc., are described and exemplified. The importance of such efficient characterization related to bio-medical applications is revealed.

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## **S2\_P02**

### **SPECIAL INTERACTIONS BETWEEN A DUAL FORMULATION OF LINEARIZED GRAVITY AND A PARTICULAR CLASS OF TOPOLOGICAL BF MODELS**

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Given the recent renewed interest in alternative description of gravity theories in terms of topological BF models (possibly with extra-constraints) as well as in dual formulations of linearized gravity (DFLG), a special type of consistent interactions between one of the DFLGs and

a particular class of topological BF models is considered. More precisely, the case of DFLG in terms of a massless tensor field with the mixed symmetry  $(k,1)$  in  $D=k+3$  spacetime dimensions together with a BF model with the field spectrum consisting in one scalar field, two sorts of one-forms, two types of two-forms and one three-form is analyzed from the point of view of consistent interactions in gauge theories based on the computation of the local Becchi-Rouet-Stora-Tyutin (BRST) cohomology.

**Keywords:** BRST symmetry, consistent interactions, topological BF models, dual formulation of linearized gravity.

**Acknowledgements:** One of the authors (L. S.O.) acknowledges partial support from the strategic grant POSDRU/88/1.5/S/49516, Project ID 49516 (2009), co-financed by the European Social Fund – Investing in People, within the Sectorial Operational Programme Human Resources Development 2007-2013.

### S2\_P03

#### SOLITON DYNAMICS S IN FERROMAGNETIC CHAINS WITH FIRST- AND SECOND-NEIGHBOR INTERACTIONS

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We have considered the ferromagnetic spin chain with both first- and second-neighbor interactions. We obtained the condition for the appearance and stability of bright and dark solitons for arbitrary wave number and different anisotropies (on-site or inter-site). The complicated dependence of the dispersion and the nonlinear coefficients lead to regions in the Brillouin zone where strong second-neighbor interactions can turn the type of the soliton solution (from bright to dark or vice versa).

**Keywords:** solitons, nonlinear Schrödinger equation, spin chains

### S2\_P04

#### The Problem of Concretizing in Quantum Mechanics

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About concretizing in quantum mechanics one may say that it does not exist. According to the classical physics, the concrete is everything that objectively exists in three dimensional space and one dimensional time. Microobjects have always position and momentum, i.e. they always exist in space and time, but these are not clearly defined concepts as they are seen in quantum mechanics.

Their non classical existence is underlined by the fact that they cannot be expressed in theory with common algebraic numbers but with operators. Only own operator values express the classical quantities. Hence, it seems that while position and momentum are space-time characteristics of microobjects, then their quantization must include the change of characteristics of space and time in themselves. But, such a thing does not occur. The space and time in quantum mechanics are the same as in classical mechanics. Further, we have analyzed the question: “What it means to exist in space and time?” and consequently to give response to the question: “Are there microobjects in themselves”? In answer to this questions we have to argue the idea that quantum mechanics is not the theory of atom in itself. In classical physics the meaning of concept “in itself” images the atom in ground state, isolated and out off any interaction with external media. In quantum mechanics the meaning of this concept is expressed with description of behavior of atom that “flows” in different ways for different conditions. The imagination on the isolated microobjects in no way responds to reality. So, quantum mechanics gives us information on microobjects no about their space-time internal structure, but on the flowing of space-time processes of observation that give the detailed information only for external structure of atom. For example, the scheme of energetic levels of atom for all their complementary characteristics is not the scheme of its structure, but the prediction of results of its interactions- the diversity of spectral lines that exited atom can emit.

**Keywords:** concretizing in quantum mechanics, interaction, characteristics of microobjects.

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## S2\_P05

### Quark -antiquark potential from lattice QCD

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Calculation techniques of Lattice QCD (Quantum Chromodynamics) offer special opportunities for the treatment of nonperturbative effects of strong interactions in physics. In Lattice QCD the static quark-antiquark potential can be derived from the Wilson loops. In this paper we use parallel computing to determine the static quark-antiquark potential. Using simulations with SU(3) gauge field configuration we derive quark-antiquark potential for different values of coupling constant and for different lattice sizes. Calculations are made for 100 configurations, statistically independent, of gauge fields of the lattice. Finally, we extrapolate for different lattice constant to measure the string tension.

Key-words: lattice constant, quark-antiquark potential, string tension, SU(3) gauge theory,

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## S2\_P06

### Classical and Quantum Approach to Tachyonic Inflation

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The main task of quantum cosmology is to describe the evolution of the Universe in a very early stage. Since quantum cosmology is related to the Planck scale phenomena it is logical to consider various geometries and parameterization of the space-time coordinates.

The theory of cosmological inflation has become an integral part of the Standard model of the Universe, and it is a “bridge” between classical and quantum in the early Universe. Many authors have emphasized the cosmological implication of tachyonic condensate rolling towards its ground state.

In order to generate enough inflation, it is necessary the inflation field rolls slowly enough. Some recent results give rise to the hopes that nonlocal inflation can succeed where the real string theory fails. We consider several tachyonic potentials which leads to the analytically or numerically solvable classical models and dynamics, as well as their quantization.

### **S2\_P07**

**Cooling Flow (CF) model, comparison with Isothermal model, profiling the hot electronic plasma on Clusters of Galaxies.**

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Building more accurate profiles for temperature and density of hot electronic gas, concentrated in the center of clusters of galaxies, is a constant problem in survey of Sunyaev Zel'dovich effect (SZ). An effect that consists in the inverse Compton effect of the hot electronic gas interacting with Cosmic Microwave Background (CMB) photons passing through Intra Cluster Medium (ICM). So far, the Isothermal model is used for temperature profiling in the calculation of the inverse Compton effect, but based on the recent improved observations from satellites, which showed that the hot electronic gas presents a feature, called Cooling Flow (CF), temperatures in this model differs towards the edges of the Clusters of Galaxies, leading to a change on the Compton parameter in comparison with Isothermal model. In this paper are processed data, provided by 3 X-ray satellites (Chandra, XMM-Newton, ASCA). The X-ray analysis is based on two models for the electron density and temperature profile. A sample of 35 clusters of galaxies are analyzed, 20 of them show this feature, and by building the temperature profiles using CF model, the differences on the Compton parameter, are 10-50% in comparison with Isothermal model. Therefore to increase the accuracy of evaluation of the Compton parameter, we should take into account the change of the electronic gas temperature, change that affect changes in both, CMB spectrum and temperature, from SZ effect.

## **S2\_P08**

### **Nonlinear Quantum Systems**

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Linear quantum mechanics is a one century theory to explain physical laws in atomic world, it has great successes in new technology and it has changed many philosophical explanation of classical point of view in natural and social sciences. But recently a lots of new physical macroscopic observations have no simple explanation in linear quantum mechanics such as superconductivity, superfluidity, BEC, quantum entanglement ect. On the other hand macroscopic world shows nonlinear dynamical behavior and there are many efforts to do physical theories for nonlinear dynamical systems. The main aim of this presentation is to define principle of nonlinear quantum mechanics and show how to explain mechanics macroscopic quantum behavior of new phenomenon mentioned above.

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## **S2\_P09**

### **Interaction of narrow dark solitons with impurities in nonlinear lattices**

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We study the interaction of discrete (narrow) dark solitons with impurities in the integrable Ablowitz-Ladik lattice model. On-site and inter-site (bond) defects are considered. The stability of the analytical solutions for solitons bound to the defect is investigated. A comparison with the standard discrete nonlinear Schrödinger equation is made. Scattering of the dark solitons from point defects of different types is studied numerically. The model plays an important role in numerous physical systems, especially when the corresponding elementary excitations obey Pauli statistics.

**Keywords:** dark solitons, nonlinear lattices, Ablowitz-Ladik equation, soliton-impurity-interaction

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## **S2\_P10**

### **Discretized total angular momentum basis within eight-band $k,p$ theory: application to heteroepitaxial core-shell quantum dots**

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Within the eight-band  $\mathbf{k}\cdot\mathbf{p}$  method and the total angular momentum theory [P.C.Sercel and K.J.Vahala, Phys. Rev. B 42, 3690(1990)], we create a numerical code for computation of the electronic energy structure of heteroepitaxial semiconductor core-shell quantum dots. The modeling takes into account the heteroepitaxial strain, which is introduced by a continuum elasticity model. The leading idea of our discretization algorithm is developing the envelope wave functions in terms of the hard-sphere eigenfunctions. Our method overcomes the limitations of the widely used plan-wave method, which introduces artificial physical interactions when one wishes to study the energy structure of a single quantum dot.

The numerical code is applied to the type II ZnTe/ZnSe semiconductor heterostructure, and the energy structure of the quantum dot for an axial symmetry of the kinetic eight-band  $\mathbf{k}\cdot\mathbf{p}$  Hamiltonian is obtained. We calculated the absorption spectra. As result of the spherical symmetry of the quantum dot shape and axial symmetry of the kinetic Hamiltonian, the absorption spectra that we calculated for the left and right circular polarization are identical. The space distributions of the charge carriers (orbitals) are simulated too. We obtain the charges distribute according to the type II ZnTe/ZnSe heterostructure, with the hole inside the core and the electron migrating into the shell with the shell thickness. The orbitals shapes reflect the axial symmetry of the eight-band kinetic  $\mathbf{k}\cdot\mathbf{p}$  Hamiltonian we used. A good match is obtained when the orbitals shapes are compared with those predicted by an atomistic approach.

## **S2\_P11**

### **Measurements of the diffractive DIS cross section at the H1 experiment**

N. Raicevic on behalf of the H1 Collaboration

*University of Montenegro, Podgorica, Montenegro*

The most recent measurements of the diffractive deep-inelastic scattering (DIS) cross section obtained with the H1 detector are reported. Measurements are performed using two approaches. One approach is based on detection of the diffractive processes

$e p \rightarrow e X Y$  where Y denotes a proton or its low mass excitation with  $M_Y = 1.6$  GeV. Diffractive events are selected by demanding a large empty rapidity gap (LRG) interval separating the final state hadronic systems X and Y. In another approach the leading final state proton from the process  $e p \rightarrow e X p$  is detected in the H1 Forward Proton Spectrometer (FPS).

## **S2\_P12**

### **Precision measurement of the proton structure functions at HERA**

N. Raicevic

*on behalf of the H1 and ZEUS Collaborations, University of Montenegro, Podgorica, Montenegro*

In the final phase of the analysis H1 and ZEUS collaborations work on precision measurements of the proton structure. To achieve high precision measurements data from both experiments have been combined leading to significantly reduced experimental uncertainties. The most recent results of combined measurements from  $e^\pm p$  deep inelastic scattering are reported and their impact on understanding of proton structure is discussed.

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## **S2\_P13**

### **Measurement of the longitudinal proton structure function at the H1 experiment**

I. Picuric

*on behalf of the H1 Collaboration*

This report presents the most recent measurement of the longitudinal structure function  $F_L$  obtained from  $e^\pm p$  interactions recorded by the H1 experiment at HERA accelerator. The data at different proton beam energies of 460 GeV, 575 GeV and 920 GeV are used to determine  $F_L$ . The measurements are obtained for low values of photon virtuality  $Q^2$  down to 1.5 GeV<sup>2</sup> and low values of Bjorken variable  $x$  down to  $2.7 \cdot 10^{-5}$ . Direct measurement of  $F_L$  allows also to measure structure function  $F_2$  which represents a model independent determination without extra assumption on  $F_L$ . The data are compared with the predictions based on NLO and NNLO QCD calculations.

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## **S2\_P14**

### **Measurement of the inclusive $e^\pm p$ scattering cross section at high inelasticity $y$ using H1 data**

I. Picuric

*on behalf of the H1 Collaboration*

This report presents the measurements of the inclusive neutral current  $e^\pm p$  scattering cross section using data collected by the H1 experiment at HERA during the years 2003 to 2007 with proton beam energies  $E_p$  of 920, 575 and 460 GeV. The kinematic range of the measurement covers low



absolute four-momentum transfers squared,  $1.5 \text{ GeV}^2 < Q^2 < 120 \text{ GeV}^2$ , small values of Bjorken  $x$ ,  $2.9 \cdot 10^{-5} < x < 0.01$ , and extends to high inelasticity up to  $y = 0.85$ .

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### S2\_P15

#### Computational Tools in Neutron Scattering Design and Optimization and for Experimental Data Processing

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In neutron spectrometry the optimal use of the neutrons supplied by the available neutron sources is of the greatest importance. The usual way to do it is to maximize the neutron flux at sample by using neutron guides, supermirrors [1] or spatial focusing effects. Optimization of an experimental configuration and a proper design of it, mainly by using Monte Carlo procedure, received a special attention since many years.

A different approach [2] is to obtain a very good resolution not by getting focused beams at sample or anywhere else, but only by decreasing as much as possible the scan variable variances. During the last period special configurations using inverse-space focusing to get high resolution properties have been developed.

To design and optimize such a configuration both Monte Carlo and matrix procedure [3] were used. The **DAX** program and the adapted Monte Carlo program will be presented in this paper.

Two programs for the experimental data processing, **LSQ1 program for the grain size and the second order strain determination** and a **Rietveld refinement program to process the pattern measured on inverse space focussing diffractometer** were developed and will be presented in this paper too. The Rietveld program has to be further modified to be suited for an inverse-space focusing instrument using a position sensitive detector.

References:

[1] **P. Boni**, *J. Neutron Research*, 5, (1996), 59-63.

[2] **I. Ionita, A.D. Stoica, M. Popovici, N.C. Popa**, *Nuclear Instruments & Methods in Physics Research, A 431* (1999), 509-520.

[3] **I. Ionita, A.D. Stoica**, *Journal of Applied Cryst.*, **33** (2000) 1074-1087

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## S3\_P01

### CONSISTENT INTERACTIONS BETWEEN DUAL FORMULATIONS OF LINEARIZED GRAVITY

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A particular case of consistent interactions of a single massless tensor field with the mixed symmetry corresponding to a two-column Young diagram  $(k,1)$ , dual to linearized gravity in  $D=k+3$ , is considered in the context of cross-interactions with another dual formulation of linearized gravity in terms of a massless tensor field with the mixed symmetry of the linearized Riemann tensor. The general approach relies on the deformation of the solution to the master equation from the antifield-BRST formalism by means of the local cohomology of the BRST differential.

**Keywords:** BRST symmetry, consistent interactions, dual formulations of linearized gravity.

**Acknowledgements:** One of the authors (M.T.) acknowledges partial support from the strategic grant POSDRU/88/1.5/S/49516, Project ID 49516 (2009), co-financed by the European Social Fund – Investing in People, within the Sectorial Operational Programme Human Resources Development 2007-2013.

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## S3\_P02

### Ground Detection in Moussala of Coronal Mass Ejections (CMEs) March-April 2012

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The Basic Environmental Observatory (2925 m.a.s.l., 22.35E, 42.11N) performs uninterrupted observations of secondary cosmic rays. The measurement equipment consists of complex particle SEVAN device and water cherenkov muon telescope. With both of them we detected Forbush decreases due to geo-effective occurred CMEs during period March-April 2012. The report presents detailed information of muon and neutron data trend due to CMEs.

**Keywords:** CME, Muon, Neutron.

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## S3\_P03

### Stochastic analysis of earth detected Coronal Mass Ejections (CMEs) March-April 2012

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The cosmic particles interactions in atmosphere are stochastic processes. The secondary particle birth, decay and path direction is branching process produced by strong and weak nuclear forces corresponding to particle energy distribution and atmosphere density. The produced particles in nuclear cascades can be measured by probability distributions. This presentation investigates different probability distributions of variations in ground neutron and muon data from observations in Moussala (2925 m.a.s.l., 22.35E, 42.11N) during March-April 2012 CME events.

Keywords: Branching process, Cascades, Cosmic Rays, CME.

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### **S3\_P04**

#### **Comparasion of Satellite estimates values of solar radiation with terrestrial measurements for Albania**

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Satellite-based solar radiation estimates have recently been incorporated into the 1990–2005. The National Aeronautics and Space Administration (NASA) also supplies satellite-based estimates of solar radiation. The usefulness of such data with respect to solar resources for site selection and designing solar energy conversion systems is often questioned. The availability of rotating shadow band radiometer measurement data at several new stations provides an opportunity to compare historical satellite-based estimates of solar resources with measurements. We compare mean monthly daily total (MMDT) solar radiation data with 22 years of NASA hourly global horizontal and direct beam solar estimates with measured data from one station, collected after the end of the available resource estimates.

Quantitative analysis shows that in most cases, measured data are comparable.

Key words: solar energy, satellite-based solar radiation, quantitative analysis, uncertainties,

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### **S3\_P05**

#### **Cosmology with Non-standard Lagrangians**

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Modern cosmological models use non-standard Lagrangians in attempt to solve contemporary cosmological puzzles. Often used non-standard Lagrangians that we consider are DBI-type Lagrangian for tachyon field and  $p$ -adic string theory Lagrangian.

DBI-type Lagrangian is used for models describing dark components of the Universe and for defining models based on real and  $p$ -adic number fields  $Qp$  ( $p$  is prime number). On the other hand,  $p$ -adic string theory Lagrangian contains scalar field that describes open  $p$ -adic string tachyon, and is used in describing ( $p$ -adic) inflation. It has non local nature defined by the infinite number of space-time derivatives it contains.

Both the DBI and  $p$ -adic type Lagrangians are of non-standard form by definition: they are not expressed as differences between kinetic and potential energy terms.

### S3\_P06

#### Differentiation of Conductivity Degradation Trace of PEDOT:PSS Films after first and second Thermal Treatment in Helium and Atmospheric Air.

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PEDOT:PSS is a stable (under heat treatment), transparent and highly conductive polymer complex of polyethylenedioxythiophene (PEDOT) oxidized by polystyrene sulphonate (PSS), used extensively in organic optoelectronic applications. PEDOT:PSS has a granular structure with small conductive grains 20 – 50 nm in diameter, separated by regions rich in insulating PSS.

Mechanisms affecting conductivity are critical for the performance of PEDOT:PSS films as buffer layer in organic optoelectronics and organic solar cells device applications. In this study a systematic study of the differentiation of conductivity degradation trace is presented. The same procedure followed twice: once under inert helium gas and another one under atmospheric air.

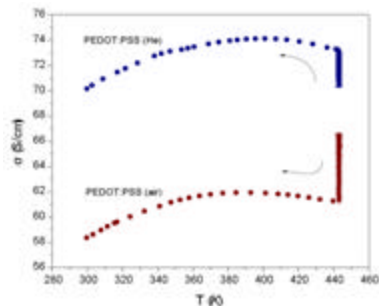


Fig. 1

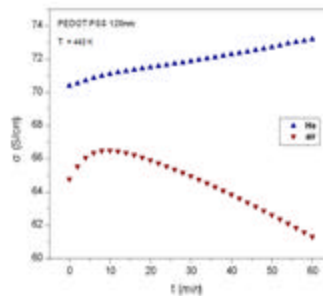
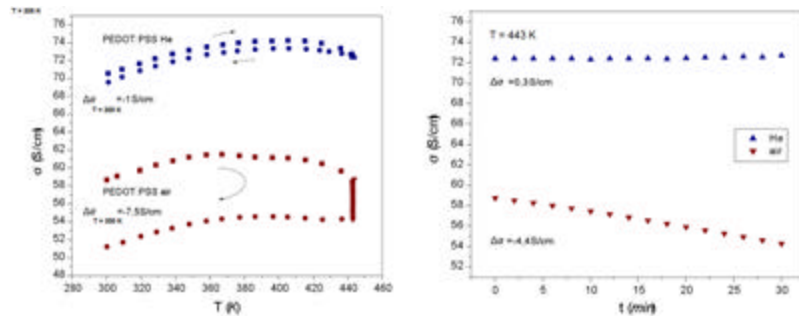


Fig. 2

In Fig. 1 the change of the conductivity  $\sigma$  of two PEDOT:PSS films 120 nm thick is shown, under He and atmospheric air. At the beginning the two samples are heated at 443 K (170 °C) for 60 min and then they allowed to cool down to room temperature. The isotherms (at 443 K) vs heating time

are shown in Fig. 2. Under He  $\sigma$  increases monotonically with  $t$ , though under air  $\sigma$  increases for the first nine minutes and then decreases. This behavior reveals the role of competitive mechanisms during heat treatment [1]. At the beginning, the thermal activation of charge carriers and the improvement of the crystalline order in the films, which enhance conductivity, prevail against the structural degradation of the polymer chains, in which oxygen and moisture from the air play the prominent destructive role, causing the decrease of the conductivity [2]. The comparison between the two curves  $\sigma = \sigma(t)$  under He and under atmospheric air verify this conclusion.

To investigate the irreversible changes caused by heating, the previous procedure was repeated for each sample, as it is shown in Fig. 3. It is obvious that the



“hysteresis” is much less under inert He than under atmospheric air. In Fig. 4 the isotherms at 443 K of the second heating are quite different from the previous. The conductivity  $\sigma$  with heating time under inert He remains practically constant, though under atmospheric air decreases almost linearly verifying the already mentioned destructive role of oxygen and moisture.

References:

- [1] E. Vitoratos, S. Sakkopoulos, E. Dalas, N. Paliatsas, D. Karageorgopoulos, F. Petraki, S. Kennou & S.A. Choulis, *Organic Electronics*, **10**(1), 61-66, (2009).  
 [2] E. Vitoratos, S. Sakkopoulos, N. Paliatsas, K. Emmanouil, & S.A. Choulis, *Open Journal of Organic Polymer Materials*, **2**, 7-11, (2012).

### S3\_P07

#### Parallax effect, a possibility to investigate free-floating planets by Euclid

Lindita Hamolli, Mimoza Hafizi

Gravitational microlensing represents a powerful and important tool to explore many astrophysics objects; it is up to now the unique method to detect free-floating planets. These last objects are questioned and discussed several times during this decade, our considerations are based on latest

results about their mass function in the mass range  $[10^{25}, 10^{22}]M_s$ . In this work we investigate the possibility of discerning the events by lens mass and distance, based on the parallax effect, especially for the observations of the future Euclid space observatory. We approach the microlensing curve with the standard one and find the residuals caused by the earth motion around sun. Our results can be generalized in the case of other observations.

**Keywords:** Gravitational microlensing method, free-floating planets, parallax effect, residuals.

## S4\_P01

### The Mechanical Properties of Ethylene-Vinyl-Acetate Copolymer/Triallylcyranurate Mixture Vulcanized by Electron Beam and Microwave Processing

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In this study, the effect of the polyfunctional monomer triallylcyranurate (TAC) on the mechanical properties of the ethylene-vinyl acetate copolymer (EVA) cross-linked (vulcanized) by electron beam (EB) and microwave (MW) processing was investigated. The control samples were obtained by cross-linking with benzoyl peroxide in a hydraulic press at 160°C and pressure of 150 MPa. Experiments were carried out with an experimental installation consisting of the following units: an electron linear accelerator of 6.23 MeV / 75 mA (ALIN-10) and a microwave oven properly electrical and mechanical modified. For EB and EB+MW treatments the rubber sheets were cut in rectangular shapes of 0.1 x 0.03 m<sup>2</sup> and covered with polyethylene foils to minimize oxidation. The layers of ten sandwiched sheets were irradiated in atmospheric conditions and at room temperature of 25°C. The results showed an improvement of mechanical properties for samples cross-linked by irradiation.

KEYWORDS: ethylene-vinyl-acetate-copolimer, cross-linking, electron beam, microwave, triallylcyranurate.

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## S4\_P02

### Flocculation Efficiency of Poly(acrylamide-co-acrylic acid) Obtained by Electron Beam Irradiation

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The correlation between physico-chemical characteristics of flocculants materials obtained by electron beam irradiation and their efficiency for waste water treatment are presented. Flocculants are obtained by copolymerization of acrylamide and acrylic acid with electron beam and has the following characteristics: conversion coefficient  $C_c > 90\%$  residual monomer concentration  $M_r < 0.01\%$ , intrinsic viscosity  $\eta_{intr.} > 6.5$  dl/g, linearity coefficient  $k_H < 0.5$  and good water solubility. For real waste water treatment, our interest was focused upon the following quality indicators

established by the Romanian Standard NPTA-002/2005 concerning the conditions for wastewater evacuation in the urban sewerage system: total suspended solids (TSS, mg/dm<sup>3</sup>), fatty matter (extractable substances with petroleum ether) (FM, mg/dm<sup>3</sup>) and chemical oxygen demand by potassium permanganate method (CCO-Mn, mgO<sub>2</sub>/dm<sup>3</sup>). Flocculation studies were carried out on waste water taken from a slaughterhouse plant, at room temperature (20-25 °C) using standard jar test.

Keywords: flocculants, acrylamide, acrylic acid, electron beam, waste water.

### S4\_P03

#### The Influence of Milling and Annealing on the Structural and Magnetic Behaviour of R<sub>2</sub>Fe<sub>14</sub>B/a-Fe (R=Nd, Nd+Dy) Magnetic Nanocomposite

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Nanocrystalline ferromagnetic materials exhibit magnetic properties which are interesting for fundamental researches in magnetism as well as for applications [1-4]. Nanocomposite exchange coupled magnets, spring-magnets, consisting of a fine mixture of hard (high coercivity) and soft (high magnetization) magnetic phases have attracted attention for permanent magnet fabrication [5-7]. This paper propose a crystallographic and magnetic study of exchange coupled hard/soft magnetic nanomaterials R<sub>2</sub>Fe<sub>14</sub>B/a-Fe (R=Nd, Nd+Dy) obtained by mechanical milling and annealing. In order to improve the crystallinity of hard magnetic phase and in the same time to hinder the increase of crystallites size of soft magnetic phase, tow type of annealing was done after milling. The first, conventional heat treatment was performed at temperatures range between 450 and 800 °C for long time. The second, rapid annealing was performed at temperatures between 700 and 800 °C for maximum 3 minutes. The better crystallographic and magnetic properties were found for rapid annealed samples. This behaviour was explained by a better crystallinity of hard magnetic phase and suitable crystallite dimensions of soft magnetic phase. The magnetic behaviour was checked from hysteresis curves and dM/dH vs H plots.

References:

1. O. Gutfleisch, A. Bollero, A. Handstein, D. Hinz, A. Kirchner, A. Yan, K. H. Muller and L. Schultz, J. Magn. Magn. Mater. 242-245, 1277 (2002).
2. R. Hasegawa, J. Magn. Magn. Mater. 304, 187 (2006).
3. G. C. Hadjipanayis, J. Magn. Magn. Mater. 200, 373 (1999).
4. Y. Yoshizawa, S. Oguma, K. Yamauchi, J. Appl.Phys. 64, 6044 (1988).
5. E.F. Kneller, R. Hawig, IEEE Trans. Magn. 27 (1991) 3588.
6. R. Coehoorn, D.B. de Mooij, C. De Waard, J. Magn. Magn. Mater. 80, 101, (1989).
7. R Skomski J. Appl. Phys. 76 (1994) 7059



## S4\_P04

### Hysteresis effect in Langmuir films based on barium stearate with phthalocyanine additives and preparation of UV sensing material based thereupon

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In this paper are reported results on the presence of an hysteresis effect observed in Langmuir films based on barium stearate with nabocarbon additions and phthalocyanines. During the first 2 cycles of compression-extension the Langmuir layer was mechanically stabilized. Further cycles do not show any modification. The area covered by every cycles becomes constant for all cycles. We have prepared multilayers composed from five 5 thin layers that were deposited on a special ceramic body provided with 2 interpenetrating platinum electrodes. The sensor thus prepared shows a strong sensing effect in resistivity when is irradiated by ultraviolet light.

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## S4\_P05

### Langmuir stabilized layers and UV-sensor based on silver stearate, carbon nanotubes and porphyrins additives

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Langmuir films based on Barium Stearate, carbon nanotubes and porphyrins have been prepared on the water surface of the LB trough. By several compression-extension cycles the films were stabilized. The different organization of the stearate molecules in the films was monitorized and evidenced after mathematical processing. The multilayer films were deposited on special ceramic body provided with platinum comb configured electrodes. We have observed a strong effect of UV light on the electrical resistivity of the materia. An UV sensor based on the observed effect has been proposed.

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**S4\_P06****Nanoengineered multiscale nano-structuring of Si surfaces combining top-down and bottom-up techniques**

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Surface patterning is of tremendous importance in many technological fields with features ranging from nanometers to millimeters. There are different patterning techniques that generally can be assigned to the top-down and bottom-up approaches. One bottom-up method for the generation of self-organized nanostructures is low-energy ion beam erosion. It is an easy one step process for the generation of large scale nanostructures of different materials, usually with a mean size below 100 nm. However due to the stochasticity of the process there is a lack of large scale ordering of nanostructures and of positional control.

In this contribution results on self-organized nanostructuring of pre-patterned Si surfaces will be presented. This method known as guided self organization has its inspiration in nature and is already successfully applied in heteroepitaxy and in diblock-copolymers. The idea is to combine the top-down technique for pre-patterning of surfaces followed by the ion beam induced self-organization process (bottom-up). Due to the periodicity, shape and lateral ordering of pre-patterns an improved ordering, and an exact positional control of nanostructures is achieved. The method allows also for the formation of new structures not possible on planar surfaces.

The pre-patterned substrates are fabricated by various lithographic techniques in combination with etching techniques for structure transfer. Depending on the shape of the pre-patterned structure (binary gratings with different periods, square arrays of cylinders, gratings with V-grooves) different results are obtained. Some experimental observations are: i) formation of curved ripples on the surface, where the curvature is caused by a continuous change in the local topography within pre-patterned regions; ii) perfectly square ordered dots on exact positions on the surface; iii) enhanced ordering of ripples and the formation of ripples with different orientation due to the local surface orientation; (iv) formation of patterns on curved surfaces.

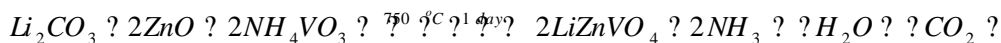
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**S4\_P07****Conductivity study of LiZnVO<sub>4</sub> for humidity sensor applications**

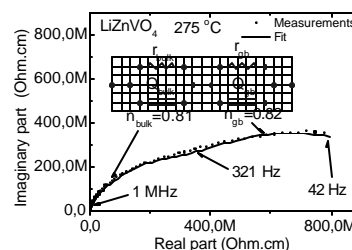
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During the last 30 years much effort has been paid to the development of humidity sensors composed of metal oxide ceramics. These materials have received much attention because of their higher sensitivity and chemical inertness. The materials  $\text{LiMVO}_4$  ( $M=\text{Ni, Co, Mg, Zn}$  and  $\text{Li}$ ) have been reported to be humidity sensitive and thick-film humidity sensors using  $\text{LiZnVO}_4$  have already been proposed [1, 2]. A structural and spectroscopic study of  $\text{LiZnVO}_4$  has been proposed in [3]. The compound  $\text{LiZnVO}_4$  was prepared with solid state reaction as it was proposed in [4].



The prepared material was chemically characterized by electron microprobe (EDAX). The average size of the grains was estimated using photographs taken by a Scanning Electron Microscopy (SEM). The structure was confirmed with XRD analysis using  $\text{CuK}\alpha_1$  radiation. Thermographic measurements (TG) were carried out with SETARAM SETSYS TG-DTA 1750 °C equipment first after preparation and then after the materials have been heated up to 300 °C and cooled down to room temperature. Impedance spectroscopy measurements were carried out on pellets of polycrystalline  $\text{LiZnVO}_4$  at temperatures from 25 to 500 °C at 25 °C steps and at frequencies from 42 Hz to 1 MHz. Equivalent circuits were drawn using the program EQUIVCRT.PAS to fit the measurements' results at each temperature level. Parts of the equivalent circuits were assigned to grain boundary (gb) conductivity and bulk conductivity using time constant arguments. From the equivalent circuits the Arrhenius plots are drawn and the activation energies associated with grain boundary and bulk phenomena were calculated. The impedance measurements of the material revealed that it displays clearly ionic conductivity over the temperature of 125 °C. The conductivity of the material below the 125 °C presents a decrease in conductivity as it is heated up to 125 °C. This decrease in conductivity is associated with the humidity desorption mechanism revealed in the TGA measurements.



## References

- [1] W. Ming-Tang, S. Hong-Tao, and L. Ping, *Sensor Actuat B Chem* 17 (1994) 109.
- [2] J. Ying, C. Wan, and P. He, *Sensor Actuat B Chem* 62 (2000) 165.
- [3] D. Capsoni, M. Bini, V. Massarotti, P. Mustarelli, F. Belotti, and P. Galinetto, *J Phys Chem B* 110 (2006) 5409.
- [4] G. T. K. Fey and D. L. Huang, *Electrochim. Acta* 45 (1999) 295.
- [5] Equivalent Circuit (EQUIVCR.PAS) Bernard A. Boukamp, University of Twente.

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## S4\_P08

### Properties of some transparent conductive oxides films to be used as transparent contact electrodes in chalcogenide solar cells

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Properties of some transparent conductive oxides (e.g. SnO<sub>2</sub>, ITO, and ZnO:Al) deposited onto glass substrates with different thicknesses (i.e. 50 nm and 300 nm) are presented. As deposition technique we used vacuum thermal evaporation of Sn, ITO and Zn:Al(3%) grains in a vacuum of approximately 10<sup>-7</sup> Torr (for each deposition). After deposition, all samples were subjected to heat treatments at 450 °C in air and for a period of two hours. Thus, conductive oxide samples, such as SnO<sub>2</sub>, ITO and ZnO:Al(3%) were obtained.

Modern methods like XPS, XRD, AFM and SEM were used to analyze the structure and morphology of the heated samples. These heat treatments may be held responsible for rearrangements in the morphology of thin films and the crystalline lattice. As a result, the roughness of the films affected the properties of the films. Using scanning electron microscopy (SEM) we also obtained information about the crystalline structure and the polycrystalline nature of the films was observed from XRD pattern.

The dependence of structural and optical properties on the thickness of the samples was also studied. These properties are suitable for transparent conductive electrodes in various optoelectronics applications.

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#### **S4\_P09**

##### **Low Frequency Polarization Mechanisms in Magnetic Fluids**

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The paper reports on the frequency and temperature dependencies of the complex dielectric permittivity over the range 4 kHz to 2 MHz and 25<sup>o</sup>C to 90<sup>o</sup>C, for a kerosene-based magnetic fluid with magnetite particles.

Based on the experimental measurements of the complex dielectric permittivity and using the Claussius-Mossotti equation, the total polarizability of the magnetic fluid was determined.

The results show that the real part,  $\epsilon'$ , of the total polarizability increases with temperature in the low frequency range (4 kHz to 100 kHz) and decreases with temperature above 100 kHz. This behaviour demonstrates that in low frequency range the distorted polarization mechanism is predominant and above 100 kHz the orientation of the dipolar moments in electric field determines the polarization of the magnetic fluid.

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#### **S4\_P10**

##### **The Influence of Anisotropy on the Green's Function of a Model Crystal**

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The study of the physical properties of the low dimensional tight binding models in a constant magnetic field is of particular importance from both theoretical and practical point of view due to the rich properties displayed by such structures. The used model was the square lattice in a constant magnetic field taking into account the anisotropy parameter leading to the Harper equation.

For the derivation of the Green's function for our model a suitable energy polynomial had to be determined. The recurrence relation for the polynomials coefficients is given and the general form of the coefficients is deduced. This leads to the eigenvalue polynomial for any rational magnetic field taking into account the anisotropy parameter. The influence of this parameter on the energy bands for a fixed value of the magnetic field is also displayed.

Having determined the characteristic polynomial we could proceed to determine the diagonal elements of the Green's function over the whole Brillouine zone  $[-p,p] \times [-p,p]$ . Using integration over the complex plane and the residue theory, the general analytical form of the resolvent for the considered Hamiltonian is obtained without explicit knowledge of its eigenvalues and eigenvectors in which the influence of the anisotropy parameter is present. The consistence of our result with the previously obtained isotropic results is pointed out. The result is used to obtain again the density of states for the anisotropic case and the derivative of the Lyapunov exponent with regard to the energy.

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## **S4\_P11**

### **SYNTHESIS AND CHARACTERIZATION OF LANGASITE NANOPOWDERS DOPED WITH ERBIUM AND YTTERBIUM**

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In this paper we present data concerning synthesis and characterization of Er, Yb-doped nanopowders from langasite family obtained by a Pechini sol-gel method. The nanopowders were annealed in air, at various temperatures (700°C, 800°C, 900°C and 1000°C) for 5 hours. The purity of the langasite phase was checked by X ray diffraction using the Rigaku MiniFlexII (Cu, Ka) diffractometer. A Bruker Tensor 27 was used for Fourier Transform Infrared Spectroscopy (FTIR) measurements. The morphology of the nanopowders was examined with the electron microscope Vega Tescan 3. These materials were characterized by optical spectroscopy (absorption, diffuse reflectance and luminescence). The luminescence of the powders was excited in IR, at 973 nm. The experimental set-up for luminescence measurements contains a Horiba Jobin-Yvon monochromator (model 1000MP), an S-20 photomultiplier and the SR 830 lockin amplifier on line with a computer. All the measurements were performed at room temperature.

In the XRD patterns some other lines are observed, but with very low intensities. These “extralines” belong to perovskite  $\text{LaGaO}_3$  phase. In the diffuse reflectance spectrum of the powders in the UV-VIS domain are identified the absorption lines ( $^4I_{15/2} \rightarrow ^2S_{3/2}, ^2H_{11/2} \rightarrow ^4I_{15/2}$ ). The transition ( $^4S_{3/2}, ^2H_{11/2} \rightarrow ^4I_{15/2}$ ) is responsible for the green luminescence while the transition  $^4F_{9/2} \rightarrow ^4I_{15/2}$  is responsible for the red one.

The upconversion luminescence in langasite nanocrystals has not been reported yet.

#### S4\_P12

### REDUCTION OF YBCO MELTING TEMPERATURE BY SIMULTANEOUS Ca SUBSTITUTION AND Ag ADDITION

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Today's plasma experiments and future fusion reactors require long confinement time and high magnetic fields, which can be obtained only by superconducting coils. The applicability of high temperature superconductors for the TF coil conductor needs further development of wire technology production. Easily accessible OPIT method is used for Bi-Sr-Ca-Cu-O tape production while more technologically complicated method of coated conductors is used for YBCO system. However YBCO material has better potential to yield a high critical current density in very high magnetic fields when compared to Bi-Sr-Ca-Cu-O. Fabrication of long-length YBCO wires and cables using OPIT method has been hindered by the high melting temperature of YBCO (approximately 1040° C.) which is well above the melting temperature of silver (960° C).

We examine two series of polycrystalline samples: first - with different calcium substitution  $\text{Y}_{1-x}\text{Ca}_x\text{Ba}_2\text{Cu}_3\text{O}_{7-d}$  ( $x=0.025, 0.05, 0.10$  and  $0.20$ ) and second - with calcium substitution and 10 wt % Ag additions. Our simultaneous TGA - DTA investigations of samples showed significant suppression of  $T_m$  (about 42 C for  $\text{Y}_{0.975}\text{Ca}_{0.025}\text{Ba}_2\text{Cu}_3\text{O}_{7-d}$  and about 65 C for  $\text{Y}_{0.8}\text{Ca}_{0.2}\text{Ba}_2\text{Cu}_3\text{O}_{7-d}$ ). The melting point was further reduced to 960 C for  $\text{Y}_{0.975}\text{Ca}_{0.025}\text{Ba}_2\text{Cu}_3\text{O}_{7-d}$  and to 975 C for  $\text{Y}_{0.8}\text{Ca}_{0.2}\text{Ba}_2\text{Cu}_3\text{O}_{7-d}$  when Ag additions are included. The Ag-sheathed tapes have been prepared by hydrostatic extrusion and subsequently hot rolling using both compositions. XRD analysis showed partial texturing of tape's core. SEM investigations show formation of large grains which seems to be interconnected. In spite of the fact that Ca substitution increase the carrier concentration and improves the inter-grain connections the critical current density is about 440 A/cm<sup>2</sup> at 20 K and zero field ( the criterion 1μV/cm was used).

## S4\_P13

### Unconventional routes for joining W and steel using FAST

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The development of the DEMO fusion reactor structure is a complex and fast evolving task. The current He cooled divertor design assumes W as armor material while Eurofer steel is going to be used as structural material. In this frame we are exploring different routes for joining W and steel. Here we present the progress on the development of functional gradient materials (FGM) as well as different brazing procedures using field assisted sintering technique (FAST). The quality of the joints is evaluated with structural investigation (SEM, EDX) and high temperature thermal properties..

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## S4\_P14

### Sintering of SiC-W nano-structured composites with enhanced thermal conductivity

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SiC-W composites have been realized by SPS sintering starting with beta SiC nanopowders and inserting 20% weight W micro or nano grains. SEM, EDX and X ray tomography have been used to analyze the sample morphology. The thermal properties of the resulting materials have been investigated up to 1000 C using a LFA thermal analyzer. Insertion of nano particles of W in the SiC matrix resulted in 300% increase of thermal conductivity at 1000 C. The present results can be used as a start point in defining a relatively simple route to produce improved W-SiC composites with possible applications in structural materials for fusion reactors..

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## S4\_P15

### THE INVESTIGATION OF STRUCTURAL CHANGES OF ORIENTED POLYPROPYLENE FILMS EXPOSED TO PRELIMINARY EXTENSION

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Oriented Polypropylene (oPP) films were exposed to preliminary extension ranging from 0.3 to 140% for 10 min. Tensile properties of pre-extended oPP films were examined. Moreover, the recovery process of the oPP films already extended at different strain levels were examined in long period of time. The effect of preliminary extension on the structure of oPP films were investigated with XRD and FT-IR/ATR methods.

From the results of recovery process, it was observed that up to low strain levels, the stretched sample showed an almost complete recovery in length. However, for higher strain levels, the recovery process became very slow and caused a great amount of residual deformation which can be considered as an undesirable property for applications in the industry. Even after very long time such as approximately one year, a complete recovery in both length and tensile properties could not be observed.

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#### S4\_P16

### ENERGETIC EVALUATION OF POLYMER-BIOLOGICAL ENVIRONMENT INTERFACE

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The surface tension of solids is a very useful parameter in studies of adsorption and wettability processes, having a great importance for all interfacial phenomena<sup>1</sup>. Thus, it is very important to evaluate the adhesion properties of implant surfaces, especially polymers, taking into account that the processes at the interface organic tissue - implant surface induce the success or fail of the implant. Therefore, the characterization of the surface properties and especially the surface energy components is the key to understand mechanisms involving solid – biological liquid interactions.

The Zisman method for calculation of surface free energy is used especially for non-polar surfaces, being not so accurate for the surfaces which have polar component<sup>2</sup>. Also Owens–Wendt theory is most applicable to surfaces which have low surface charge and are moderately polar<sup>3</sup>. Therefore, numerous test liquids need to be used to calculate the more precisely surface energy of a solid surface.

We present a comparison from energetical point of view between different polymeric surfaces such as poly(propylene) poly(ethylene terephthalate), poly(tetra Fluor ethylene) and polymers with the same chemical composition, poly(styrene) films, obtained by various techniques such as spin coating, plasma polymerization and commercial films. We used different techniques: Fowkes, Owens – Wendt, Zisman to calculate the surface energy of hydrophobic polymers in order to evaluate their stability and biocompatibility in biological environment.

**Acknowledgements.** This work was supported by the project: “Doctoral Studies: “Gateway to a Career of Excellence in Research and Knowledge Society” - contract POSDRU/88/1.5/S/ 47646 project co-funded from European Social Fund through Sectorial Operational Program Human Resources 2007-2013.

#### References



1. C. van Oss, *Interfacial forces in aqueous media*, Taylor and Francis, 2nd ed, 2006
2. W. A. Zisman, *Ind. Eng. Chem.*, 1963, 55 (10), pp 18–38
3. N. Selvakumar, H.C. Barshilia, K. S. Rajam, *J. Appl. Phys.*, 2010, **108**, 013505

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## S4\_P17

### Study of structural and electrical properties of some metallic nanocomposites

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Nanostructures composed of transition magnetic metals have attracted a special attention due to their potential applications. The aim of this paper is an investigation of Ni-Cu and Co-Cu structure and surface morphology and to correlate these characteristics with the electrical properties.

A series of Ni-Cu and Co-Cu nanocomposites with different thicknesses were deposited by thermal vacuum evaporation. The thin films were characterized using TEM, SEM and EDAX techniques. Electrical measurements were performed with four point probe method. The samples exhibit an ohmic behaviour. We studied the relations between the crystalline structure and electrical resistance, analyzing the Feret diameter and shape factor.

Investigating the properties of these samples allowed us to evaluate the mechanism of formation of interconnections between particles.

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## S4\_P18

### Classification of Polymers by Using Fuzzy Clustering Algorithm

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Classification and prediction of especially high molecular weight polymers is complex and not easy method for classification directly. But these polymers have greatest use in industry. High molecular weight polymer systems represent complex class of materials and are very difficult to model. Polymers are high non-linear systems and have many parameters necessary to identify the correct identification. In this study a novel approach is applied for classification of polymers by using fuzzy clustering method. Fuzzy clustering, which combines fuzzy logic and cluster analysis techniques, has experienced a spur of interest in recent years owing to its important applications for classification. Polymers physical properties is used for this database: all kinds of bonds number,

aspect ratio, molecular weight, dynamic elastic modulus at room temperature, glass transition temperature, lower secondary order transition temperature,

**Key Words :** *polymers, classification, fuzzy clustering*

#### S4\_P19

##### Electron beam trials for a slow positron accelerator

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Preliminary tests for an upcoming slow positron accelerator have been performed in order to find out the best setup for the electromagnetic and geometrical parameters used to confine, transport and accelerate the electron beam.

This study combines the development of beam transport simulation models by LORENTZ software with beam line experiments in order to improve the understanding of the properties of the extracted particles. The simulation of the beam extraction from electron source is particularly challenging and interesting as the initial density distribution at extraction is unknown. By combining magnetic field tracking, experimental measurements and beam diagnostics, we were able to predict beam patterns. Simulation results are in agreement with the practical observations.

**Keywords:** electron beam, positron, LORENTZ software

#### S4\_P20

##### Optical Absorption Edge and Its Temperature Behaviour Studies in $(\text{Ag}_3\text{AsS}_3)_{0.5}(\text{As}_2\text{S}_3)_{0.5}$ Glass

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Chalcogenide glasses are of a great interest due to various possibilities of their applications as solid electrolytes, functional elements in optical devices etc [1].

The entitled vitreous alloy was obtained by a vacuum (0.01 Pa) melting of the corresponding mixture of  $\text{As}_2\text{S}_3$  and  $\text{Ag}_3\text{AsS}_3$  components, which were synthesized beforehand from highly pure

elemental substances. Melt homogenization temperature has reached 820-840 K and homogenization time has been turned to 24 hours. The melt has been mixed periodically and thereafter quenched in the icy water (273 K).

Spectrometric study of optical absorption edge was carried out in the temperature range 77-400 K using LOMO KSVU-23 grating monochromator. For low temperature studies cryostat of UTREX type was used, stability and accuracy of temperature measurement were maintained at  $\pm 0.5$  K.

Optical absorption edge studies reveal two regions with different types of its temperature behavior, namely the first one in temperature range 77-150 K without the change of a slope of exponential parts of the spectrum and with a shift towards the long wave region, and the second one in temperature range 150-400 K, where the absorption edge of  $(Ag_3AsS_3)_{0.5}(As_2S_3)_{0.5}$  glass has the Urbach shape [2]. The convergence point of extrapolated lines has coordinates  $\nu_0 = 2.78 \cdot 10^7 \text{ cm}^{-1}$  and  $E_0 = 2.790 \text{ eV}$ . Such parameters of the Urbach absorption edge, as optical pseudogap  $E_g^*$  and Urbach energy  $E_U$  were obtained and at  $T=300 \text{ K}$  are found to be 2.030 eV and 73.8 meV, respectively. Comparing those parameters to pure  $As_2S_3$  glass ( $E_g^* = 2.323 \text{ eV}$  and  $E_U = 51.0 \text{ meV}$ ), one should note that increased  $E_U$  is a clear evidence of an influence of compositional disordering on absorption processes in  $(Ag_3AsS_3)_{0.5}(As_2S_3)_{0.5}$  glass. On the other hand, the optical pseudogap  $E_g^*$  diminishes by almost 0.3 eV.

Parameters of electron-phonon interaction (EPI) were obtained from temperature dependence of  $s$ . They are found to be  $\nu_0 = 0.521$  and  $\hbar \omega_p = 65.6 \text{ meV}$ . Parameter  $\nu_0$  reveals a magnitude of less than unity, which is an evidence of a strong EPI. Furthermore, it increases with addition of Ag-containing compound to the  $As_2S_3$  glassy matrix in comparison to  $\nu_0$  of the last one ( $\nu_0 = 0.625$ ). At the same time the energy of effective phonon  $\hbar \omega_p$  in single oscillator model, which describes the EPI, increases on more than 20 meV.

## References

- 1) M. Frumar and T. Wagner, *Cur. Op. Sol. State Mat. Sci.* **7**, 117 (2003).
- 2) F. Urbach, *Phys. Rev.* **92**, 1324 (1953).

## S4\_P21

### Study of electric conductivity models in organic polymers

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The study of electric conductivity of organic polymers now days have a special importance because the necessary of using them in the last applications in advanced technology. In this study are mentioned the models of electric conductivity of organic polymers especially Polyanilin polymers

and Polypyrrole polymers which are: Fluctuation-induced tunneling (FIT), Mott, Variable – range-hopping, VRH and Sheng-Model. The technique used for this investigation is called Cryostat.

#### S4\_P22

### Time and temperature dependence of creep modulus of elastomers. A mathematical analysis of the creep, using Burger Model.

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Many polymeric materials are susceptible to time-dependent deformation when the stress level is maintained constant; such deformation is termed viscoelastic creep. The time-dependent creep modulus it was analyzed and compared for natural and vulcanized rubber, at same temperature. In a one-dimensional creep test, the samples are subjected to a sudden stress that is maintained at a constant level duration the test, and the strain is measured as a function of time. Creep results are represented as a time-dependent creep modulus  $E_c(t) = s_0/e(t)$ . The experimental results indicate that creep modulus of natural rubber is greater than vulcanized rubber due to the crosslinks of vulcanized rubber.

Also, it was analyzed the temperature dependence of creep modulus for both samples. The creep modulus is temperature sensitive and diminishes with increasing temperature.

To permit a mathematical analysis of the creep for natural rubber at  $T_1 = 26^{\circ}\text{C}$  and  $s = 0.069 \text{ MPa}$ , it is used Burger model (the combined of Maxwell element and Kelvin-Voigt element) that exhibits all the essential features of viscoelasticity.

**Keywords** : elastomers, viscoelasticity, creep module, rubber.

#### S4\_P23

### Uniaxial Tensile Properties of Uncoated and $\text{TiO}_2$ Coated Single Wool Fibers Exposed to Thermal Treatment

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Single wool fibers were coated with  $\text{TiO}_2$  with sol-gel process. The uniaxial tensile properties of uncoated and  $\text{TiO}_2$  coated single wool fibers heated at different temperatures from 25 to 200 °C were investigated. The TGA/DSC and FT-IR spectral methods were used to explain structural

changes and deformation process. It was observed that the shape of the stress-strain curve of TiO<sub>2</sub> coated wool fibers became the same as uncoated wool fibers and showed a similar tendency of change to uncoated wool fibers with increasing temperature. The TiO<sub>2</sub> coated wool fibers became stronger and obtained higher rigidity than uncoated wool fibers. Although the breaking extension of TiO<sub>2</sub> coated wool fibers decreased little, the Young's modulus of TiO<sub>2</sub> coated wool fibers increased and remained relatively higher than that of uncoated wool fibers after thermal treatments. Structural changes due to thermal effect on both uncoated and TiO<sub>2</sub> coated wool fibers were discussed.

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## S4\_P24

### Relaxation properties in randomly diffusive model of k-mers on a triangular lattice

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We study the relaxation process in a two-dimensional lattice gas model, based on the concept of geometrical frustration. In this model the particles are k-mers which can both randomly translate and rotate on the planar triangular lattice. In the absence of rotation, the diffusion of hard-core particles in crossed single-file systems is investigated. We monitor, for different densities, several quantities: mean square displacement, the self-part of the van Hove correlation function, and the self intermediate scattering function. We observe a considerable slowing down of diffusion on a long-time scale when suppressing the rotational motion of k-mers; our system is subdiffusive at intermediate times between the initial transient and the long-time diffusive regime. We show that the self-part of the van Hove correlation function exhibits, as a function of particle displacement, a stretched exponential decay at intermediate times. The self intermediate scattering function (SISF), displaying slower than exponential relaxation, suggests the existence of heterogeneous dynamics. For each value of density, the SISF is well described by the Kohlrausch-Williams-Watts law; the characteristic timescale  $t(qn)$  is found to decrease with the wave vector  $qn$  according to a simple power-law. Furthermore, the slowing down of the dynamics with density  $\rho$  is consistent with the scaling law  $1/t(qn; \rho) \sim R^*(\rho_c - \rho)^{-\nu}$ , with the same exponent  $\nu = 3.34 \pm 0.12$  for all wave vectors  $qn$ . The density  $\rho_c$  is approximately equal to the closest packing limit,  $\rho_{CPL} \sim 1$ ,  $\rho_{CPL} < 1$  for dimmers on the two-dimensional triangular lattice. The self-diffusion coefficient  $D_s$  scales with the same power-law exponent and critical density.

Keywords: lattice gas model, subdiffusion, microporous materials

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## S4\_P25

### THE EVOLUTION OF HOMOGENEITY IN PROCESSING BY EQUAL CHANNEL ANGULAR PRESSING (ECAP)

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Equal Channel Angular Pressing (ECAP) is a very interesting method for modifying the microstructure in producing ultra fine grained (UFG) materials. It consists of pressing test samples through a die containing two channels, equal in cross-section and intersecting at an angle  $F$ . This procedure is capable of producing large fully-dense samples containing an ultra fine grain size in the submicrometer or nanometer range and there is experimental evidence demonstrating that these ultrafine structures may exhibit, by comparison with large - grained polycrystals, major differences in some fundamental properties.

This work reports on ECAP experiments performed on two Al alloys. Samples were processed by ECAP at temperature 150<sup>0</sup> C, for one to eight passes and microhardness measurements were recorded in three mutually perpendicular planes, in order to study the evolution of homogeneity during ECAP.

The measurements show the average microhardness increases significantly in the first pass and additional but smaller increases in hardness occur in subsequent passes. The hardness values are distributed homogeneously throughout the pressing direction. Based on the demonstrated correlation between microhardness measurements and internal microstructure, it is reasonable to assume that there is also a homogeneity in the microstructure along the lengths of the billets after processing by ECAP.

*Keywords:* Aluminum alloy, Equal Channel Angular Pressing (ECAP); Hardness, Homogeneity, Ultrafine grains.

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#### S4\_P26

### ENHANCEMENT OF MECHANICAL PROPERTIES OF NANOSTRUCTURED MATERIALS BY SEVERE PLASTIC DEFORMATION

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In the last few years the mechanical properties of materials of nanocrystalline structure and of ultrafine grain (UFG) size, in the range of 100 nm to less than 1  $\mu$ m, have received considerable scientific attention and technological interest [1–3]. It is now well established that the grain size of metallic alloys may be

substantially refined to the submicrometer or even nanometer range, through the application of severe plastic deformation (SPD) [1–3,4,5].

Among various SPD processes, Equal Channel Angular Pressing (ECAP), High pressure Torsion (HPT) and Accumulated Roll Bonding (ARB) have been widely used for a large range of metals

and alloys. Equal Channel Angular Pressing (ECAP) is one of the most diffuse SPD techniques since it is able to induce a refined microstructure, virtually maintaining the billet shape.

In the present work, we present an overview of the most used methods of severe plastic deformation with the objective of assessing recent advances in the production of bulk nanostructured materials with very significant enhancement in their mechanical and functional properties.

In order to examine the potential for using ECAP to refine the grain size and improve the mechanical properties, the commercial 5754 Al alloy, was selected for study. Processing by ECAP through up to 7 passes gives a very substantial reduction in the grain size from  $\sim 70 \mu\text{m}$  to  $\sim 0.3\text{-}0.4 \mu\text{m}$ . This reduction in grain size gives an increase in the 0.2% proof stress by a factor of at least three times.

*Keywords:* Nanostructured materials; Severe Plastic Deformation; Equal Channel Angular Pressing (ECAP); Mechanical properties.

## References

- [1] V.M.Segal, Mat. Sci. and Eng. A271, (1999), 322
- [2] Lowe TC, Valiev RZ, JOM 2000, 4:8-27.
- [3] Iwahashi Y, Horita Z, Nemoto M, Langdon TG, Acta Mater 1998;46: 31.
- [4] Valiev RZ, Mater Sci Eng 1997;A 234–236:59–66.
- [5] Langdon TG, Furukawa M, Horita Z, JOM 2000; 52(4):30–3.
- [6] [5] M. Furukawa, Z. Horita, M. Nemoto, T.G. Langdon, Mat. Sci. and Eng. A324, (2002), 82-89
- [7] Valiev RZ, Islamgaliev RK, Alexandrov, Prog Mater Sci 2000;45 89 – 103

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## S4 P27

### A QUANTITATIVE INVESTIGATION OF THE GROWTH OF BETA PHASE IN THE GAMMA BRASS – COPPER DIFFUSION COUPLE

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The beta phase can be developed using a Cu – Zn diffusion couple, produced for example, by plating technique, but it can be observed at very high temperatures and very long annealing times and it shows a reduced thickness which offers limited possibilities to do calculations on it.

In this work we propose the diffusion in the infinite couple Gamma Brass – Copper. Using the above mentioned diffusion couple, allows the use of high annealing temperatures, which result in a faster kinetics of diffusion and in a rapid growth of beta phase.

The Gamma Brass – Copper diffusion couple was produced by electrolysis. The used copper electrolyte contains 40g/liter copper and 160g sulphuric acid (H<sub>2</sub>SO<sub>4</sub>). The temperature was 65°C,



the amperage was 0.2A and the duration of deposition was 30 h. The thickness of the deposited copper layer was more than 1 mm and by light microscopy one can detect a nice interface between gamma brass and copper.

For the diffusion process to happen, they were used four different annealing temperatures: 500°C, 550°C, 600°C and 650°C and for each temperature five to six different annealing times, ranging from 2 hour to 14 hours.

The concentration profiles were determined by the use of the electron micro-beam analyzer. From the light microscopy and the concentration profiles one can detect the presence of beta phase according to the Cu – Zn phase diagram.

The quantitative analysis of multiphase diffusion in Gamma Brasses - Copper diffusion couple is based in using the concentration profiles provided by electron micro-beam analyzer. The growth constant for beta phase in each annealing time, can be calculated by studying the dependence of the square of phase thickness from annealing time. Then one can calculate the activation energy and the diffusion coefficient of beta phase.

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#### **S4\_P28**

### **INVESTIGATION OF ENERGY POSSIBILITIES OF PERMEABLE THERMOELECTRIC ELEMENTS**

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Permeable thermoelectric elements for cooling (heating) liquid or gas flows passing through the legs consisting of connected branches of thermoelectric semiconducting materials was investigated. Methods for theoretical calculations and optimization of thermoelement energy characteristics based on the mathematical theory of optimal control and computer design techniques are presented.

Computer design results for the case of using semiconductor materials based on Bi-Te-Se-Sb in the legs are given. The impact of the structural and thermophysical factors on the energy possibilities of thermoelement has been studied under the optimal electrical current and air pumping velocity. The results demonstrate the optimal operating conditions when coefficient of performance can be increased by 10 to 30% in cooling and heating mod. Experimental verification confirms the basic statements of the theory and the results of computer simulation.

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#### **S4\_P29**

### **COMPOSITES OF CELLULOSE ACETATE NANOFIBERS CONTAINING ZnO NANOPARTICLES**

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A new method is proposed for obtaining ZnO nanoparticles embedded in a matrix of cellulose acetate nanofibers. Electrospinning of a solution containing zinc acetate and cellulose acetate with degree of substitution of 2.5 in the solvent 2-methoxyethanol gave cellulose acetate nanofibers of about 300 nm containing ZnO nanoparticles of about 20 nm. SEM, TEM, and AFM methods are used to investigate the structure and morphology of the obtained composites. ZnO nanoparticles are known for their antibacterial efficiency and photocatalytic activity under visible light.

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## **S4\_P30**

### **ZnO NANOSTRUCTURES GROWN ON CELLULOSE ACETATE BUTYRATE NANOFIBER MATS AND PRELIMINARY TESTS OF THEIR PHOTOCATALYTIC ACTIVITY**

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This paper reports preparation of a new cellulosic composite based on cellulose acetate butyrate (CAB) containing nanostructures of zinc oxide by means of a two steps procedure. First, a CAB nanofiber mat with ZnO nanoparticles is performed by electrospinning from 2-methoxyethanol-dimethylformamide solution containing zinc acetate. Subsequently, ZnO nanostructures are grown on this polymeric mat by means of a chemical dipping technique in ammonium zincate bath. The morphology of the obtained composite is correlated with the number of dippings and concentration of ammonium zincate bath. Crystallinity of ZnO nanostructures arrays is also investigated by XRD method. The potential of the obtained composite as photocatalyst for dyes oxidation is assessed on acid fuchsin.

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## **S4\_P31**

### **SEMIEMPIRICAL MO STUDY OF ELECTRONIC SPECTRA FOR SOME ALKYNE, ALKENE AND AZOMETHINE OLIGOMERS**

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The paper presents some theoretical considerations on electronic spectra for four alkyne, alkene and azomethine oligomers as models for their analogous polymers. The molecular conformations of these molecules are calculated by means of AM1 technique. The electronic spectra are calculated using ZINDO/S method with configuration interaction (CI). A comparative discussion on their theoretical and experimental electronic spectra is performed.

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**S4\_P32****Dielectric dispersion and relaxation of pure TGS crystals**

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Triglycine sulphate (TGS for short), is a ferroelectric crystals which undergoes a typical second order transition of order-disorder type. Pure TGS crystal has a complicated monoclinic structure and a complicated ferroelectric domains evolution, crossing up and down the Curie Point (~49 °C). It was estimated that about 80% of the dielectric constant value is related with the ferroelectric domain walls oscillation. This make unpredictable the temperature dependence of the dielectric constant, if we do not know previous temperature variation of the TGS sample. Pure TGS crystal was grown in the paraelectric phase (54 Celsius), by slow solvent evaporation. Samples of ~1 mm thick and ~0.5 cm<sup>2</sup> surface were polished and the silver electrodes were painted. Dielectric dispersion was investigated on the frequency range 1 Hz ? 10 MHz, over the temperature range -120 to +65 °C, crossing up and then down the Curie Point.

Cole-Cole diagrams of pure TGS crystal were drawn in the ferroelectric phase, coming from the upper paraelectric phase, Two type of relaxation in the ferroelectric phase, with characteristic time  $\tau_L \sim 10^{-3}$  sec and  $\tau_H \sim 10^{-7}$  seconds were found in this representation. An unusual mid type relaxation of  $\tau_M \sim 10^{-5}$  seconds, was clearly discerned in some temperature range of the ferroelectric phase. The lower frequency relaxation is related with ferroelectric domain cropping and has an important thermal evolution, with the activation energy of 0.7 eV (~28 k<sub>B</sub>T). The second one, the higher frequency relaxation mechanism, is ascribed to the “critical slowing down” effect, similar to the relaxation in the paraelectric phase, above T<sub>C</sub>. This relaxation was found to be almost independent of temperature. The middle relaxation mechanism do not appears to have a specific physical support and was clearly evidenced for the first time in the literature.

*Keywords:* Triglycine sulphate crystals; dielectric spectroscopy; relaxation mechanism

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**S4\_P33****FLUORESCENCE QUENCHING MECHANISMS BY METAL IONS**

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Fluorescence quenching could proceed via different mechanisms, usually classified as dynamic quenching and static quenching. In this presentation the fluorescence quenching of some imidazole derivatives by metal ions ( $\text{Cu}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Cr}^{3+}$ ) as quenching agents in methanol solution at room temperature was investigated by steady state fluorescence measurements. With addition of metal ions ( $\text{Fe}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Hg}^{2+}$ ) as quenchers a significant reduction of the emission intensity of the imidazole derivatives was observed in comparison with the other metal ions ( $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Cr}^{3+}$ ). At low concentrations of quencher the Stern-Volmer plots of imidazole derivatives were linear. Deviations from linear Stern-Volmer are frequently due to the static quenching or to a combination of static and dynamic quenching. Various parameters for the quenching process were determined using the Stern-Volmer equation and different models for static quenching.

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## S4\_P34

### REGULARITIES OF STARK PARAMETERS FOR MULTIPLY CHARGED ION SPECTRAL LINES

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Recently published Stark widths and shifts measured and calculated data and their dependence on the upper level ionization potential ? are used here to demonstrate the existence of the other kinds of regularities of different elements and their ionization stages. The found relations connecting Stark widths and shifts parameters and upper level ionization potential, rest core charge and electron temperature were used for prediction of new data, avoiding much more complicated procedures.

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## S4\_P35

### Appearance of Collective Oscillations in Many – Band Superconducting Systems Doped with Non - Magnetic Impurity

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The overlapping of energy bands on the Fermi surface changes the properties of multi – band superconductors as qualitatively as well quantitatively.

Here we investigate the appearance of collective oscillations caused by phase fluctuations of order parameters from different bands. Namely, how non- magnetic chaotic distributed impurity influences on the collective oscillations in two – band superconductors.

Two – particle Green function is considered and the system for vertex functions averaged on chaotic distributed impurity are obtained using the Hamiltonian of two – band superconductors. Necessary values to determine the frequency of collective oscillations ? are calculated in linear approximation after the impurity concentration. The equation for ? is obtained and its solutions are found. It is shown that in this doped system an exciton – like frequency of collective oscillations could arise. At low impurity concentration the damping of collective oscillations is absent.

#### **S4\_P36**

##### **The law of the growth of nitration layer in steel**

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Three steels with different chemical contents were subjected to nitration process in  $\text{NH}_3$  gas at three different temperatures: 510 °C, 550 °C and 590 °C, and for each temperature four different nitration times were used, producing in this way 36 samples in total. For analysis of the samples the metallographic research and electron beam microanalysis (EBMA) were utilized. These methods made possible the determination of the thickness of the nitration layer and the concentration profile, i.e., the diffusion depth of the nitrogen. Experimental results for steels under study are found as a function of the nitration parameters, i.e., temperature and nitration time, and are compared with each other. From these results we were able to find the law that governs the growth of the nitration layer as the function of nitration parameters. Through this law it is possible to predetermine the layer thickness for every real parameter in nitration of steel.

#### **S4\_P37**

##### **Gross-alpha activity determination in aqueous samples by alpha-LSC**

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The activity measurement of alpha-emitting radionuclides by liquid scintillation counting has the major advantage of reaching high counting efficiencies, which recommends it as appropriate for gross-activity measurements. When performed without alpha/beta discrimination the alpha-LSC efficiency can usually be considered as 100%. The difficulties appear when both alpha and beta emitters are present in the sample, due to the overlapping of the spectra. The separation of alpha-

emitters can be done quantitatively by using the Actinide Resin, under specified conditions, from aqueous samples. This paper presents the results of the tests which have been performed with various alpha-emitting radionuclides, to verify and validate a method based on isolation with Actinide Resin and measurement of alpha-emitters by LSC.

Keywords: alpha-LSC, Actinide Resin

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## S4\_P38

### **Magnetic and structural properties of Fe<sub>65</sub>Co<sub>35</sub> alloys obtained by melting, high-energy milling and heat treatment**

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The influence of milling and annealing conditions on the structural and magnetic behavior of mechanically-milled Fe<sub>65</sub>Co<sub>35</sub> alloys has been studied. Samples were taken at different milling times in order to study the influence of milling time on structure and microstructure. The thermal evolution of milled powders was studied by calorimetric studies (DSC). The structural evolution of the samples was followed by X-ray diffraction. The coercive field and magnetic permeability were studied from magnetic measurements, performed in magnetic fields up to 12 Tesla at 300K.

Using DSC measurements we found the internal stress relaxation temperature, the recrystallisation temperature and the structural order/disorder transition temperature. The width of the diffraction peaks was found to increase with milling time. The intensity of the characteristic diffraction peaks of the Fe<sub>65</sub>Co<sub>35</sub>-type phase increases significantly upon annealing. Two types of annealing were performed: conventional heat treatment at 500, 550 and 600°C for 2h and rapid annealing for a maximum of 3 minutes at 700, 750 or 800°C followed by rapid quenching. The structure and microstructure, and hence the magnetic properties of the samples were controlled by the temperature and time of the heat treatment. This fact is supported by magnetic measurements which show an increase of magnetic permeability found to occur for samples which were annealed at 750 and 800°C for up to 2 minutes. The increase of magnetic permeability results from crystalline structure improvement, changes in crystallite size and internal stress diminution.

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## S4\_P39

### **Tri-axial Magnetic Field Exposure System for a Patch Clamp set up**

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The Patch Clamp technique provides a powerful tool to investigate the electrophysiological activity of ion channels at cellular and even at single channel level, suggesting that this technique can be used to study the effects of electromagnetic fields on ion transport across the cell membrane. For this purpose we have designed and fabricated a magnetic field exposure system able to generate any combination of static and time varying fields, in the range of extremely low frequencies, consisting of three large orthogonal pair square coils surrounding the patch-clamp recording set-up. The exposure system has the following characteristics: 1) good accessibility to the sample on the microscope stage and to the electrode; 2) uniformity of 1% over an area whose diameter is twice that of the Petri dish; 3) good mechanical decoupling between the coils and the other parts of the system; 4) very small electromagnetic interference between low intensity varying magnetic fields generated by the coils and the recording apparatus.

**Key words: ELF magnetic fields, three-directional coils . patch clamp, MF homogeneity , ion channels**

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#### **S4\_P40**

**Electron Microscopy characterization of some CuNiCo thin films, obtained by Thermoionic Vacuum Arc(TVA) method**

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Thin CuNiCo films obtained by Thermoionic vacuum arc(TVA) method present Giant magnetoresistance(GMR) effect. Giant magnetoresistance(GMR) effect appears in the structure of thin films composed of metallic layers. The electrical resistance has a significant decrease in the presence of the magnetic field. For the Giant magnetoresistance(GMR) effect to take place, the magnetic grains from these films(Ni and Co) are isolated in the non-magnetic matrix(Cu). The films were obtained using two TVA guns, one of them evaporating the copper from the first crucible, and the other one evaporating Ni and Co alternatively, these being on two different crucibles. In total 6 films made of eight layers on glass sublayer were deposited. The thickness of the films was 37nm. The first layer was of Cu, having a thickness of 5nm. A 5nm thick Ni followed, then a 4nm Cu layer, a 5nm Co layer, a 4nm Cu layer, a 5nm Ni layer, a 4nm Cu layer and a 5nm Co layer. The characterisation by Electron Microscopy technics, reveal the fact that, deposited films present a uniformity in what concerns the thickness and dispersion of the nanograins from the film. The diameter calculated is determined by mediation of distances between two lines tangent to the contour of the particle measured for angles from 15 to 15 degrees. The studied nanostructures present special morphological properties, having grains with diameter below 20nm. The majority diameters are about 10nm.

Keywords: Thermoionic Vacuum Arc, Giant Magnetoresistance, Electron Microscopy.

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## S4\_P41

### COMPARATIVE STUDY OF THIN FILM THICKNESS MEASUREMENT METHODS

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Thickness measurement in the range of micro and nanometers is an important technique for thin film characterization. In case of thin soft organic films the contact methods for thickness measurement face the problem of film scratching.

This paper compares different measurement techniques aiming to find a proper non-contact method for thin film thickness determination. The results will be utilized for thickness measurements of thin soft organic semiconductor films.

Standard samples with vacuum deposited aluminum films of different thicknesses in the range of 50-1000 nm were prepared. Film thicknesses are measured by different techniques – chromatic light sensor, interference microscopy and talystep mechanical profilometer. In addition film thickness of some of the samples was calculated from in situ quartz crystal microbalance data, accumulated during the film deposition.

It was found that chromatic light sensor, interference microscopy and talystep measurements give similar results, while the quartz crystal microbalance defers considerable, which is probably due to the difference between the actual film density and the bulk material density used for the calculation.

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## S4\_P42

### SM-CO THIN FILMS – STRUCTURAL AND MAGNETIC INVESTIGATIONS

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The miniaturization of magnetic data storage devices forces the modern technology to store bits of information on increasingly smaller units of magnetic material. In this sense thin Sm-Co films are attractive as they allow thermal stability even in nanometer ordered grains. Sm-Co films were deposited by dc magnetron sputtering on Cu seedlayers that were deposited on thermally oxidized



Si(001) wafers. The microstructure of the thin films was investigated by X-ray diffraction and electron microscopy, while the magnetic properties such as remanent magnetization and coercive field were analyzed by VSM measurements. Here, we present a systematic study of the influence of Co-Sm film thickness and annealing conditions (deposition on pre-heated substrates or post-annealing) on the structural and related magnetic properties. We observe an increase in coercivity with increasing thickness of the Co-Sm film. This behavior is accounted to the internal stress induced by the lattice mismatch between the Cu seedlayer and the Sm-Co film for the as-deposited films at room temperature. In contrast, for deposition on pre-heated substrates the coercivity is strictly related to the phase formation of the Sm-Co.

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**S4\_P43****MONITORING  $\text{Fe}_3\text{O}_4$  NANOPARTICLE AGGREGATION DYNAMICS IN A DILUTED AQUEOUS SUSPENSION BY SIMPLE OPTICAL METHODS**

Dan CHICEA

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A simple recipe for preparing a small amount of  $\text{Fe}_3\text{O}_4$  nanoparticles was used and is briefly presented in the extended work. The  $\text{Fe}_3\text{O}_4$  nanoparticles aggregate fast when they are in small concentration in an aqueous suspension. Aggregation monitoring is important when the nanoparticles are used in medical purposes, because the rheological properties of the nanofluid tremendously depend on the nanoparticle size distribution and concentration; both of them change rapidly during aqueous dilution.

Several procedures have been described and used in the last years for monitoring the aggregation process, Dynamic Light Scattering and a modified version of the Static Light Scattering being just some of them. The Dynamic Light Scattering is used in this work as a control method.

Several optical properties of a suspension depend on the size and on the concentration of the particles in suspension, the refractive index and the average scattered light intensity being some of them. In this work the time variation of the refractive index of the suspension and the average scattered light intensity variation in time during a dilution experiment are presented. The results are presented in detail and discussed in connection with the DLS particle sizing as a reference monitoring method.

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**S4\_P44****Optical and Spectral Properties of Polyurethane Coumarine. Self-organization phenomena induces nanoaggregate formations**

Silviu Gurlui, Dan Dimitriu and Mitachi Strat



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Coumarin and most of its derivatives are strongly fluorescent in liquid solutions, but they are easily quenching in solid state, so coumarin and its derivatives as electroluminescent materials always need doped in polymer host. However this fabrication method could not prevent the crystallization of coumarin molecule, which affects the device's lifetime. We introduce coumarin to the side chains of the polymer. By this method the phenomena of fluorescent quench and some instabilities, which caused by the crystallization of coumarin, were avoided.

In agreement with literature data, reports that coumarin and its derivatives are excellent fluorescent properties, which have been exploited in the laser, was investigated for polymer fluorescence spectrum recorded in solution DMFsi be able to. In this case, polyurethane chain attached coumarin molecule emits at 320 nm (? exc = 280 nm) and 440 nm as a broad maximum attributed to the formation of aggregates. Complementary aggregates formation was emphasized by atomic force microscopy (AFM). Three-dimensional image of the polymer film show that polyurethane analyzed is characterized by relatively homogeneous morphology, there is separation of specific nanophezic such polymers and aggregates formed have approx. 3 nm in height.

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## S4\_P45

**Selforganization phenomena in polyurethane coumarine film. The study of formation of nanoagregates by means of AFM and SEM methods.**

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The stability of polymer micelles, which affects the stability of encapsulation of guest molecules, may be a crucial condition for some controlled delivery applications.

In these conditions we have been studied the contribution of photodimerization to the formation of polymer micelles.

Aggregate formation was studied by atomic force microscopy (AFM) and SEM. Three-dimensional image of the polymer film can be inferred that polyurethane analyzed is characterized by relatively homogeneous morphology, there is separation of specific nanophezic such polymers and aggregates formed have approx. 3 nm in height. Exposing the film UV irradiation for 60 min, it is found that the polymer morphology is not significantly affected, keeping the aggregates formed in the same dimensional area.

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**S4\_P46****BROADBAND DIELECTRIC SPECTROSCOPY of  $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$  FERROELECTRIC CERAMICS**

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Ferroelectric materials are very attractive for a large number of applications. In informatics, such materials are used for DRAM memories. In high frequency communication domain, they have important applications due to the nonlinear variation of their permittivity with the applied electric field. These properties offer the opportunity to realize specially electrically electronic control of devices.

$\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$  (BST) is a family of solid solutions of  $\text{BaTiO}_3$  and  $\text{SrTiO}_3$  over the whole concentration range. The Curie temperature of these continuous solid solutions decreases monotonically with the strontium content. As a result, the transition temperature and hence the electrical properties of BST can be tailored over a broad range, in order to meet the requirements of various electronic applications.

$\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$  solid solutions with  $x = 0.25, 0.35, 0.4, 0.5, 0.6$  and  $0.75$  were prepared by solid-state reaction. X-ray diffraction and scanning electron microscopy methods have been used for compositional, structural and morphological characterization. The complex dielectric dispersion of the samples was investigated using Quatro Cryosystem with Alpha Analyzer (Novocontrol) on the frequency range  $0.1 \text{ Hz} \div 10 \text{ MHz}$  and on the temperature range  $-100 \text{ }^\circ\text{C} / +100 \text{ }^\circ\text{C}$ . Microwave measurements, performed at room temperature, show a monotonically decrease of the permittivity from about 3000 to 300 with the increase of the strontium content. Moreover, the decrease of the dielectric loss from 0.8% to less than 0.1% with the increase of Sr content was noticed. These results strongly suggest the BST materials, particularly in the paraelectric phase, are suitable for important microwave applications.

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**S4\_P47****Photooxidation behavior of some polyurethane based semi-intepenetrated polymer networks**

Dan Rosu, Liliana Rosu, Cristian-Dragos Varganici

*Petru Poni" Institute of Macromolecular Chemistry"*

Epoxy resins are known of reactive materials with multiple technical applications, due to superior physico-mechanical properties and to the multiple possibilities of cross-linking. The disadvantages such as brittleness, easy stress cracking under impact stress after curing, limit their further applications in high-tech fields. Therefore much attention was paid to improve these properties. A way to improve the physico-mechanical properties of epoxy resins is mixing with elastomers. Sometimes the use of mixtures of two or more polymers to obtain of final properties is more convenient than using the chemical synthesis methods . The polymer blending may substantially improve many physical properties of the final material relative to any single polymer characteristics. The blending process is often limited by the lack of miscibility between the polymers. Interpenetrated polymer networks are particular polymer blends that include chemically dissimilar crosslinked polymer chains with no chemical bonding between them. When a polymer with linear structure is entangled at the molecular scale in the network of another polymer with crosslinked structure a semi-interpenetrating polymer network (S-IPN) is formed. Therefore several types of SIPNs based on linear polyurethanes and epoxy resins were prepared. The SIPNs were characterized regarding the dynamic mechanical behaviour as a function of structure and composition. We did not find the literature data on the photochemical stability of the studied SIPN systems polyurethane-epoxy. In this paper the effect of UV light with  $\lambda > 300$  nm on the photochemical stability of SIPNs was investigated. Variation of some surface properties during the irradiation such as the contact angles, colour and gloss of the studied samples were correlated with the structural changes.

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## **S4\_P48**

### **The effect of temperature on the thermal stability of some semi-interpenetrated polymer networks based on epoxy resin and aromatic polyurethane**

Cristian-Dragos Varganici, Dan Rosu, Liliana Rosu

*Petru Poni" Institute of Macromolecular Chemistry"*

Semi interpenetrating polymer networks (SIPNs) have received much interest due to their unique structure which consists of a combination between two or more polymers, in permanent entanglement, of which at least one is a crosslinked network. The S-IPN characteristic structure may result a synergic effect on properties, which is expected to combine good properties of different polymers. Due to their technical applications, of the high reactivity and of the cross-linking possibilities, the epoxy resins are between the most important thermosetting polymers. Some disadvantages of the cured epoxy resins such as the easy stress cracking under impact forces and brittleness limit their applications in high-tech fields. Therefore much attention is given to improve these properties. A way to improve the physico-mechanical properties of epoxy resins is mixing with elastomers. The blending process is often limited by the lack of miscibility between the polymers. When a polymer with linear structure is entangled at the molecular scale in the network of another polymer with crosslinked structure a semi-interpenetrating polymer network is formed. SIPN structures obtained between thermosetting resins such as epoxy resins or modified epoxy resins and elastomeric materials such as polyurethanes are known in literature.

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**S4\_P49****Spectroscopy and structural analysis of Iridium intermediate compound**

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To produce so-called white light, the resulting phosphorescence from the organometallic compounds require the mixing of the three colors red, green and blue. Mixed-ligand compounds avoid the aggregation and segregation processes between different phases. The two steps reaction procedure of obtaining mixed-ligand compounds require an intermediate iridium compound, called diiridiumcomplex tetrakis (2-phenylpyridyl)-m-(dichloro) diiridium( $[(C^N)_2Ir-m-Cl_2]$ ).

Spectroscopy and structural characterization of this intermediate compound shows a less stable compound compared with the final product, in our case mer-IrQ(ppy)<sub>2</sub>-5Cl. Differential Scanning Calorimetry shows a large exothermic peak around 240°C assigned to decomposition process of this micro-bridged structure. Thermal gravimetric analysis supports the decomposition process with a 20% weight losses around 200°C, followed with another one at around 450°C assigned to phenylpyridine decomposition with a weight losses around 20%.

Raman spectroscopy, together with FT-IR spectra, allows us to identify the metal-ligand vibrations. The low frequency vibrations, between 200-280 cm<sup>-1</sup>, are assigned to Ir-C, N stretching, while the frequencies between 180-220 cm<sup>-1</sup> are assigned to Ir-ligand bending.

The Energy Dispersive X-ray patterns suggests a ration Ir/Cl around 2/1 in the limit of errors, suggesting a bridging between the two Iridium atoms with one Chlorine, but this fact can be altered by the unreacted IrCl<sub>3</sub> raw material which may influences this ratio.

A series of the Scanning Electron Microscopy images, together with backscattering electrons patterns, shows a slightly charging surface of this compound, specific to the semiconductor materials.

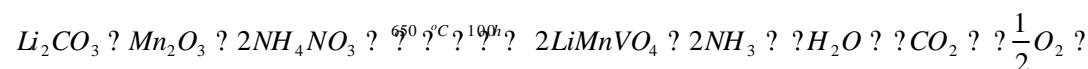
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**S5\_P01****Ionic conductivity study of LiMnVO<sub>4</sub>**A. Kazakopoulos<sup>1</sup> and O. Kalogirou<sup>2</sup>

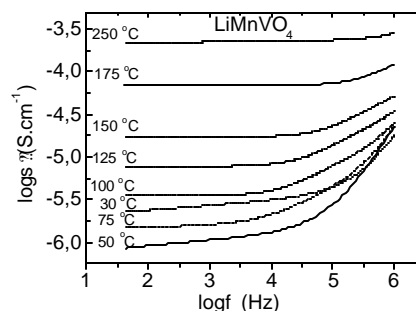
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The goal of this paper is a detailed impedance spectroscopy study of the LiMnVO<sub>4</sub> aiming to investigate into its conduction processes, calculate the activation energy of the material's conduction mechanisms, investigate into the various parameters that affect its conductivity as well as to provide a comparative study of the electrical properties of this non humidity sensitive member with the other members of the LiMVO<sub>4</sub> vanadate series, M = Ni, Co, Zn, Li, Cu, Mg.

The compound LiMnVO<sub>4</sub> was prepared with solid state reaction as it has been proposed in [1].



A detailed study of the electrical properties of LiMnVO<sub>4</sub> concerning the frequency dependence of the dielectric constant, the dielectric loss as well and the modulus master curves was carried out in order to compare the electrical behavior of this non humidity sensitive member of the Li vanadates series with the other members. The conductivity mechanisms of LiMnVO<sub>4</sub> were studied in the range from room temperature to 500 °C by taking impedance measurements in the frequency range from 42 Hz to 1 MHz and fitting the measurement results using the program EQUIVCRT.PAS [3]. The LiMnVO<sub>4</sub> bulk and grain boundary activation energy values were calculated and found to be 0.46 and 0.69 eV respectively, much lower than the corresponding 0.89 and 1.89 eV values that have been calculated for the non humidity compound LiCuVO<sub>4</sub> in [2]. The impact of these different values on the ion hopping rate of these two materials was observed and commented in the conductivity versus frequency plots.

**References**

- [1] G. T. K. Fey and D. L. Huang, *Electrochim. Acta* 45 (1999) 295.
- [2] A. Kazakopoulos and O. Kalogirou, *Solid State Ionics* 179 (2008) 936.
- [3] Equivalent Circuit (EQUIVCR.PAS) Bernard A. Boukamp, University of Twente.

**S5\_P02****Prospects for heavy lepton searches at LHC**

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The production of fourth family leptons at LHC using the Monte Carlo generators, Pythia 6 and Pythia8 is investigated. These exotic fermions have different experimental signatures, depending on the chosen decay channel. Both Drell-Yan and Gluon-Fusion pair production mechanisms were considered. We will present a comparative study based on various kinematic variables for both MC generator and production mechanisms.

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### S5\_P03

#### Influences of the initial and final state radiation on the reconstruction of dileptonic top-antitop events

Tudorache Valentina

The influence of initial state radiation and final state radiation on the top quark mass reconstruction in dileptonic channel is investigated. To reconstruct the top mass  $m_{T2}$  variable is used. Studies are performed on simulated samples produced with two Monte Carlo generators, PYTHIA8 and POWHEG, and the detector response is modelled with DELPHES framework. Quantitative results on Initial State Radiation, Final State Radiation and Leading Order/Next To Leading Order comparative analysis are shown.

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### S5\_P04

#### Neutron diffraction study of Bi<sub>0.25</sub>Nd<sub>0.25</sub>Sr<sub>0.5</sub>MnO<sub>3</sub>

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The striking feature that makes distinct the Bi-based manganites from the rare earth manganites with similar perovskite-like structure is the much higher temperature of onset of charge ordering (CO) reported as high as  $T_{CO} = 525\text{K}$  for  $\text{Bi}_{0.5}\text{Sr}_{0.5}\text{MnO}_3$  (BSMO) [1]. In reasoning the structural consequences of setting in charge ordering, the role of the highly polarized  $6s^2$  character of  $\text{Bi}^{3+}$  was advanced. A dominant character of the lone pair was inferred for BSMO with a consequence that an average radius of  $\text{Bi}^{3+}$  is  $1.24 \text{ \AA}$  in contrast to the case of  $1.16 \text{ \AA}$  for screened lone pair. The latter value is just the effective radius of  $\text{Nd}^{3+}$  ions ( $1.163 \text{ \AA}$ ) and we present results from a high resolution neutron diffraction study on a powder sample of  $\text{Bi}_{0.25}\text{Nd}_{0.25}\text{Sr}_{0.5}\text{MnO}_3$  (BNSMO) carried out at 295 K and 10 K. With the half substitution by Nd for Bi both the average size of the A-site

cations and the mismatch between A-site cations are influenced, the tolerance factor is reduced and by analogy with the structural trends already established for the rare-earth based manganites [2] the charge ordering is affected as well. What we observe for BNSMO is presence at room temperature of two coexisting orbitally ordered phases with similar unit cell parameters, and at least one of these phases exhibits at low temperature charge ordering.

This study was supported in part by the Bulgarian National Fund for Science (grant DO-224/18.12.2010), the BAS-HAS co-operation project 6/2010-2012 and the European Commission grant NMI3-CT-2009-226507.

#### References

[1] C. Frontera, J. L. Garcia-Munoz, M. A. G. Aranda, C. Ritter, A. Llobet, M. Respaud, J. Vanacken. *Phys. Rev. B*, 2001, 64, 054401.

[2] KA. Krezhov, D. Kovacheva, E. Sváb and F. Bourée. *J. Phys: Condens. Matter*, 17 (2005) S3139-S3147.

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### S5\_P05

#### Relativity versus the Observation Tools

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The classical description is connected with some abstractions. It implicitly assumes the independency of physical processes by the observation way, the possibility to observe simultaneously all parts of a given process and the equivalent determination of each process. The analysis of typical quantum phenomenon, i.e. those in which the wave-particle duality of photons or electrons is appeared, leads us toward exclusion of these abstractions. Then, it requires a new base to describe physical phenomenon. This new way must evaluate the real possibilities of measurements on microobjects, the structure and the action of apparatus that form conditions where the object is. In this case the apparatus and external conditions must be classically described giving the values of parameters that characterize them. But, these parameters cannot be given with accuracy greater than Haisenberg's uncertainty principle allows. Otherwise, we come out the limits of real possibilities of the construction of apparatus. Thus, the necesary mediators of the study of atomic objects are the apparatus. We must understand that that the behavior and properties of microobjects do not derive by "pure" reasoning, but from an analysis of results of interaction of objects with measuring apparatus that operates in concrete physical conditions and creates these conditions. Meanwhile, the act of recognition is not pure reasoning, but is based on observations that have material character. Thus, the result of interaction of atomic object with measuring apparatus, which is classically described, need to consider as main element that represents the object of quantum mechanics. By the analysis of such interactions are appeared even the properties of microobjects, while the predictions of theories are made as expected results of interactions. Hence, this treatment is focused on idea: The measuring apparatus is subject to the measuring object. This means that the action of apparatus influences on measuring object, the action of object

influences on measuring apparatus, and in such interaction measurement stays. The measurement, by itself, identifies the change of object. In macroscopic world these changes are negligible, but in microscopic world they are essential. Further, we have to illustrate this idea with action of measuring process of position in its momentum and the action of measuring process of momentum in position of particles, in accordance with results of interaction of microobjects with classical apparatus. This does not show that without observer and apparatus microobjects do not exist, but underline what this interaction essentially influences on motion of object, so determining the possibilities to appear the characteristic properties of microobjects. Moreover, this does not show that we reduce the properties of object to those of apparatus. These are expression of introducing the concept of relativity versus observation tools that generalizes the well known classical concept of relativity to the reference system.

**Keywords:** relativity, microobjects, position and momentum, measuring apparatus, observation tools.

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### S5\_P06

#### A short evaluation of the use of oxygen-18 and deuterium in the aquifer of Lushnja.

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The goal of this paper is to present a short evaluation of the use of the stable isotopes of deuterium and oxygen-18. The region in this case is not unknown to the hydrologists, but now due to the changes that this region has been through it is necessary to expand the study of this aquifer. This study was conducted on water samples gathered from two boundary rivers, drillings, wells and precipitations. In addition to the hydrochemical analyses, were determined the isotopic composition of the stable isotopes of hydrogen and oxygen. The determination of these two isotopes was done by mass-spectrometry. The processed data are put in the same plot with the meteoric water line. We notice that different water samples from different origins show differences in their deuterium and oxygen-18 isotopic composition.

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### S5\_P07

#### Calculation of Neel Temperature for Quasi-two-dimensional Antiferromagnets

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We analyze magnetic properties of quasi-two-dimensional Heisenberg antiferromagnet (Q2DHAFM) with spin anisotropy and compare the results of several approaches. These include standard linear spin wave theory (LSW), self-consistent spin wave theory (SCSW) based on Dyson-Maleev representation and the method of double-time Green's function within Tyablikov approximation (RPA). To determine parameters of the Hamiltonian (exchange integrals and spin anisotropy), we use self-consistent methodology based on the experimental data on magnon dispersion. Numerical calculations are performed for concrete compounds  $K_2MnF_4$ ,  $Rb_2MnCl_4$ ,  $Rb_2MnF_4$  ..., all known to be good realizations Q2HAFM. Final results for sublattice magnetization and Neel temperature single out Tyablikov RPA as the most appropriate method for describing magnetic properties of these compounds.

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**S5\_P08****Charge Density Evaluation for a Fermionic System in a Curved Space-Time**

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We considered a massive fermionic field minimally coupled to a spherically symmetric space-time. For the considered gauge field, we developed a particular software tools in order to succeed in reaching the Maxwell tensor and the corresponding Dirac equation in the space-time configuration. Software program is briefly presented.

Keyword: Dirac equation, Maxwell tensor, gauge fields

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**S5\_P09****OSCILLATOR FORCES OF INTER BAND QUANTUM TRANSITIONS IN MULTI-SHELL SPHERICAL NANOSYSTEMS**

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The theoretical investigation of energy spectra in multi-shell spherical nanosystems is already performed during more than ten years in the framework of different theoretical models. Calculating the energies of intra band and inter band transitions, the electron-hole and electron phonon interaction, influence of polarization charges at the interfaces of the media with different dielectric constants was taken into account [1-2]. The influence of non-central impurity and outer charges at

the intensity of inter band transitions and distribution of quasi-particles inside of nanosystem is still not completely investigated. In this paper we study this problem for CdS/ZnS and ZnS/CdS/ZnS nanosystems.

The theoretical investigation is performed using the variational method in the approximation of effective mass. The energies and wave functions of the electron and hole ground states are calculated as functions of the position of hydrogen-like donor impurity in multi-shell spherical quantum dots. The different potential profiles of spherical nanosystems are studied. The dependences of dipole momentum and oscillator forces of inter band transitions in different spherical nanosystems are obtained as functions of impurity position. It is proven that the maximal influence of impurity at the intensity of inter band quantum transitions in multi-shell quantum dots is observed in the case of their location inside of the potential well, created by the outer shell of the nanosystem. The impurity placed into the center of the quantum dot (the core of which creates the potential barrier) almost does not change the oscillator forces of inter band transitions. The outer charges essentially influence at the distribution of quasi-particles in quantum dot. It is also displayed at the intensities of inter band quantum transitions.

The results of numeric calculations prove that the oscillator force of quantum transition in multi-shell nanosystems essentially depends on the position of charged impurity. The changes in the intensity of radiation are more sensitive to the outer charges than the energy of radiation. At the base of these changes over radiation energy and intensity the distribution of outer charges can be studied and further used in the sensors of new generation.

### **S5\_P10**

#### **TUNNELING PROPERTIES OF TWO-WELL NANOSTRUCTURES WITH $\delta$ -LIKE BARRIERS PLACED INTO THE STRONG ELECTROMAGNETIC FIELDS**

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In the majority of papers the tunneling of electrons through the resonance tunnel structure placed into the electromagnetic field is investigated within the assumption that the electric field intensity is small and, thus, the electron-electromagnetic field interaction can be neglected. However, the production and rapid development of quantum cascade lasers and detectors with the main operating elements constructed of multi-layer resonance tunnel structures placed into the high frequency electromagnetic fields, constantly stimulates an active investigation of transport properties of electrons in the strong fields.

The theory of strong electron-electromagnetic field interaction in resonance tunnel structure is usually developed within the tunneling Hamiltonian, containing several fitting parameters due to the model or in the frames of the model of effective mass for the electron with fixed potential profile. In the latter, the transmitting coefficient for the resonance tunnel structure is obtained using the Floquet approximated method or within the numeric ones.

In the paper we develop the analytical theory for the transmitting coefficient of the electrons in three-barrier resonance tunnel structure with  $\delta$ -like barriers placed into the high frequency electromagnetic field with the arbitrary magnitude of the electric intensity applied along the direction of electrons movement. Exactly solving the complete Schrodinger equation, we obtained the wave function of electron-field system. Using the periodical vector potential and expanding the wave function into Fourier range, the wave function is written as the complete super position over all field harmonics. The conditions of continuity of wave function and its density of current at all interfaces of nanostructure determine all unknown coefficients and, since, the wave function itself. The transmitting coefficient and transport properties of all open canals are studied in details.

We established that the anti-crossings of energy levels arise in the vicinity of all resonance energies of electromagnetic field. They can cardinaly change the operating characteristics of quantum cascade lasers and detectors.

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**S5\_P11****DYNAMIC CONDUCTIVITY OF RESONANCE TUNNEL STRUCTURES IN THE MODELS OF OPEN CASCADES IN NANOLASERS**

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The first quantum cascade lasers were designed more than twenty years ago but the interest to their research is still increasing. It is caused by their unique properties, new fundamental phenomena and precise applying abilities.

In the majority of theoretical papers where the physical properties of quantum cascade lasers are studied, the tunneling Hamiltonians or the models of closed resonance-tunnel structures are used. The papers with tunneling Hamiltonians contain the free fitting parameters and, thus, can be useful for the discussion and interpretation of the known experimental results. The papers based at the closed resonance tunnel structures allow to evaluate the energy spectra and oscillator forces of quantum transitions arising due to the interaction between electrons and high frequency electromagnetic field. However, the conductivity can not be obtained within the closed models principally because it can not physically appear in them.

In the paper we study the dynamic conductivity of open multi-layer nanostructure, as separate cascade of quantum cascade laser. We assume that the mono-energetic electronic current tunnels through the multi-shell resonance structure placed into the constant electric field. In the frames of the one-dimensional model we solve the complete Schrodinger equation for the electrons interacting with high frequency electromagnetic field.

The wave function of the system is obtained in the one-mode approximation over the photons energy. Using it, we calculated the electronic currents through the resonance tunnel structure and obtained the negative dynamic conductivity arising due to the quantum transitions of electrons from the upper into the lower quasi-stationary states accompanied by the radiation of high frequency electromagnetic field.

The numeric calculations of dynamic conductivity are performed for the experimentally designed quantum cascade lasers with three- and four-barrier active regions. It is shown that the specific geometric design of separate cascade provides the maximal magnitude of dynamic conductivity. The numeric and experimental data for the energy of laser radiation coincide up to 2-3 per cents.

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**S5\_P12**

**The Generating Functional method and its application to quantum systems.**

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Generating functions play important roles in theory of orthogonal polynomials, known as being part of solutions of some QM systems. The generating functional method, based on generating functions, was introduced to find the energetic levels for different quantum systems. This paper is a survey on generating functional method and the results obtained by applying it are discussed.

Keywords: Generating function; Orthogonal polynomial; Hamiltonian systems; Energy levels;

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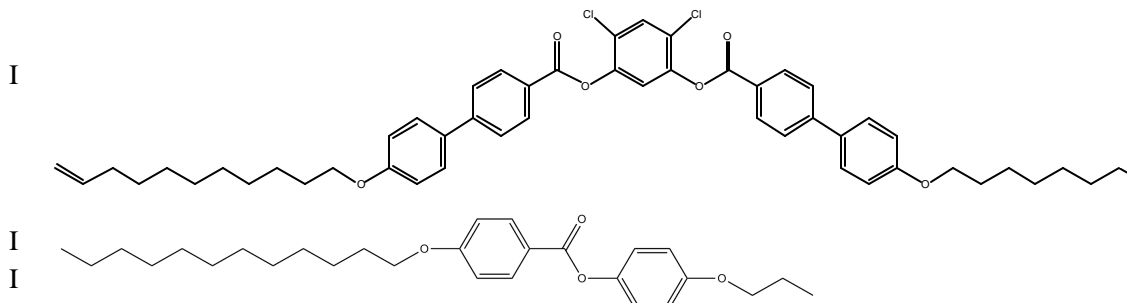
## S6\_P01

## Nematic phases of some binary mixtures of bent-core and calamitic compounds

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Due to their attractive properties, bent-core liquid crystalline compounds have been extensively studied in the last two decades [1]. Here we present the phase diagram for a binary system composed of a bent-core and a calamitic liquid crystal. One mixing component is the previously prepared 4,6-dichloro-1,3-phenylene bis[4'-(10-undecen-1-yloxy)-1,1'-biphenyl-4-carboxylate] (I), which is a nematogenic ester-type banana-shaped compound [2]. The calamitic compound is the well known 4-n Dodecyloxi-benzoicacid-[4-n-propyloxi-phenylester] (II), which exhibits smectic SmA phase in a moderate temperature range of 15°C as well as a very narrow nematic phase [3]. 5 mixtures with different concentrations have been prepared. Selected mixtures were studied by polarising optical microscopy and X-ray diffraction on non-oriented samples, as well as by semi empirical quantum chemical calculations. The general formulae of the studied compounds are:



In all mixtures a nematic phase exists in wide temperature ranges near to the room temperature, by far exceeding the temperature ranges of the nematic phases of the pure compounds. Suppression of the SmA phase, which exists in a moderate temperature range in the pure calamitic compound (II), is evident in the mixtures, where the SmA phase is found only in the mixture with the highest concentration of compound II existing in a narrow temperature range below the nematic phase. Due to the suppression of the smectic phase, the widening of nematic phase and its closeness to room temperature, we conclude that these mixtures are adequate candidates for potential application in the display industry [4].

Keywords : Liquid crystals; binary mixtures; nematic; smectic; bent-core; calamitic; phase transitions; optical microscopy; x-ray diffraction

#### Acknowledgments

This work was partly supported by the research Grant No. OI171015 from the Ministry of Education and Science of the Republic of Serbia, the Hungarian Research Fund OTKA K81250 and the SASA-HAS bilateral scientific exchange project #9.

*References:*

1. Obadovic, D.Ž., A. Vajda, A. Jakli, A. Menyhárd, M. Kohout, J. Svoboda, M. Stojanovic, N. Éber, G. Galli, and K. Fodor-Csorba, *Mesophase behaviour of binary mixtures of bell-shaped and calamitic compounds*. *Liquid Crystals*, 2010. 37(5): p. 527-536.
2. Fodor-Csorba, K., A. Vajda, A. Jakli, C. Slugovc, G. Trimmel, D. Demus, E. Gacs-Baitz, S. Holly, and G. Galli, *Ester type banana-shaped liquid crystalline monomers: synthesis and physical properties*. *Journal of Materials Chemistry*, 2004. 14(16): p. 2499-2506.
3. Demus, D., H. Demus, and H. Zschke, *Flüssige Kristalle in Tabellen*. 1976: Deutscher Verlag für Grundstoffindustrie.
4. Keith, C., A. Lehmann, U. Baumeister, M. Prehm, and C. Tschierske, *Nematic phases of bent-core mesogens*. *Soft Matter*, 2010. 6(8): p. 1704-1721.

**S6\_P02****Mott scattering in the presence of an intense laser field**

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In Mott scattering (the elastic scattering of a relativistic electron on a fixed nucleus) the electron energy is conserved, and only its direction can change. If the process takes place in the presence of a laser field, the electron can absorb or emit an arbitrary number of laser photons. In the simplest model in which the laser field is described by a monochromatic plane wave, the electron energy spectrum consists in an infinite series of discrete lines, each corresponding to a given number of emitted/absorbed photons.

In this work we consider a more realistic model, in which the laser field is described by a plane wave pulse of finite duration and arbitrary shape, and the initial state of the electron by a wavepacket. We present analytical results for the scattering amplitude and differential cross section. We also study numerically the dependence of the differential cross section on the laser pulse shape and duration for different scattering geometries. Finally, we study the effect of the delay between the laser pulse and the electron wavepacket.

**S6\_P03****Analysis of Automotive glass of various brands using EDXRF spectrometry**

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The purpose of this study is to develop an analytical procedure for the analysis of glass samples using XRF spectrometry and to apply this procedure for the compositional characterization of several auto glass samples of different brands.

The characterization of auto glass samples requires information about a large number of elements, starting from light elements (Na, Mg, Al, Si, Ca, etc.), which are the major components of glass composition, to heavy metals which may be present in the glass samples for different reasons. The samples were measured in secondary target excitation EDXRF system, using Cu and Mo secondary targets for excitation of low - and medium-Z elements, respectively. The program Corex, which uses fundamental parameters and backscattered peaks from the measurements was used for the calculation of the concentrations. EDXRF spectrometry shows acceptable values of the detection limits for most of the determined elements. Precision and accuracy of the determinations were evaluated by the measurements of a series of standard reference materials. The results show good agreement between the recommended and calculated concentrations, i.e. no evidence of systematic error. Precision, expressed as relative standard deviation of the repeated measurements of SRM, shows values in the range 5 – 8 % for major elements, and values within 10 % for most of the minor elements.

The analytical procedure was applied for the analysis of a group of automotive glass samples. The obtained results allowed us not only to identify the type of glass but also to put in evidence the relation between the presence of some minor elements and certain features of the glass samples.

**Keywords:** Automotive glass; Spectrum; Quantitative analysis; Energy Dispersive X-Ray Fluorescence.

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## S6\_P04

### Some Optical Properties of CeNi<sub>5</sub> Thin Films

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The study of the physical properties of the intermetallic compounds of rare earths with 3d transition elements as thin layers is of particular importance from both theoretical and technological point of view due to the high number of applications for this class of materials.

The CeNi<sub>5</sub> thin films were deposited on glass or quartz substrate using pulsed laser vaporization with electro-optical tuning of the quality factor. The structure and the composition of the thin films was studied using X-ray diffraction. It was found that single-phased thin films were obtained.

The thickness of CeNi<sub>5</sub> layers were determined by optical absorption at certain wavelengths and extrapolated down to nanometers according to the number of impulses of the laser radiation. The linear dependence of the layer thickness on the number of laser impulses used to obtain the thin films has been pointed out. The layers of small thicknesses displayed a discontinuous structure and had an insular shape.

The reflection spectra of the layers with nanometric thicknesses ( $d = 10 \text{ nm}$ ) have a band structure localized in the  $h\nu < 2 \text{ eV}$ . In these layers, owing to the capture of free charge carriers on the surface states, the Fermi level  $E_F$  shifts toward the bottom of the valence band, in contrast with the bulk sample where the contribution of the surface states is negligible. The maximum of the reflection bands appear as a result of the optical transitions of electrons from the surface states and the occupied states at the bottom of the valence band to the free levels immediately near the Fermi level.

Using the reflection spectra and the Kramers-Krönig formalism and a broad wavelength range, the spectral dependencies of the  $n$  and  $k$  optical constants was computed in the domain  $1-10 \text{ eV}$  for the  $\text{CeNi}_5$  thin films with thickness up to  $50 \text{ nm}$ .

In the case of  $\text{CeNi}_5$  layers, with thicknesses of a few tens of lattice constants of the system, the dependency of  $k$  on  $h\nu$  for the  $1-10 \text{ eV}$  domain has a shape specific to discontinuous layers. At greater thicknesses the  $h\nu$  dependence of both  $n$  and  $k$  increase with the wavelength. The slope of the increase for  $n$  and  $k$  with photon energies  $h\nu < 2 \text{ eV}$  is much sharper than the one determined by the free charge carriers mechanism. This rapid increase of  $n$  and  $k$  in the studied spectral range is in good agreement with the XPS spectrum for this energy range. The X-ray photoelectron spectroscopy measurements gave information on the density of states of the Fermi level, being a real help.

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### S6\_P05

#### THE STUDY OF NANOPARTICLES GENERATION BY LASER ABLATION

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This paper is a qualitative and quantitative study on the ablation process involved in obtaining nanoparticles in aqueous suspensions. The subject is topical and fits into the larger field of thin film deposition by laser ablation.

Were irradiated copper samples with a laser YAG: Nd and the analysis of nanoparticles was performed with an AFM XE-100 type. Based on the profilometry diagrams, the images and the data provided by the instrument, there have made estimates on the nanoparticles number (the amount of copper in suspension), on the size and number of atoms composing the nanoparticles.

The variable parameters of the experiences were the laser radiation intensity and the number of pulses. The theoretical model of ablation used in interpreting experimental data allowed estimates regarding the order of measurement of nanoparticles, and the amount of material expelled.

Keywords: laser ablation, nanoparticles, AFM.

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## S6\_P06

### An overview on the dependence between the input aperture and the efficiency of a paraboloidal static optical concentrator

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The electrical energy obtained from solar radiation receives an increasing weight in the used energy. However, the cost to obtain electrical energy from solar energy, based on the photovoltaic effect, is increased because of the high cost of the materials used to construct the PV cells. In the same time their efficiency is still low. A possible solution to decrease the cost of obtaining electrical energy from solar energy is the concentration of the solar radiation which could lead to an increase of the efficiency from 14% to 30%. The concentration of the solar energy can be achieved by using either static concentrators or concentrators which follow the Sun. The second type of concentrators have a high cost, therefore the most used variant is that of static concentrators which can be easily realized using cheap materials.

In order to design such concentrators we used the Ray-Tracing method and we implemented a software application [1], [2].

The input measurements are: the input aperture radius; the minimal and the maximal value of output aperture (PV cell), the step used to modify the value of the output aperture; the position of PV cell (the distance between the peak of the parabola and the cell); the initial moment of measurements; the final moment of measurements; the orientation angle of the paraboloidal axis; the month and the day.

The output measurements (calculated) are: solar irradiance; the angle of incidence of the radiation on the input aperture; the density of the radiant flow in the plane that contains the input aperture; the density of the radiant flow in the plane that contains the photovoltaic cell; the optical concentration factor; the amount of energy which passes through the input aperture during the measurements; the amount of energy captured by the cell; the average optical efficiency of the concentrator.

In this paper we present results obtained for a paraboloidal concentrator, having a variable radius of the PV cell under the assumption that the cell is placed on the southern wall of a building and the simulations correspond to equinoxes and solstices. Graphs of the dependence between the cell radius and the efficiency of the concentrator are also presented.

#### References

- [1] I.Luminosu, I.Zaharie, D. Ignea – *The study of a paraboloidal optical concentrator by ray-tracing method : foundations*, Moldavian Journal of the Physical Sciences, Vol.7, nr. 2, 224-228, 2008
  - [2] I. Zaharie, I. Luminosu, D. Ignea – *The study of a paraboloidal optical concentrator by ray-tracing method: results*, Moldavian Journal of the Physical Sciences, Vol.7, nr. 2, 229-233, 2008
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**S6\_P07****Study of the laser signal emergent from some fatty acids samples**

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The paper presents a study of a semiconductor laser beam, emergent from thin samples of fatty acids in liquid crystal state. The randament of the experimental setup built for this purpose was estimated, by taking into account the output optical power and the laser parameters, so as to emphasize the laser light interaction with the samples.

After irradiating the fatty acids with a flow of thermal neutrons, many modifications were observed. The results were compared with others obtained by us in other experimental conditions.

Theoretical considerations are also presented in the paper, to explain this behavior.

Keywords: fatty acids, liquid crystal, laser, thermal neutrons

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**S6\_P08****The INTERACTION OF LASER RADIATION WITH METALS (the INFLUENCE OF LASER RADIATION ON THE HYSTERESIS LOSSES IN Fe-si sheets)**

Marinela G. Voicu, Sergiu Dinu<sup>1</sup>, Calin Oros<sup>1</sup>, Gabriel Dima<sup>1</sup>

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This paper aims at highlighting the influence that the laser radiation has on the hysteresis losses in Fe-Si laminations, and the explanation of differences between irradiated and non-irradiated sheets. Comparative measurements were carried out between two identical sheets, size 300x30x0,5 mm, for frequencies and inductions of magnetic field between 10 Hz and 1000 Hz, respectively between 100 mT and 2100 mT. For a fixed frequency it can be seen an increase in the hysteresis curve area for irradiated sheet. Qualitative and quantitative interpretation of these results was made considering the microscopic structure of ferromagnetic materials (Fe-Si sheets), meaning that laser irradiation increases the degree of fragmentation of Weiss domains, so the energy needed to guide them on magnetic field direction.

**Keywords:** power losses, Fe-Si electrical sheets, Weiss domains.

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**S6\_P09****Application of optical polymers in plastic or hybrid glass-plastic optics**

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In the last two decades application of optical polymers grows in popularity. Plastics have several key advantages over glass as reduced manufacturing cost, low weight and design flexibility. However, their instability to temperature variation and humidity, insufficient scratch and mar resistance restricts polymer usage in high precision optics. Nowadays, attention is drawn to hybrid glass-polymer devices which combine the benefits of both optical materials and meet the requirements of enhanced quality imaging in various environment conditions.

Compatibility of optical polymers and glasses requires the knowledge of their transmittance, refractive and dispersive characteristics. We have examined various types of basic and commercial plastics. Bulk specimens as well as thin polymer films, obtained from polymer solutions, were investigated to determine their refractive and dispersive properties in the visible and near infrared region. Several measuring techniques have been used to obtain more extensive refractometric data applying a goniometric set-up and two modifications of a laser microrefractometer.

On the base of measured results dispersion coefficients, curves and Abbe numbers  $n_d$  for visible and  $n_{879}$  for the NIR region are calculated. Comparison of refractometric and dispersive properties of a number of polymers to catalogue glasses is presented to determine the possibility of their integration in hybrid glass-polymer components.

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## S6\_P10

### **Thermo-elastic solicitation of a shape memory alloy enhanced with thin polymer films through pulsed laser deposition technique**

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The adhesion of polymer thin layer obtained by PLD technique on a shape memory alloy was analyzed through thermo-elastic solicitation cycles. A Nitinol shape memory alloy element was enhanced with polymer thin layers in order to improve them corrosion resistance and biocompatibility. As deposition method a pulsed laser installation was used and nanometer layers were obtained on the round metallic surface. The polymer target, the substrate and the final shape memory element were analyzed through scanning electrons microscopy (SEM), calorimetry (DSC) and chemical investigations (EDAX) to establish the deposition method effects on materials. The

shape memory element improved with thin polymer layer is subject of 5000 heating under tension, using a 500 g weight, cycles and the element surface analyzed from 100 to 100 cycles to observe the polymer coating microstructure stability. Calorimetric investigations were also applied to analyze the shape memory effect behavior and properties also the polymer glass transition occurrence. The solicitation conditions determine a polymer coating fail after 4700 cycles with exfoliations and micro cracks appearance.

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### **S6\_P11**

#### **Silver nanoparticles for different applications characterization of their interesting optical properties**

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The silver nanoparticles used in this study were synthesized by chemical reduction method. Silver nitrate solution was added of sodium borohydride solutions in the ultrasonic field. The particle's size were determined and their distribution was analyzed. For all the samples was determined the zeta potential. The chemical composition was analyzed by atomic absorption spectroscopy (AAS). The color of metal nanoparticles is found to depend on the shape and size of the nanoparticle and dielectric constant of the surrounding medium, leading to many studies on their synthesis and applications

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### **S6\_P12**

#### **CARBON NANOPARTICLES SYNTHESISED BY LASER PYROLYSIS TECHNIQUE**

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Laser-induced single-step preparation method was successfully applied in obtaining Fe-C compounds and nanocompounds. Gaseous reactant CO<sub>2</sub> laser pyrolysis reveals a powerful and versatile technique in various nanostructures growth. Properties and structures are controlled by major process parameters (vapors or gaseous precursors), flowing gas rate, pressure and laser power. Carbon encapsulated iron nanoparticles have been lately reported as results of gradual and controlled oxidation process. It was used a conventional CO<sub>2</sub> continuous laser that irradiated the iron pentacarbonyl and acetylene gas mixture, acting as transfer agent of laser energy. In this work different carbon nanostructures through mixture gaseous pyrolysis (based on iron pentacarbonyl and ethylene vapors) are obtained using successive variation of major synthesis parameters (reaction pressure, laser intensity, irradiation geometry).

Keywords: Carbon, TEM, SAED, HRTEM, nanoparticles, laser pyrolysis

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## S7\_P01

### Structural and electrical properties of $\text{La}_{0.8}\text{Pb}_{0.2}\text{FeO}_3$ thin films deposited by RF magnetron sputtering

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Lanthanum perovskite  $\text{LaFeO}_3$  (LFO) is a semi-conducting oxide and has been extensively studied with reference to several potential applications, such as gas sensors, humidity sensors and catalysts. This oxide crystallizes in an orthorhombically distorted perovskite structure. The electric resistance of the  $\text{LaFeO}_3$  based sensor is very high, which is a disadvantage in application. The replacement of rare earth element La by Ba, Ca, Sr and Pb in  $\text{LaFeO}_3$  can diminish the resistance.

We have studied in this work the structural and electric properties of some thin films obtained through RF magnetron sputtering using as target the  $\text{La}_{0.8}\text{Pb}_{0.2}\text{FeO}_3$  perovskite. We have investigated the effects of the substrate (quartz and alumina) and its temperature during deposition, of plasma composition (Ar/O<sub>2</sub> ratio) and of subsequent thermal treatments.

The microstructure of the thin films was characterized by XRD, SEM, EDX and AFM analyses. The XRD patterns of the as deposited thin films feature small peaks corresponding to the perovskite phase. By annealing, the peaks become evident and show the high sample crystallinity. The influence of the environmental humidity on the electric resistivity of the obtained films was determined within the 0% ÷ 98% RH interval.

**Acknowledgement:** The authors would like to acknowledge the financial support of POSDRU/89/1.5/S/49944.

## S7\_P02

### Structure and morphological properties of Ca-containing perovskites for catalytic applications

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In the last years there is an interest in investigating the catalytic combustion of hydrocarbons using metal oxide compound as catalysts. The catalytic combustion make possible to drastically reduce the temperature required for a complete combustion.

Perovskite like-lanthanum manganites are known not only as magnetoresistive materials, but also as a catalytic material because of its high melting point, hardness, thermal and chemical stability and low cost.

In this study we report the effect of Ca incorporation on some structure aspects of  $\text{La}_{0.6}\text{Pb}_{0.4}\text{MnO}_3$  perovskite like manganite.  $\text{Ca}^{2+}$  ion was introduced as substituent for  $\text{Pb}^{2+}$  or as addition over the basic composition.

Powders of  $\text{La}_{0.6}\text{Pb}_{0.4}\text{MnO}_3$ ,  $\text{La}_{0.6}\text{Pb}_{0.2}\text{Ca}_{0.2}\text{MnO}_3$  and  $\text{La}_{0.6}\text{Pb}_{0.4}\text{Ca}_{0.2}\text{MnO}_3$  were prepared by a nonconventional method, selfcombustion. This simple method offers some advantages such as lower processing temperature, short annealing time, high purity materials and a controlled growth of the particles. The phase composition and lattice parameters were determined by X-ray diffraction at room temperature. All samples have a cubic perovskite structure. By Ca substituting for half of Pb ions a decrease of the lattice parameter was obtained due to smaller ionic radius of Ca (0.114 nm) than that of Pb ion (0.133 nm). This result indicates the solubility of Ca ions in the perovskite structure. Microstructure studies have been performed by SEM. There are significant differences between the microstructures of the samples with Ca substitutions and with Ca addition.

The catalyst property of the samples was tested for ethanol/air, methanol/air and acetone/air mixtures. It was determined the minimum temperature at which takes place the gas combustion over perovskite surface.

### S7\_P03

#### La-Pb-Mg-Mn-O perovskites: preparation and structural/microstructural characterizations for catalyst applications

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In this paper we focus on less studied system La-Pb-Mg-Mn-O perovskite. In the last years there is a great interest for these perovskites due to their application as combustion catalyst of volatile organic compounds (VOC). Magnesium was introduced as partial substitute for Pb or as additive to the stoichiometric composition  $\text{La}_{0.6}\text{Pb}_{0.4}\text{MnO}_3$ . The important role of the Mg ions is to prevent the abnormal growth of the grains by reducing the grain boundary mobility. The ultrafine powders were prepared by selfcombustion method followed by heat treatment at 1000 °C for two different times, of 40 and 320 minutes. As starting materials were used metal nitrates of high purity.

The structure and morphology were investigated by XRD and SEM. X-ray diffractograms indicate cubic perovskite structure (Pm3m) in all samples. The lattice parameter decreases by partial substituting of  $\text{Pb}^{2+}$  with  $\text{Mg}^{2+}$  due to the smaller ionic radius of  $\text{Mg}^{2+}$ .

The average grain size, determined from SEM images, decreases from 400 – 500 nm to about 100 nm by magnesium doping. The effect of the heat treatment time on the grain size was investigated. It was determined the minimum temperature for combustion of ethanol/air, methanol/air and

acetone/air mixtures over La-Pb-Mg-Mn-O perovskite catalyst. The results evidenced a lower combustion temperature in the presence of perovskite catalyst.

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## **S7\_P04**

### **Scale relativity theory applied to the modeling of the negative differential resistance in discharge plasma**

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Negative differential resistance effect in the current-voltage characteristic of an electrode immersed into a discharge plasma, associated with the bistability, hysteresis and the generation of a fireball, was experimentally evidenced. A negative resistance requires an active component in the electrical circuit able to act as source of energy. In the case of plasma, this component is the self-consistent double layer existing at the border of a fireball. The potential drop across the double layer is almost equal with the ionization potential of the working gas. The initially thermal electrons from plasma are accelerated when passing through the double layer, gaining enough energy to produce electron-neutral excitation and ionization impacts. In this way, an enhancement of the charged particles production takes place, leading to a sudden increase of the current collected by the electrode. Thus, the double layer works as a nonlinear circuit element able to convert the thermal energy into electrical energy, i.e. it is a source of energy in the electrical circuit, creating all the conditions necessary for the appearance of the negative differential resistance effect.

The negative differential resistance is modeled in the frame of the scale relativity theory. The model is based on both the fractal space-time concept and on a generalization of the Einstein's principle of relativity to scale transformations. In other words, the scale relativity model is built by completing the standard laws of classical physics by new laws, the space-time resolution being used as intrinsic variable, playing for the scale transformation the same role as played by velocities for motion transformations. We consider that the charged particles movements take place on continuous but non-differentiable curves, *i.e.* on fractal curves. Then, the complexity of these dynamics is substituted by fractality. The proposed model explains the relation between the negative differential resistance and the self-structuring of plasma as double layer, as well as the shape of the current-voltage characteristic of the electrode immersed into plasma.

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## **S7\_P05**

### **Spectroscopic Diagnostics of Free Air Arc in Different Regimes**

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In this work were conducted spectroscopic studies of free air arc in four different regimes: DC and AC arcs in continual and interruptible modes. The fixed-grating spectrograph PGS-s Carl Zeiss Jena actually is a variation on the very first spectrometer design where photo-plate was replaced with a detector array of Pixis-Roper Scientific camera. Abilities of the system are analyzed and plasma temperatures were determined by different spectral lines ratios.

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### S7\_P06

#### **Determination of electron energy distribution function from the intensity of spectral lines by Tikhonov regularization method in low pressure He plasma**

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Many problems in plasma diagnostic can be formulated as a linear inverse problem i.e., the problem that requires determination of unknown plasma parameters from known experimental data. Most of those problems are ill-posed. The ill-posed problem means that little non-avoidable errors in the measured values can lead to significant changes in the solution. Computer-supported techniques play an important role in the evaluation of experimental data but, even only discretization of inverse problems generally gives rise to very ill-conditioned linear system of algebraic equations. The linear systems obtained have to be regularized to make the computation of a meaningful approximate solution possible. This means that the systems must be replaced with nearby systems that are less sensitive to perturbations. Tikhonov regularization is one of the oldest and most popular regularization methods. He found an effective way to regulate an ill-posed problem by using the minimum *a priori information*, as an estimation error of experimental data. The regularization method FORTRAN-subroutine has been adapted for different experimental plasma diagnostics applications.

In this work special attention was focused on problem of determination an electron energy distribution-EEDF in plasma from the intensity of spectral lines. Several model tasks were done to check applicability limitations of the method. Such test parameters are chosen by intention to simulate, as close as possible, low-pressure helium plasmas for future comparisons. Principally, there are not any differences to apply the above method to any other plasma whose optical cross-sections of their spectral lines are known, but other parameter such as electron density are needed.

Helium plasmas were chosen due to several reasons: first, there are a lot of experimental data (spectrum, EEDF); second, there are a lot of atomic data (oscillator strengths, cross sections); and third, the intensities of spectral lines are highly sensitive in respect to the EEDF. In our method are relevant only lines with different relative excitation functions i.e., with sharp differences in energy dependences. The relative excitation functions for the helium lines belonging to one series are the same and thus, one can use a suitable (easy measured) spectral line or a few lines per a series. Our assumption that the threshold energies are the same for all lines is fulfilled (the lower levels of transitions of neutral helium), because they are actually dispersed in a small energy interval, compared to energy interval where EEDF is searched.



In cases of highly non-equilibrium plasmas the effectiveness of extraction information about the EEDF by using the Tikhonov's regularization procedures depends on the experimental errors of the measured specter, the number of the appropriate chosen spectral lines and the shapes of its excitation functions. The most important fact is that one can use Tikhonov's regularization method and "visualize" how close to the exact EEDF could be.

From our numerical experiments, we found that range of the reliable results for EEDF's is started just at the energy where these lines have maximum excitation function. In the case of helium plasmas it is triplet series  $2p^3P^0 \rightarrow nd^3D$ . Advantages to use this method are: absence of the condition that EEDFs are close to be Maxwellian; application in fast changing plasma processes; and this is non-contact method. Disadvantages are: mostly determination only the "tail" of electron energy distribution.

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## S7\_P07

### Nanoindentation analysis on DLC thin films obtained by anodic arc plasma deposition

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Nanoindentation is the technique usually employed for studying mechanical properties of thin DLC films with thickness less than a few hundred nanometers. The main aspects of the technique are: high depth sensitivity and high control of low load. These important characteristics can be used to finely tune the experimental parameters for obtaining the most accurate results. The main concern is the influence of the substrate on the properties of the studied thin film. In order to find the most suitable load to be used for DLC films obtained by an anodic arc plasma, a series of nanoindentation analysis were undertaken. A comparison of results was obtained and specific conclusions were drawn. Nanoindentation was performed using the MultiMode NanoScope IIIA Controller microscope and a three sided pyramidal diamond tip stainless steel cantilever. The DLC thin films were prepared on Si substrates using a plasma source developed at NILPRP-Magurele, called Thermionic Vacuum Arc (TVA). The principle of this coating method consists in the acceleration of the electrons emitted by a tungsten filament towards a graphite rod - which acts as the anode. Applying a high voltage on the anode, the electrons heat up the graphite rod surface till sublimation, a stable plasma is then ignited. The analyzed samples were deposited using identical discharge parameters: discharge current ( $I_{arc}$ )= 2.6 A; Discharge potential ( $U_{arc}$ )= 800V at different distances from the anode ranging from 2.5 cm to 25 cm.

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**S7\_P08****Preliminary determination of hydrogen in DLC films using NRA**

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The presence of hydrogen in some materials has dramatic effects on their properties. Many of these phenomena are not completely understood because of the reduced availability of techniques to measure the hydrogen concentration as a function of depth into the material. Investigations concerning hydrogen content are not usually considered necessary for the characterization of the so called "H-free DLC (Diamond Like Carbon)" films due to the fact that the methods to produce this type of DLC do not use H-containing precursors. Nuclear Reaction Analysis (NRA) using  $^{19}\text{F}$  ions was used for hydrogen depth profiling in DLC thin films deposited onto BK7 glass. The measurements were performed at the 9MV FN Bucharest IFIN-HH Tandem Accelerator. These films were obtained using Thermionic Vacuum Arc (TVA) method at INFLPR and were assumed to be hydrogen free. The analysis of DLC films using NRA gave useful information for materials fabricants regarding the presence of hydrogen in their materials. We have found that hydrogen is present within DLC films deposited by TVA plasma, although no H-containing gas is used. The main processes responsible for these findings were analyzed.

**Keywords:** NRA, DLC, TVA.

Acknowledgements: The work was partially funded by the Romanian Ministry of Research PN 09 39 04 01.

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**S7\_P09****The Transmission Coefficient of Gravitational Waves in Non-magnetized Stratified Plasma**

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We study transmittance properties of gravitational waves at a horizontal interface separating two isothermal regions of a gravitationally stratified non-magnetized plasma. Possible applications to the boundary between the solar interior and the corona are discussed.



**S7\_P10****Local structural investigation of lithium-phosphate glasses with (FeV) ions, by Raman spectroscopy**

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Glasses from  $x(\text{Fe}_2\text{O}_3 \cdot \text{V}_2\text{O}_5)(100-x)[\text{P}_2\text{O}_5 \cdot \text{Li}_2\text{O}]$  were prepared and investigated using Raman scattering spectroscopy, over compositional range  $x=0 \div 50$  % mol. The influence of  $(\text{Fe}_2\text{O}_3 \cdot \text{V}_2\text{O}_5)$  content on the structure of  $[\text{P}_2\text{O}_5 \cdot \text{Li}_2\text{O}]$  glass matrix was followed. The addition of  $(\text{Fe}_2\text{O}_3 \cdot \text{V}_2\text{O}_5)$  determines the modification of the structure of the studied glasses. The Raman spectra of  $x(\text{Fe}_2\text{O}_3 \cdot \text{V}_2\text{O}_5)(100-x)[\text{P}_2\text{O}_5 \cdot \text{Li}_2\text{O}]$  do not present any absorption bands characteristic to  $\text{Fe}_2\text{O}_3$ , but its evolution is depending on the iron content and present besides the bands specific for the matrix, some bands assigned to characteristic vibrations of V-O bonds which are evidenced only for high content of  $(\text{Fe}_2\text{O}_3 \cdot \text{V}_2\text{O}_5)$ . The increasing of iron and vanadium content indicate a gradual decrease in the number of bridging oxygen ions and an increasing in the number of non-bridging oxygen ions.

**S7\_P11****SEM AND RAMAN INVESTIGATION OF THERMIONIC VACUUM ARC DEPOSITED TIN CONTAINING AMORPHOUS CARBON FILMS**

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The paper presented the synthesis of tin containing carbon amorphous composite films deposited by thermionic vacuum arc technique. The chemical composition, morphology and microstructure of the films were investigated by energy-dispersive spectroscopy (EDS), scanning electron microscopy (SEM) and Raman spectroscopy. One of the samples investigated, with 37.5 at. % Sn, presented the lowest  $I_D/I_G$  intensity ratio and highest value of Full-Width Half-Maximum (FWHM) for G band.

*Keywords:* TVA, electron microscopy, sp<sup>3</sup> content

## **S7\_P12**

### **OBTAINING AND STUDYING OF THERMIONIC VACUUM ARC DEPOSITED Cu AND Co NANOSTRUCTURED MULTILAYERS ON CERAMIC SUBSTRATE.**

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In this paper we present an approach of the obtaining and study of nanostructured materials with special resistive magnetic properties. The Cu and Co thin films are grown by a physical thermionic vacuum arc method (TVA). Successive layers of Cu and Co were deposited on silicon substrates using tungsten crucibles each containing Cu and Co metals, respectively.

The morphological and structural investigations were achieved by means of electron microscopy technique: TEM (Philips, CM120ST) and SEM.

The compositional analysis of the films with the atomic percentage determination of the constituent elements was performed by an energy dispersive X-ray spectroscopy (EDS) analysis and correlated to the electrical resistance.

Keywords: thermionic vacuum arc method, the morphological and structural investigations, the compositional analysis of the films, the electrical resistance

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## **S7\_P13**

### **OBTAINING AND STUDYING OF EVAPORATION IN VACUUM DEPOSITED Cu, Co AND Ni NANOSTRUCTURED MULTILAYERS**

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In this paper we present an approach of the obtaining and study of nanostructured materials with special resistive magnetic properties. The Cu/Co/Cu/Ni multilayers thin films are grown by physical vapor deposition technique.

The morphological and structural investigations were achieved by means of electron microscopy technique: TEM (Philips, CM120ST) and SEM.

The compositional analysis of the films with the atomic percentage determination of the constituent elements was performed by an energy dispersive X-ray spectroscopy (EDS) analysis and correlated to the electrical resistance.

Keywords: evaporation vacuum, the morphological and structural investigations, the compositional analysis of the films, the electrical resistance, magnetoresistance.

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**S7\_P14****OBTAINING AND STUDYING OF EVAPORATION IN VACUUM CO- DEPOSITED Cu AND Co**

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In this paper we present an approach of the obtaining and study of nanostructured materials with special resistive magnetic properties. The Cu and Co thin film are grow by evaporation in vacuum co-deposition.

The morphological and structural investigations were achieved by means of electron microscopy technique: TEM and SEM.

The compositional analysis of the films with the atomic percentage determination of the constituent elements was performed by an energy dispersive X-ray spectroscopy (EDS) analysis and correlated to the electrical resistance.

Keywords: evaporation vacuum, co-deposition, the morphological and structural investigations, the compositional analysis of the films, the electrical resistance, magnetoresistance.

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**S7\_P15****CHARACTERIZATION OF (Zr,Al)CN COATINGS DEPOSITED BY THE CATHODIC ARC METHOD**

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Despite TiCN and ZrCN coatings present a good wear resistance, the addition of Al improve their corrosion and oxidation resistance, as well as the hardness [1,2]. Despite all the data gathered with regard to the properties of (Ti,Al)CN, little is known about the (Zr,Al)CN coatings.

The aim of this work is to investigate the characteristics of (Zr,Al)CN hard coatings deposited by duplex technology [3] on high-speed steel (HSS) substrates. Both the nitriding treatment and the film deposition were performed in a cathodic arc deposition unit. The nitrided layers were characterized for microhardness depth profiles, while the deposited films were analyzed in terms of elemental and phase composition, chemical binding state, texture, and hardness. To appreciate the benefits of the duplex technology as compared to simple plasma nitriding or untreated samples, friction and wear resistance of the untreated, nitrided and duplex coatings were comparatively investigated. The EDS and XPS analyses showed that the coatings were highly over-stoichiometric, (C+N)/(Zr+Al) ratio was calculated to be of 2. X-ray diffraction patterns revealed the formation a crystalline nanostructure consisting of a carbonitride fcc solid solution ((111) texture). For the (Zr,Al)CN film deposited on nitrided HSS steel substrate, a high hardness of about ~36 GPa was measured. Tribological tests, carried out under dry conditions, revealed that both friction coefficient and wear resistance of the duplex coatings were superior to those of the untreated or nitrided specimens. The experimental results demonstrated that the (Zr,Al)CN duplex coatings, investigated in this work, represent promising candidates for protective coatings to be used in various tribological applications.

[1] S. PalDey and S.C. Deevi, Mater. Sci. Eng. A 342, 58 (2003).

[2] J.J. Araiza, O. Sánchez and J.M. Albella, Vacuum 83, 1236 (2009).

[3] M. Braic, V. Braic, M. Balaceanu, A. Vladescu, C.N. Zoita, C.P. Lungu, C.E.A. Grigorescu, E. Grigore and C. Logofatu, Surface & Coatings Technology 205, S209 (2011)

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## S7\_P16

### Deposition and Characteristics of high-entropy alloy carbide coatings

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In recent years, high-entropy alloys (HEA), consisting of 5–13 elements with almost equiatomic concentrations, have received considerable attention because of their remarkable properties such as high hardness even after annealing, high strength, good fatigue and corrosion resistance, and high thermal stability [1-2]. These excellent characteristics were found to be the result of a fine grained structure, with nanoscale particles embedded in an amorphous/crystalline matrix. Considering the HEA superior qualities, various compounds (nitrides, oxides, carbides, and borides) of HE alloys are also expected to exhibit interesting properties. So far only nitride films of HEA have been prepared: (TiAlCrSiV)N, (AlCrTaTiZr)N, (FeCoNiCr-CuAlMn)N, and (AlCrNiSiTi)N.

Multi-principal-element (TiZrNbHfTa)N and (TiZrNbHfTa)C coatings were deposited on Ti6Al4V alloy by co-sputtering of Ti, Zr, Nb, Hf and Ta metallic targets in reactive atmosphere. The coatings were analyzed for elemental and phase composition, crystalline structure, morphology, residual stress, hardness, friction performance, wear-corrosion resistance and cell viability. For all

the films, only simple fcc solid solutions with (111) preferred orientations were found, with crystallite size of about 10 nm. The coatings were subjected to compressive stress, with values ranging from  $-0.8$  to  $-1.6$  GPa. The carbide coating with the highest carbon content (carbon/metal  $\sim 1.3$ ) exhibited the highest hardness of about 31 GPa, and also the best friction behavior ( $\mu = 0.12$ ) and the highest wear resistance (wear rate  $K=0.2 \times 10^{-6} \text{ mm}^3 \text{N}^{-1} \text{m}^{-1}$ ), when testing in simulated body fluids (SBF). Cell viability tests proved that the osteoblast cells were adherent to the coated substrates, and a very high ratio of live cells were present on sample surfaces, after 72 h incubation time.

[1] J.W.Yeh, S.K.Chen, S.J.Lin, J.Y.Gan, T.S.Chin, T.T.Shun, C.H.Tsau and S.Y.Chang, *Adv. Eng. Mater.*, 6 (2004) 299.

[2] M.Braic, V.Braic, M.Balaceanu, C.N.Zoita, A.Vladescu and E.Grigore, *Surface & Coatings Technology* 204 (2010) 2010.

### S7\_P17

#### EFFECT OF SiC, Ag AND Ti INTERLAYERS ON CHARACTERISTICS OF HYDROXYAPATITE FILMS DEPOSITED ON Ti6Al4V ALLOY

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It is well known that of about 20 % of the implanted prosthesis required revision within 10 years, the average life span of an implant is only about 15 years. Therefore, it is important to develop methods for improving the metallic surfaces by changes in material's surface characteristics, leaving intact the mechanical, anticorrosive, tribological and biocompatible bulk properties. Lately, many different transition metal nitride, carbide, or oxynitride coatings have wide application as biomaterials, due to their valuable properties such as high hardness, wear and corrosion resistance, and good biocompatibility. Even if these types of coatings proved to be successful in applications such as couple metal-polyethylene, in the case of the direct interaction between the metallic implant and the bone, a bioactive material seemed to be needed. In the last years, the bioactive coatings were frequently used to enhance the bonding between the bone and metallic medical devices. Among different types of bioactive coatings, HydroxyAPatite (HAP) is one of the most extensively used in repairing of hard tissues, because of its chemical similarities to the component of bones and teeth. However, the low mechanical strength of plain HAP ceramics and the relatively low bone bonding rate restrict its use as biomaterials.

The aim of this paper is to study the characteristics of hydroxyapatite films deposited on Ti6Al4V alloy by deposition of SiC, Ag and Ti as adhesion interlayers. The films were characterized in terms of elemental and phase composition, texture, morphology, hardness, adhesion and corrosion resistance.

The corrosion tests in SBF solution revealed that the corrosion resistance of the coated samples depended on the interlayer type. On overall, improved mechanical properties and corrosion behavior were found for HAP coatings deposited with an adhesion interlayer.



*Acknowledgements:* The work was supported under the a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-RU-TE-2011-3-0284 and Sectoral Operational for Human Resources Programme (POSDRU- 88/1.5/S/60203).

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## **S7\_P18**

### **MAGNETIC THIN FILMS STRUCTURES OBTAINED BY THERMIONIC VACUUM ARC METHOD**

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Multilayer thin films were obtained using thermionic vacuum arc method. The aim of this work was to obtain Giant Magentoresistive (GMR) properties on the multilayer thin film structures.

Two sets of samples (Cu/Ni/Cu/Fe)x10/Ta type nanostructure of 3 nm per each layer of the thin film and 10 nm respectively were prepared. The samples were subject to systematic study, correlating their magnetic properties regarding the thermal treatment temperatures. For this purpose, the samples were thermally treated at 475 K and 625 K. being compared with the ones not thermally treated. Morphological and structural properties of the prepared multi structures were analyzed by Atomic Force Microscopy, Scanning Electron Microscopy and Electron Dispersion Spectroscopy, respectively. The magnetic properties of the obtained thin films were first analyzed using a Magneto-Optical Kerr Effect experiment. It was observed an increase of the MOKE signal for the thermally treated probes. The electrical resistance behavior of the multi layer structure was determined in a variable magnetic field with values between -0.2T to 0.2T. An increase of the magneto resistive effect was observed for the thermally treated samples at the same magnetic field interval.

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## **S7\_P19**

### **OPTICAL EMISSION SPECTROSCOPY IN FOTODYNAMIC THERAPY APPLICATIONS**

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Efficient photodynamic therapy application requires a constant improvement in the transmission radiation technology field and also for different types of photosensitizing devices in order to destroy malignant tumors.

For this, a system that permits testing different configurations of spectral gas discharge tubes (Ar, Xe) at different values for the inside gas pressure was conceived. In this experiment, the discharge tube was made out of quartz with a length of 11 cm and 8 cm in diameter, having the electrodes made out of tungsten.

An AC power supply was used having a voltage range of 0-1000 V and an adjustable frequency between 8-25 KHz. The emission spectra had been acquired and analyzed using a SM240 CCD Spectrometer (Spectral Products, USA) using an UV type optical fiber.

Plasma temperature was evaluated for the discharges of the Ar and Xe atoms. The method consists in selecting two representative lines of the species. Using the ratio of their relative intensities ( $I_1$  and  $I_2$ ) we estimated the electron temperature ( $T_e$ ) of the produced plasma with a formula based on the Boltzmann distribution of the species.

In this work are presented the analysis of the optical emission spectra, spatial distribution of the electron temperature ( $T_e$ ) and also the discharge gas pressure dependency of the electron temperature ( $T_e$ ).

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### **S7\_P20**

#### **Investigation of polymers surface treated with SDBD Helium plasma**

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Polycarbonate is a versatile, tough plastic used for a variety of applications, from bulletproof windows to compact disks and is considered one of the fastest growing engineering plastics. Compact disks and digital versatile discs (DVDs) are perhaps the most readily recognized examples of polycarbonate. The main advantage of polycarbonate over other types of plastic is unbeatable strength combined with light weight. Polycarbonate is just one-sixth the weight of glass, and one of its drawbacks is that it is more expensive than glass.

Atmospheric pressure plasma treatments had been successfully used as a dry process to alter the surface properties of polymers. The effect of He plasma on the surface free energy of polymers treated at atmospheric pressure in surface dielectric barrier discharge (SDBD) has been studied in this paper and the changes in the surface free energy of the polymers were followed as a function of the plasma treatment time. One of the advantages of SDBD technique is that it offers the possibility of inducing significant surface chemical modifications on a material exposed to the discharge at atmospheric pressure at different treatment times.

The valuable properties of polymers are often compromised by their unfavorable surface characteristics, such as low resistance to abrasion and scratching, low surface energy, which leads to problems with adhesion and wettability. In this study contact angle measurements were used to

record the short- and long - term variations in wettability of treated and untreated polycarbonate sheets. After the modification process was determined with hydrophilicity measurements, evaluated by means of the SEE system drop test, we noticed that the hydrophilicity of individual sheets of polycarbonate has distinctly decreased after plasma treatment. Also the AFM and SEM measurements were performed for a better understanding of the processes that occurs during the treatments.

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## **S7\_P21**

### **Morphological and mechanical characterization of hydrogenated DLC (a-C:H) films synthesized using Magnetically Gaseous Thermionic Vacuum Arc (MGTVA) technology**

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The effect of using a magnetic field to confine and focus the carbon plasma in a Magnetically Gaseous Thermionic Vacuum Arc deposition system was investigated in the preparation of hydrogenated amorphous carbon thin films (a-C:H), from a hydrocarbon precursor gas (in our case CH<sub>4</sub>). The distribution of the discharge of dual internal magnetron exactly corresponds to basic principles of a magnetic confinement of the plasma. Every important progress in magnetron technology is vitally dependent not only on a deep understanding of the physical basis of magnetron discharges and significant improvements of existing systems but mainly on the development of new ones operating under new physical conditions.

The morphology and the mechanical properties of the hydrogenated carbon thin films grown in the high-density magnetic field were studied in detail. The morphological studies of the films have been carried out using Transmission Electron Microscopy performed on a Phillips CM 120 ST (acceleration voltage of 120 kV) TEM and the mechanical properties of the films were investigated using the Fisherscope H 100 and the Ultrananindenter (UNHT) equipment with two types of indenter: Vickers and Berkovich. Moreover, the influence of substrate material on the results of the indentation test was performed.

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## **S7\_P22**

### **Morphological investigation of the Mg thin films deposited by Thermionic Vacuum Arc (TVA) technology**

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Hydrogen storage materials have attracted intensive attention for the increasing demands on energy consumption and environment protection. Magnesium is considered as a promising hydrogen storage material for automotive applications due to its high capacity (7.6 wt% of hydrogen), lightweight and low cost.

Preparing Mg thin films by Thermionic Vacuum Arc (TVA) technology is an efficient method to create advanced materials at the frontier of science. TVA is an original method for deposition of high purity thin films with compact structure and extremely smooth, just convenient for nanostructured film synthesis despite of the high melting point of some materials: carbon, tungsten, tantalum pentoxide as well as magnesium.

The aim of this paper is to analyze the morphology and the wettability in terms of surface free energy of the nanostructured Mg thin films.

The structure and the morphology of the coatings were examined using Transmission Electron Microscopy (TEM) with a resolution of 1.4 Å. The free surface energy was determined by means of Surface Energy Evaluation System (See System) based on contact angle measurements using different testing liquids.

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### S7\_P23

#### MATERIAL FOR REPLACING Ti6Al4V IN MEDICAL APPLICATIONS

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Research dedicated to the most adequate biocompatible material for insertion in biological internal environment has led to the development of many alloys, such as titanium and its alloys, stainless steel, cobalt–chromium, and shape memory alloys. Among them, titanium and its alloys are extensively presently used because of their high specific strength-to-weight ratio, good fatigue strength, low density, small elastic modulus, high corrosion resistance and good biocompatibility. However, titanium and its alloys cannot meet all of the clinical requirements because of their poor tribological properties.

The goal of the current work is the investigation of Ti–10Nb – 10Zr–5Ta alloy as possible candidate material for replacing Ti6Al4V alloy in medical applications. The alloy was prepared in a levitation melting furnace with cold crucible and characterized in terms of elemental and phase composition, texture, microstructure, hardness, wear and corrosion resistance by EDS and XRD techniques, optical microscopy, microindentation, electrochemical and tribological tests in simulated body fluid (SBF) and Fusayama Meyer artificial saliva solutions. The characteristics of the material were compared to those of the Ti6Al4V alloy.

The potentiodynamic polarization tests revealed better corrosion resistance of Ti10Nb10Zr5Ta as compared to Ti6Al4V. Comparing the friction coefficients of the studied alloy systems in both

corrosive solutions, it appeared that Ti10Nb10Zr5Ta alloy exhibited better friction behaviour. On overall, the Ti10Nb10Zr5Ta alloy possesses the best combination of corrosion and tribological behavior in SBF and artificial saliva solutions, when compared to the commercial Ti6Al4V alloy.

*Acknowledgements:* The work was supported under the Project MNT-ERA NET – FIMED no. 7-026/2010.

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## S7\_P24

### Electrical diagnosis of carbon laser produced plasma by using Faraday cup detector

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Carbon laser produced plasma has been extensively studied due to its large potential applicability showed for the carbon allotropes (carbon nanotube and graphene), which can be obtained in a pulsed laser deposition (PLD) system [1]. For physical vapour deposition methods (that include PLD), the properties of the resulted thin films depend on the plasma parameters. In this paper, using an electrostatic energy analyzer consisting in a Faraday cup and three metallic grids in front of it, some parameters derived from the monitoring of the positively charged species (time of flight – TOF evolutions, plasma temperature and velocity distributions) are studied. The plasma has been generated by laser ablation of the pyrolytic graphite in vacuum, by sending a focalized KrF excimer laser beam (248 nm, 20 ns) at 45° incidence with respect to the normal on the target surface. The plasma parameters have been studied for various laser fluences in a low fluence regime ( $< 5 \text{ J/cm}^2$ ), *i.e.* in the usual range for thin films deposition. By applying a negative voltage on the second grid and collector for repelling the primary and secondary electrons, respectively, the ion yields are recorded as function of time. Then, assuming a shifted Maxwellian ion energy distribution, the plasma temperature has been derived as a function of fluence, ranging from 1 to 12 eV. By applying on the third grid a retarding voltage  $V_R$  for ions, particles that have the kinetic energies below  $eV_R$  are repelled towards the opposite direction of the collector. Thus, the shape of the signal (TOF spectra) characteristic for the ions which pass towards the collector became narrow with the applied voltage. Consequently, the energy distribution function will be affected. This result is particularly important for thin films deposition process where the energy distribution of plasma particles is generally a determining factor for low roughness and the grain size of the deposited films [2,3]. Increasing the applied voltage, the number of the repelled ions becomes significant and beyond a threshold voltage it is observed a reheating effect of laser produced plasma, the plasma temperature increasing with the retarding applied voltage.

**Acknowledgements:** The financial support was assured by POSDRU/89/1.5/S/55216.

#### References

- [1] D.B. Geohegan: in *Pulsed Laser Deposition of Thin Films*, ed. D.B. Chrisey and G.K. Hubler (Wiley, New York, 1994).
  - [2] A. Tselev, A. Gorbunov, and W. Pompe, *Appl. Phys. A* 69, 353–358 (1999).
  - [3] A. Tselev, A. Gorbunov, and W. Pompe, *Rev. Sci. Instrum.* 72, 2665–2672 (2001).
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**S7\_P25****Investigation of photoluminescence properties and piezoelectric response of ZnO thin films deposited by HIPIMS**

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In recent years there has been increased interest in ZnO in terms of potential applications as piezoelectric films for surface acoustic wave devices (SAW), UV photodetectors, UV and blue light emitting devices. The aim of this research is to investigate the influence of annealing temperature and deposition parameters on photoluminescence (PL) properties and piezoelectric response of ZnO thin films deposited by **H**igh **P**ower **I**mpulse **M**agnetron **S**puttering (HIPIMS). The reactive pulsed magnetron discharge operates in a preionised regime (pulse width: 1 - 20  $\mu$ s, frequency: 0.1 - 4 kHz, target voltage: 1 kV, current density: 1-20 A/cm<sup>2</sup>) with lower breakdown delay, high ion-to-neutral flux ratio at the substrate, no arc development and provides very good sputtering process stability and reproducibility. The most important advantage of the HIPIMS is high ionization rate of sputtered material and the resulting higher mobility of the species adsorbed on the substrate which is beneficial for coatings with preferred crystal orientation.

Films with highly piezoelectric properties and good PL response are prime candidates to fabricate UV sensors based on surface acoustic wave devices. The effect of annealing temperature and deposition parameters on the crystal quality was investigated using X-ray diffraction (XRD), photoluminescence (PL) spectroscopy and piezoresponse force microscopy (PFM). Annealing, gas pressure and deposition rate have a strong effect on the piezoelectric domains and crystallinity of the layers in terms of grain size, residual strain, and defect density. Piezoresponse force microscopy was employed to investigate the local (in the nanoscale) piezoelectric properties of the ZnO thin films.

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**S7\_P26****Modifications of Carbon nanowalls by Plasma Treatment**

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Carbon nanowalls (CNWs), which are often described as quasi-two-dimensional lamellar nanostructures based on multi-layers of superimposed graphene domains, are some of the newest promising carbon nano-materials. Their special characteristics (reduced dimensionality, 2D anisotropy, sharp edges and high surfaces in respect to the volume) recommend these materials for

many applications like superhydrophobic coatings, fuel cells, batteries, catalytic devices, biosensors.

Post-synthesis treatments can improve some of the physico-chemical properties of these nanostructures and usually they make the CNWs more suitable for applications.

In our previously work [1-2] we have demonstrated the possibility of CNWs syntheses layers on different substrates using original methods based on plasma jet CVD. A way of tuning or optimizing their properties is achievable by post-synthesis plasma treatments [3]. In this study we present our last results in plasma modification of CNWs layers. Two kinds of RF plasmas were used for these treatments: a parallel plate discharge and a low pressure plasma jet (the same that was used for CNWs synthesis). We present here the changes of morphology, structure, and surface chemistry of CNWs after the treatments in various gas mixtures injected in the discharge (oxygen, hydrogen, nitrogen, tetrafluoroethane or sulfur hexafluoride).

Keywords: Carbon nanowalls, plasma functionalizations, superhydrophobic surface, surface modification, graphene layers.

Acknowledgements: One of the authors (S. Vizireanu) is gratefully acknowledging the financial support from the European Social Fund through POSDRU/89/1.5/S/54785 project: "Postdoctoral Program for Advanced Research in the field of nanomaterials". This work was also partially supported by the Romanian Ministry of Education and Research under the contract TE\_228 No 92/2010 (Human Resources Programme).

References:

1. S. Vizireanu, S.D. Stoica, C. Luculescu, L.C. Nistor, B. Mitu, G. Dinescu, Plasma Sources Science and Technology, 19, 034016, 2010
  2. S. Vizireanu, B. Mitu, C.R. Luculescu, L.C. Nistor, G. Dinescu, Surface and Coatings Technology, doi:10.1016/j.surfcoat.2011.07.09.
  3. S. Vizireanu, M. D. Ionita, G. Dinescu, I. Enculescu, M. Baibarac, I. Baltog Plasma Processes and Polymers, DOI: 10.1002/ppap.201100153, 2012
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**S8\_P01****Experimental Study for Using PhotoVoltaic Panels at Politehnica University Timișoara**

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The classical resources, like those of coal and of oil, are limited, fact that led to the search for new energy resources, the so called regenerable energy resources (e.g. solar energy, wind energy, biomass, geothermal energy, tidal energy, wave energy, small hydro power plants). The solar energy is one of the most important regenerable resource allowing the generation of electrical energy both by photovoltaic conversion and by thermal conversion.

At the Politehnica University of Timisoara, Department of Physical Foundation of Engineering, there are installed 14 photovoltaic panels (PV SOLARWATT M220-60GET AK) out of which 11 panels inject electrical energy through an inverter SUNNY BOY 3000 (SB3000) directly into power network, and 3 panels charge, through a charger SUNNY ISLAND 50 SIC50-MPT, 24 storage batteries. From the storage batteries the electrical current is transferred through an inverter SUNNY ISLAND 5048 into a room. This system functions as an UPS (Uninterruptible Power Source) for two servers: for a web-server, respectively a server for a computational cluster. The data on the energy of the solar radiation converted into electrical energy are transferred through a SUNNY WEBBOX toward the portal <http://www.sunnyportal.com/Templates/PublicPageOverview.aspx?plant=ddf2de77-7e72-488a-bd51-08ba98fc201b&splang=en-US> where they can be visualized. In the same time these data are stored on a memory card as text files, thus they can be processed using specific experimental data processing software.

In order to compute the efficiency of the photovoltaic installation we used the data stored at <http://solar.physics.uvt.ro/srms/index.php?target=download&lang=en>

The stored data allow the estimation of the solar potential in the Timisoara area, the computation of the efficiency of the photovoltaic conversion of the solar energy and also of the dependence between the solar energy and temperature. In order to improve the efficiency we intend to introduce a cooling system consisting of a system of Cu pipes. This system will be a closed circuit through which will flow distilled water mixed with antigel which will pass through a heat exchanger. The installation in function at the mentioned location have injected during 11246 functioning hours 8504 KWh, which illustrates that such a system can cover the electrical power needs of at least three families. Based on the collected data, our team can offer consultancy to those who are interested in installing a PV as additional source of electrical power.

**S8\_P02****Impact of energy harvesting in PV-TEC cells**

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Energy harvesting applied at the photovoltaic cell level used for thermal energy recovery with help from a thermo element module can provide an efficiency boost. In this paper there is presented the integration of a nanostructured porous Si cell with a BiSeTe thermoelement using a ceramic interlayer.

Keywords:energy harvesting, nanostructured PV cell, thermoelement cooler

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## S8\_P03

### Fragmentation dynamics at transition from multifragmentation to neck fragmentation

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In heavy-ions collisions at Fermi energies, depending on the impact parameter, the reaction mechanism moves from nuclear multifragmentation to neck fragmentation. We present new features of the fragmentation dynamics and we focus on the collective flow properties of the intermediate mass fragments and on the dynamics of the isospin degree of freedom. Based on a microscopic transport model, the Stochastic Mean Field (SMN), we analyze  $Sn+Sn$  reactions at an energy of  $50A MeV$  and for an impact parameter  $b=4fm$ . In this case, an intermediate situation between multifragmentation and neck fragmentation manifests. We consider three and four intermediate mass fragments. The analysis of the isospin-dependent observables in correlation to position in mass hierarchy provides new experimental opportunities to study the behaviour of the symmetry energy in the nuclear equation of state, below saturation density.

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## S8\_P04

### Commissioning of TR19 Cyclotron for further research in nuclear medical radioisotopes

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Recently, a new investment dedicated to the installation and operation of the cyclotron, imagery microPET equipment and associated laboratory for radiopharmaceuticals production based on positrons emitter was made in IFIN-HH.

The main equipment of this Radiopharmaceutical Research Centre is TR19 cyclotron which was produced by Advanced Cyclotron Systems Inc. (ACSI) a Canadian Company. The TR19 is a very flexible cyclotron because of the 14 to 19 MeV variable energy beam extraction, and up to 300 microamps of extracted beam current. This paper presents a general description of TR19, the main components of this machine and the planned research program.

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## **S8\_P05**

### **Planning for PAC'S in the UHC "Mother Teresa"**

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This paper introduces Picture Archiving Communication System, (PAC'S) and Radiology Information System (RIS) as a necessity and helpful tool to the radiologists and physicians of UHC "Mother Teresa".

In the last 10 years, Tirana, the capital of Albania, has encountered a significant increase in population due to internal migration (about 30% in the last 10 years) and, as such, also the number of patients that received medical treatment in UHC "Mother Teresa" has increased considerably. Also an increased number of patients from around the country visit UHC "Mother Teresa" with its qualitative expertise. Therefore, the workload of physicians and radiologists has increased, and so does the waiting time for patients to get served.

Today's UHC "Mother Teresa" is able to deliver qualitative medical examinations and diagnosis by deploying several kinds of technology solutions including computed radiography systems, DICOM-compliant magnetic resonance, and computed tomography. The problem that remains is that all these modalities (physicians and radiologists) do not communicate effectively with each other and in a timely manner.

Therefore we recommend UHC "Mother Teresa" to start planning for a digital infrastructure comprising of PACS and RIS's.

Some essential QSUT data such as current networking capability, modalities, number of patients, examinations, physicians and radiologists were considered by the specialists in the department of radiology at UMCG, The Netherlands. Guidelines and key components for integrating the PACS with the existing radiology systems in UHC "Mother Teresa" were defined.

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## S8\_P06

### Dose Optimization in Practice Computed Tomography Examinations

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The aim of this study was to find an optimization approach to minimise the dose to pediatric patients undergoing CT examinations, while maintaining the diagnostic image quality. On the CT scanner the pediatric patient dose is highly dependent on the scan parameters used: kV, mA, rotation time, focal spot size, scan field of view, slice width and pitch. On multi-slice scanners there is the additional variable of X-ray beam collimation, as the same imaged slice width can be achieved from data acquired at a number of collimations. All these parameters must be carefully selected so that the given diagnostic requirements are met at the optimum level of radiation dose. In addition to the scan parameters, the reconstruction parameters such as the reconstruction matrix, reconstruction field of view and reconstruction algorithm must be considered. Although these do not affect dose directly, they may have an indirect effect by altering the image characteristics. We considered different CT scans protocols dedicated for pediatric cases to exemplify this study in comparison with the standard images obtained with phantom.

Keywords: dose, computed tomography, optimization, pediatric patient

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## S8\_P07

### Blind estimation of SNR in medical images

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Many algorithms for estimation of the Signal to Noise Ratio (SNR) in images are been proposed. In this paper we present an algorithm for blind estimation of the Signal to Noise Ratio (SNR) in medical images. The described algorithm performs the estimation without prior knowledge of the noiseless signal. We define the optimized SNR for medical images and implement the above mentioned algorithm. This new methodology is based on the well known SNR definition for speech signal find in literature as global SNR (GSNR). Also it is able the creation of a image with predefined SNR. The described algorithm is implemented in MATLAB and its performance is compared with images were the SNR is already known. Moreover we analyze the performance of our algorithm with real data.

Keys: Signal to-noise ratio, SNR, biomedical signal analysis, real data analysis

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**S8\_P08****Fast Estimation of Average Glandular Dose by MPD Detector**

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The purpose of this work is to analyze quality assurance and quality control (QA/QC) of radiation protection in mammography in Montenegro and compare it with international standards. Because of complexity of such issues, the Montenegro technical service body faced a lot of problems: lack of a national legal system in this field, expertise, appropriate equipments etc.

Here is analyzed accuracies of calculation of average glandular (AGD) doses, from input data such as entrance surface air kerma (ESAK), measured by multi purposes detector (MPD) of Barracuda device. The distribution of AGD in different medical units in Montenegro is given.

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**S8\_P09****THE INFLUENCE OF THE LOW-FREQUENT ELECTROMAGNETIC RADIATION ON HUMAN HEALTH**

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The influence of the electromagnetic radiation of frequency 50 Hz on human health is considered. Stress is on the electromagnetic radiation from voltage transmission lines and other high voltage instalations in urban areas. It is shown that some of them emitted very strong electromagnetic field, so that people should stay far from them. The measured data are compared with the corresponding ones in literature, as well as with the critical values suggested by the Serbian Ministry of Environment, Mining and Spatial Planning.

**Keywords:** Electromagnetic Field, Electromagnetic Radiation, Influence on Human Health, Non Ionizing Radiation.

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**S8\_P10****Commercial juices authentication by mean of IRMS technique**

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Adulteration of a product consists in making it impure by fraudulent addition of a foreign or inferior substance. The result is either an alteration of the product and of its quality or a falsification. The falsification is a voluntary act with the intention of abuse. The falsification may be more or less sophisticated and its sophistication as well as its costs increases with the improvement of analytical methods.

In the last years, a growing number of research articles detailing the use of natural abundance isotope variations as a tool in the fight against fraud in the food industry have been published. One of the greatest limitations to the applications of the technique in origin assignation is the lack of large databases of isotopic abundance in food items. The interpretation of such analysis requires a sufficient number of data for authentic wines and juices of the same seasonal and regional origin, especially since the isotopic parameters of these show remarkable variability depending on climatologically factors.

In this study, the applications of the H, C, O stable isotope ratios in the assessment of watering in beverages and C4 sugar addition, commercialized on Romanian market are presented and discussed.

*Key words: authentication, fruit juice, food control, IRMS*

**Acknowledgements**The financial support for this work was provided by the National Plan for Research-Development and Innovation 2007-2013 (NPRDI II), TE, Contract No. 120/2010

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## **S8\_P11**

### **APPLICATION OF BIOMECHANICAL RESEARCH IN SPORTS EDUCATION**

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Sport in general and biomechanics in particular are main scientific disciplines in sports education. The purpose of this study is to explore and to develop the methodology of data collection and biomechanical analyses taken in lab or field situation.

The studies have shown that the data collected in labs are nearly opposite of the situation on fields. Applied biomechanics in sport research explain clearly accuracy, validity and error assessment.

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## **S8\_P12**

### **Electrophysiology study of amyloid beta channel formation and activity in reconstructed planar lipid membranes**

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Amyloid beta (A $\beta$ ) is a [peptide](#) of 36–43 [amino acids](#) that is processed from the [Amyloid precursor protein](#) and is the main component of [amyloid](#) plaques, deposits found in the [brains](#) of patients with Alzheimer's disease. Recent research suggests that soluble oligomeric forms of the peptide may be causative agents in the development of Alzheimer's disease [1]. Several lines of research have concluded that lipid membranes efficiently induce the formation of amyloid oligomers and aggregates, by concentrating monomer peptides onto their surfaces and forcing them to maximize intramolecular hydrogen bonding by folding into amphipathic structures, which further aggregate. The pathways and states of the polypeptide conformational transitions further depend on the lipid composition, which thus couples the inherent properties of lipid membranes to the inherent properties of proteins. Direct insertion into membranes of A $\beta$  leads to formation of oligomer channels, and disrupt the calcium homeostasis *via* unregulated cytotoxic channels [2]. In this work we have employed electrophysiology techniques in order to study the association of A $\beta$ 1-42 (DAEFRHDSGYEVHHQKLVFFAEDVGSNKGAIIGLMVGGVVIA) peptides with planar reconstructed lipid membranes of various compositions. We are aiming to decipher how amyloid activity is catalyzed or inhibited by membrane electrostatics, elastic features and structural biochemical asymmetry. The lipid systems used herein were zwitterionic phosphatidylcholine membranes and negatively charged membranes composed of a mixture of POPC:DOPG (w/w 85:15) respectively. We showed that A $\beta$  is able to insert and aggregate into the hydrophobic core of lipid bilayers of both compositions leading to transmembrane pore formation. Data analysis of the electrophysiology recordings showed distinct types of current fluctuations revealing that the membrane activity of A $\beta$  peptides is due to an overlap of mechanisms consistent with distinct types of pores. We were able to observe irregular ion current fluctuations with random amplitudes which could be determined by transient membrane defects induced by peptides adsorbed at the bilayer interface, as well as discrete current fluctuations with constant amplitudes consistent with stable 'channel like' peptide oligomers with specific conductances. Peptides were shown to be more active in negatively charged lipids. As A $\beta$ 1-42 carries a small negative charge at neutral pH, this phenomenon cannot be easily explained by electrostatic considerations. Electrostatic repulsions manifested between the charged polar heads of POPG may induce a positive curvature of the membrane monolayer were peptide oligomers adsorb altering lipid packing and the mechanical properties of the bilayer and consequently promoting oligomer insertion.

Keywords: Alzheimer's disease, amyloid beta peptides, electrophysiology, amyloid channels

**Acknowledgments:** The financial support from the Grant POSDRU/89/1.5/S/63663 is highly acknowledged.

#### References:

- [1] G.M. Shankar et al., 2008, Nat. Med. 14 (8), 837–842.
- [2] O. Simakova and N.J. Arispe, 2006, Biochemistry 45, 5907–5915.

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### S8\_P13

#### Single-channel investigation of the electrical and structural features that guide peptide translocation through biological nanopores

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Recent explorations have shown that mechanistic understanding of polypeptide translocation at single-molecule resolution can be achieved using high-resolution, time-resolved single-channel electrical recordings with nanopores and protein design. Combining recordings of single-channel electrical currents through nanopores with protein engineering emerged as a novel single-molecule technique for the detection, examination, and characterization of polypeptides, and a promising perspective for high-throughput screening devices in drug design and proteomics [1]. The staphylococcal alpha-hemolysin (aHL) is a heptameric transmembrane protein very suitable as a model for examining protein translocation through a  $\beta$ -barrel type pore. In the transmembrane domain, the aHL channel narrows to form a  $\beta$ -barrel region with an average diameter of  $\sim 20 \text{ \AA}$  and a length of  $\sim 52 \text{ \AA}$  and its large single-channel conductance facilitates high-resolution electrical recordings [2]. In this study we have employed such single-molecule electrophysiology techniques in order to monitor the interaction between two specially designed peptides (i.e. two mutants derived from the fusion of cecropin A and magainin, CA-MA, KWKLFKKIGIGKFLHSAKKF and its analogue P5, KWKKLLKKPLLKKLLKKL) and the interior of the aHL protein pore in order to understand the particularities which drive on peptide translocation. Ionic current blockages induced by peptide straining through the pore lumen allowed us to analyze the kinetics of interaction which, as expected, was proven to be concentration and voltage dependent. For CA-MA, which carries at neutral pH a positive charge of +7, the voltage dependence of the dissociation constant was found to be nonmonotonic as peptides that reach the constriction zone of the protein can either be electrophoretically driven on the other side of the membrane or, when thermal energy cannot be overcome, they can return to the initial compartment moving against the electrical gradient. The threshold voltage that enables translocation was found to be about 50mV for CA-MA. The data revealed no such threshold for P5, which carries at neutral pH a positive charge of +9, pointing to the conclusion that charged aminoacids are an important feature in peptide translocation. Nevertheless, the dissociation rate constants were found to be higher for P5 than for CA-MA. This phenomenon could be determined by the presence of multiple terminal aromatic aminoacids in the primary structure of CA-MA. These aminoacid residues are able to establish additional reversible interactions, which we were able to monitor in real time and that were kinetically described herein, with either one of the six methionine residues present in the constriction zone of the pore, therefore, prolonging the residence time of the peptides inside the lumen.

**Keywords:** alpha-hemolysin, peptide translocation, electrophysiology, aromatic interactions

**Acknowledgments:** The financial support from the Grants: POSDRU/89/1.5/S/49944 and POSDRU/89/1.5/S/63663 are highly acknowledged.

**References:**

- [1] L. Movileanu, 2008, *Soft Matter* 4, 925-931.
  - [2] L. Movileanu, J.P. Schmittschmitt, J.M. Scholtz and H. Bayley, 2005, *Biophys. J.* 89, 1030-1045.
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**S8\_P14****Structural investigation of potassium-phosphate glasses containing vanadium ions with bioactive potential**

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The research in the field of reconstructive medicine is in a continuous search of synthetic biomaterials, but also of new solutions for prosthetic or regeneration of living tissues. Bioactive materials adaptable for bone implants must have a series of qualities: physical and mechanical properties (hardness, strength, durability); chemical properties (chemical stability, chemical composition similar to bone, corrosion resistance); biological properties (compatibility with surrounding tissue, non-toxic, without filtered products, they should not cause allergic effects, carcinogenic, teratogenic phenomena, they should not cause rejection by the body, change of blood chemistry, should be hemocompatible or do not change the biological pH. Synthesis and marketing of improved biomaterials is always required as this automatically leads to an improved in the life quality. from a medical point of view it is known that potassium minimizes the loss of calcium from the body and thus reduces the risk of osteoporosis, providing a healthy skeletal system, but increases also the mechanical resistance of the material. Vanadium is an active agent in helping to the body metabolism, focusing on the growth of bones and teeth strengthening, although the mechanism is not yet fully understood [1].

The present work is a structural study of some potassium-phosphate glasses containing vanadium. The following glass systems was prepared and investigated by EPR and IR spectroscopy:  $xV_2O_5(1-x)[0.8P_2O_5-0.2K_2O]$ . According to the calculated EPR parameters ( $g_1 \sim 1.92$ ,  $g_2 \sim 2.00$  and  $A = 19370^{-4} \text{ cm}^{-1}$ ) vanadium ions are present in this glasses in a square pyramidal ( $C_{4v}$ ) site as  $VO^{2+}$  ions for  $x < 10 \text{ mol } \%$ . The shape of the EPR spectra is changed with the increasing of the vanadium content, this consisting in a progressive disappearance of the hyperfine structure characteristic to the  $V^{4+}$  ions and in the appearance of a broad line without hyperfine structure characteristic for clustered ions for  $x > 10 \text{ mol} \%$  [2].

IR spectra of the studied glass system show for low concentration of ions the specific bands belonging to the phosphate groups, but at high concentration of  $V^{4+}$  ( $x = 10 \text{ mol} \%$ ) the bands belonging to the vibration of  $V_2O_5$  groups dominates the spectra. In the same time the bands belonging to the phosphate groups are strongly reduced except the specific bands of the short chain phosphate units. This suggest that in the studied glasses vanadium act as network modifier for low concentration ( $x < 10 \text{ mol} \%$ ) but may act also as a network former at high concentration of  $V_2O_5$  [3].

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## S8\_P15

### Alternative dosimetry determination for medical linear accelerator monitoring

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Usually the dosimetry control at radiotherapy centre is done through a water phantom – ionizing chamber –electrometer system. Ionizing chamber and electrometer are calibrated in base of international standard, and for determination of dose in water for photon and electron beams are apply different protocols such as that applied in our centre IAEA TRS 398.

There are also and a day alternative control, simples, which is done through an electronically devise, Quality Beam Checker. Through this device every day is done the alternatively dosimetry checking of medical linear accelerators. This alternatively checking consisted to Beam output constancy, beam flatness axialsymmetry and transverse symmetry.

The measurements tolerance for this system is Beam output constancy 2%, beam flatness 3%, axial symmetry 3% dhe transverse symmetry 3%.

Key words: dosimetry, beam flatnes, trs 398, Beam output constancy

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## S8\_P16

### STUDY OF NANOPARTICLES WITH POSSIBLE APPLICATION IN DRUG DELIVERY SYSTEMS

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The development of nanoparticles has a great potential to improve the future of cancer therapies and reducing the harmful side effects of chemotherapeutic drugs. In recent years, scientists focused on researching new ways to develop multi-functional nanoparticles, combining drug delivery systems, tumor therapies and nuclear magnetic imaging, in order to provide a more successful approach against cancer.

In targeted drug delivery the transport of the particles, after injection, to the region of interest for treatment can be done by blood circulation. It is important that the nanoparticles reach this region in a larger proportion without the existence of dispersion.

This study was focused on the synthesis, characterization and functionalization of magnetic nanoparticles that can be used for drug delivery systems. Iron oxide nanoparticles (Fe<sub>3</sub>O<sub>4</sub>) were

synthesized by the co-precipitation method and characterized by X-ray diffraction, transmission electron microscopy, dynamic light scattering and zeta potential. The nanoparticles were coated with oppositely charged polyelectrolytes using the layer-by-layer technique. The functionalized nanoparticles are intended to be used in drug delivery systems after incorporation of the chemotherapeutic drug.

#### Acknowledgments

This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/107/1.5/S/78342].

#### S8\_P17

### SYNTHESIS AND CHARACTERIZATIONS OF MANGANESE FERRITE FOR APPLICATION IN HYPERTHERMIA

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In the last years, nanoparticles magnetic offer great potential in biomedical application like agents contrast for MRI, magnetic separation, drug delivery and hyperthermia. The heating effect of the nanoparticles used in hyperthermia induced by AC magnetic field depends on the size of the nanoparticles as well as the frequency and amplitude of the applied alternating magnetic field

In this study a series of ferrite nanoparticles with chemical formula  $Mn_xFe_{1-x}Fe_2O_4$  was produced by co-precipitation method that allows a good control of shape and size of the nanoparticles. The microstructure of the as synthesised particles was characterized by an X Rays diffractometer using CuK $\alpha$  radiation and transmission electron microscopy. The crystallite size was calculated using Scherrer's formula and constant lattices was determined from XRD pattern. The nanoparticles have spherical shape and their size was in the same range as crystallite size suggesting that nanoparticles are mono domain. The magnetic parameters of the ferrofluids were measured by a vibrating sample magnetometer. The shape of the hysteresis loop suggested a superparamagnetic behaviour supported also by microstructure characterization results. For specific absorption rate (SAR) measurement was used a RF generator with 1.95MHz frequency and 3.2 kW maximum power. The temperature dependence versus time has been registered and was used also for Curie temperature measurement. It has been observed that the value of SAR depends on chemical formula of the nanoparticles and nanoparticles concentration.

ACKNOWLEDGMENTS This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/107/1.5/S/78342].

## S8\_P18

### THE BIOACCUMULATION OF HEAVY METALS IN *BRASSICA OLERACEA* (CABBAGE)

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The aim of this work was to determine the heavy metal content of the cabbage parts (roots, strain, spine, leaves) and to calculate the bioaccumulation factor and the translocation factor for all sample. The concentrations of Cu, Fe, Mn, Ni, Zn, Cd, and Pb in the samples were determined by Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometry and the concentrations of Cu, Cd, Cr and Pb were determined by Atomic Absorption (AA) spectrometry. Was observed a high accumulation of Fe and Mn in roots, and a high translocation of Cu, Ni and Zn from roots in external and internal leafs. Also, was observed the migration of Cu and Ni from external leafs and from roots to internal (the youngest) leafs.

**Keywords:** heavy metals, bioaccumulation factor, translocation factor, cabbage.

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## S8\_P19

### ANALYSIS OF ESSENTIAL METALS IN PLANT OF MAIZE AND DETERMINATION OF THE BIOCONCENTRATION FACTOR

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Only a few of the metals present in the environment are essential to all plants. The essential metals are well known for their biochemical role in biological systems and in the human body. Essential metals are required for healthy plant growth but can be toxic when present in excess. The accumulation of metals in agricultural soils is potentially hazardous to human, livestock and plant health.

Purpose of this study is determination of essential metals cobalt, copper, manganese and zinc in maize plant and in their soil, as well as calculation of bio-concentration factor soil to plant.

We have collected in total 22 samples, where 16 were maize samples and 6 were soil samples, in the rural sites in Shkoder, Albania.

Maize plant samples and their soil samples were analyzed for content of essential metals Co, Cu, Mn and Zn by using Atomic Absorption Spectrometry (AAS) in the Centre of Applied Nuclear Physics, Faculty of Natural Sciences, University of Tirana, Albania. The study of essential elements in maize plant, indicate their values are in ranges: Co (1-4) mg/kg, Cu (1.4-7) mg/kg, Mn (45-62) mg/kg and Zn (12-70) mg/kg. Also, from analyses soil samples showed that concentration of essential elements is in ranges: Co (12.85-17.18) mg/kg, Cu (14.45-21.13) mg/kg, Mn is (586.5-715) mg/kg and Zn (5.4-10.2) mg/kg. We have calculated bio-concentration factor (BCF) soil to plant.

### **S8\_P20**

#### **Study of gradient radiation dependence of Linac from type of radiation during application in therapy**

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Different types of tumors occur at different depths related to patient's skin surface. Based on that it is needed a variety of dose gradient to achieve the desired dose in the depth of the body at which the tumor occur. The aim of this work was to study the dependence of the gradient by the type of radiation during treatment the tumors in different depths. For these purpose has been used source of photons with energy 10 MV and electrons with energy 7 MeV, 10 MeV and 12 MeV produced by LINAC. Results show that by using 7 MeV energy of electron, the maximum depth dose is achieved in 1.3 to 1.5 cm while by using 10 MeV and 12 MeV this maximum extend from 2 to 2.5 cm. In case of photons with the energy 10 MV, the maximum depth dose is reached in 2.5 cm. Therefore, in case of photons the dose doesn't go rapidly as in case of electrons, but the value is 50 % at 20 cm depth.

### **S8\_P21**

#### **X-ray Tomography used in the study of Neolithic ceramics objects**

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The technique of Computed Tomography (CT) is a powerful diagnostic tool used to visualize the inner features within solid objects, helping the analyst to obtain information on their 3-D geometries and properties.

The communication will present an X-ray CT device developed at “Horia Hulubei” National Institute for Nuclear Physics and Engineering, which was mainly designed for the structural study of small archaeological objects made out of low-Z materials (Constantin et al., 2010).

The device consists of a compact X-ray source, a home-made positioning system and a Varian PaxScan<sup>2</sup> flat panel detector. Using this CT device and the corresponding reconstruction algorithms, small archaeological objects (20?20?20 cm<sup>3</sup>) can be imaged with a spatial resolution around 300 ?m. Were examined several ceramics archeological objects dating from the Neolithic and the results will be presented in this communication. The internal structure of the investigated objects was put in evidence, revealing - in some cases - their inner content. Thus, for the so-called “rattles”, enclosed mobile or fixed balls/bodies were observed, while in the case of some ceramics objects, cracks or fissures in their structure were observed. For some composite artifacts the analysis of the obtained tomographic images provided some hints on the way the ceramics objects were manufactured.

CONSTANTIN F., PAVEL C., BUGOI R., TODERAS M., 2010. An X-ray tomograph based on a flat panel detector. *Nuclear Instruments and Methods in Physics Research A* **621** 685-689.

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## S8\_P22

### THE USE OF ISOTOPE RATIOS IN THE AUTHENTICATION OF COMMERCIAL FRUIT JUICES

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In the last years, a growing number of research articles detailing the use of natural abundance isotope variations as a tool in the fight against fraud in the food industry have been published. One of the greatest limitations to the applications of the technique in origin assignation is the lack of large databases of isotopic abundance in fruit juices. The interpretation of such analysis requires a sufficient number of data for authentic juices of the same seasonal and regional origin, especially since the isotopic parameters of these show remarkable variability depending on climatologically factors.

Each plant has its own unique pattern of naturally occurring stable isotopes of carbon (<sup>12</sup>C, <sup>13</sup>C), hydrogen (<sup>1</sup>H, <sup>2</sup>H) and oxygen (<sup>16</sup>O, <sup>18</sup>O), whose distribution has been influenced by a number of physical and/or biochemical properties and geoclimatic conditions. The isotope content of natural products depends on their botanic and geographical origin.

The use of stable carbon isotope analysis to determine food fruit juices, authenticity is well documented in literature. Determination of d<sup>18</sup>O and dD values of water from fruit juices is today applied in routine analysis as an automated and acknowledged method in order to differentiate between directly pressed and re-diluted single strength juices. Authentic juices have elevated d<sup>18</sup>O

and dD content of water as compared to water from re-diluted products made using tap water which is relatively depleted in heavy oxygen and hydrogen isotopes.

In the present study commercial fruit juices present on Romanian market were investigated from the point of view these authenticity and the obtained results were compared with those corresponding to authentic juices.

*Key words: Stable isotopes, adulteration, fruit juice*

References:

1. Andreas Rossmann, Determination of stable isotope ratios in food analysis, Food reviews international, 17(3), 347-381 (2001)
2. Koziat, J., Rossmann, A., Martin, G.J., Johnson, P., Determination of oxygen-18 and deuterium content of fruit and vegetable juice water, Anal.Chim Acta (1995), 302, 29-37

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### **S8\_P23**

#### **The determination of heavy metals migration from soil to plants and detoxification processes of these metals at high concentrations in *Zea Mays***

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The heavy metals are present anywhere in environment, but their effects on the plants are related by their concentrations in soil. At small concentrations is observed a deficiency (mainly for copper, zinc), while at high concentrations are produced biochemical disturbances due to contamination.

In this paper were studied biochemical processes induced by high concentrations of heavy metals in *Zea Mays*. It's one of the most important cereal plants on the planet. The heavy metals participate in many biochemical processes and can replace other chemical elements in the biogeochemical cycle. Each metal has a different behavior through interaction with the plant, leading to the conclusion that the defense mechanisms are different. Increasing the concentration of a metal in soil, produced effects were observed using chlorophyll fluorescence, EDXRF and FAAS techniques.

This study attempts to determine the concentration's limits that reduce productivity of plants, biochemical reactions related to these metals and detoxification processes for each metal (Cu, Zn, Ni, Pb) in *Zea Mays*.

*Keywords: Zea Mays, heavy metals, detoxification processes, chlorophyll fluorescence, EDXRF, FAAS*

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**S8\_P24****Enhancing performance of image segmentation through feature extraction**

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We propose a novel computerized method for semi-automatic detection of contours in ultrasound breast. The novelty of our study consists of introducing a modified version of the image energy in the active contours models (ACMs), which considers the first-order textural features (mean, standard deviation, skewness, kurtosis and entropy). This new approach allows incorporation of the local smoothing of the image intensities in edge detection algorithm and it promotes robust segmentation based on statistical concepts of smoothing procedures and chooses the most valuable first order texture feature (FOTF) allowing the accurate segmentation. Even if our method is semi-automatic, in term of segmentation accuracy it is able to overcome the limitations of snake techniques (such as initialization, multiple minima, and the optimal selection of elasticity parameters). We compare the performance of the proposed method with that of fully automatic method based on texture and location characteristics. The performance of the both methods has been estimated using the area error rate (AER).

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**S8\_P25****The determination of CTV-PTV margin for Whole Brain region using EPID**

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The evaluation of the setup uncertainties and the determination of CTV-PTV margins in different sites of the body is an important goal in the radiotherapy departments. In this papper we are focused in the study of the whole brain region CTV PTV margins. To evaluate this differencies we used the electronic portal imaging device (EPID). We studied 20 patients with brain tumors. In the treatment planning system, XiO were created plans with two lateral opposite beams. The digitaly reconstructed radiograf (DRR) of one of Lateral fields was sended to the iWiew system. Before treatment portals taken with electronic portal imaging device (EPID) was also sended in the iWiew system. Afer we compared the differencies. For our 20 patients the results for CTV-PTV margins are: Right-Left 6.8 cm, Superior-Inferior 7.5 cm and Anterior-Posterior 6 cm. This margins give the possibility to cover the target with 95 % of described dose and having under dose limits the organ at risk.

Keywords: Geometry Uncertainties, margin, portal image, DRR

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**S8\_P26****OPTIMIZATION OF IONIZING RADIATION IN MEDICINE**

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Ionizing radiation has nowadays become a powerful tool in diagnostic, radiotherapy and nuclear medicine, so at the same time, it is significantly increasing the population's medical exposures. As a result, a large number of people always need training for the above purposes. Under these conditions, the immediate task to arise is the optimization of these exposures, in order to avoid the possible detrimental effects of different radiation, especially for those procedures that are related to high doses, which are part of procedures in intervention radiology.

Medical radiations have to fulfill the three principles of radiation protection requirements: justification, optimization and dose limits. Many institutions and companies aim to reduce the doses received by patients by giving them smaller/lower doses than the rates allow. On the other hand, this allows a significant reduction of doses received even by people exposed professionally.

In diagnostic radiology, there is a need for a periodical check of the physical and geometrical characteristics of X-ray beam and the uses of screens which are used to divide areas which are not related to the examination. Generally, in all the cabinets related with the usage of ionizing radiation or radioactivity materials for medical purposes, a periodical quality control check of the equipment is needed. We have to always follow the recommendations of Basic Safety Standards related with classifications of areas, dose limits, etc. Finally, TLD dosimeters for personal doses monitoring are used by all the medical staff who are working in different cabinets of "Mother Teresa" Hospital.

**S8\_P27****Assessment of Effective Dose during Panoramic Radiography for Staff and Patients using TLD-100 cards in Albania**

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Practically, the techniques for dental procedures by radiographic film are same basically. The examinations of dental radiography performed by panoramic apparatus are a unique film technique that allows the dentist to view the entire dentition and related structures, from condyle to condyle, at one film.



Dental radiography is one of the largest single group examination performed, although the effective dose per radiograph is small. The individual risks from dental radiography are low, but it has identified a significant potential for reduction in the collective dose and for upgrade the diagnostic quality of dental radiography.

Since 1985, the monitoring of occupational exposures was performed regularly for about 500 workers on a bimonthly basis, using two dosimeters TLD-100 card for each monitored worker. The evaluation of TLD cards is performed through the TLD-REMS programme and processing of results is carried out with RAIS programme. A national Dose Register is created for this purpose, which contains radiation doses for all workers, because the CANP is responsible institution for the monitoring, evaluation of the occupational exposure in country's scale.

The economic impact of our recommendations suggestion to cover all aspects of dental radiography: training and examination regimes for dentist staff, patients' selection and clinical justification for radiography, diagnostic interpretation, equipment and procedural aspects, and finally the question of quality assurance in dental radiography

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## **S8\_P28**

### **The behavior of some *Lactobacillus salivarius* strains at different pH values**

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The role of *Lactobacillus acidophilus* in dental caries, either as an etiological agent or an index organism of expected caries experience, has been emphasized repeatedly.

Were investigated nine strains of *Lactobacillus*, as follows: A. *Lactobacillus salivarius* strains with origin other than dental canal: *Lactobacillus salivarius*: strains A, B, C, D, E. Source of isolation of strains of *Lactobacillus salivarius* different channel dental origin. In this paper we presents the numerical simulation results.

Keyword: numerical simulation, non-linear system

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## **S8\_P29**

### **Actinide activity determination in environmental samples**

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Environmental radioactivity monitoring around a nuclear installation requires a set of reliable methods for determination of radionuclides present, even in small amounts, in various types of

samples. Among the radionuclides of interest, the actinides are the most hazardous and also some of the most difficult to be measured, due to their alpha-only particle emission. In the recent years new materials and methods were developed for separation of actinides from different matrices. This paper presents a sequential separation procedure implemented in the routine activity of the Radiation Protection Laboratory from the Institute for Nuclear Research, Pitesti. The measurement of the actinide solutions was made by alpha particle spectrometry. The results are shown, from the testing and validation phase, for the actinide separation procedure. A combination of alpha-LSC and alpha particle spectrometry was used during the testing procedure.

Keywords: actinide, sequential separation, alpha spectrometry

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### **S8\_P30**

#### **Satellite remote sensing monitoring of nuclear power plants environment**

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Satellite remote sensing is an important tool for spatio-temporal analysis and surveillance of nuclear power plants' (NPP) environment. Thermal heat waste of environment is a major concern in many coastal ecosystems involving nuclear power plants, as sharp changes in air, vegetation and water temperature can significantly affect the vegetation and distribution and physiology of aquatic biota and contribute to global warming. The thermal plume signature in the NPP hydrological system in TIR (Thermal Infrared) spectral bands of Landsat TM and ETM and MODIS TIR bands time series satellite have been used for WST (Water Surface Temperature) detection, mapping and monitoring. Also have been evaluated vegetation NDVI, EVI, FPAR parameters for NPP Cernavoda area during period of 1990-2011 years. Thermal discharge from two nuclear reactors cooling is dissipated as waste heat in Danube-Black -Sea Channel and Danube River. If during the winter thermal plume is localized to an area of a few km of NPP, the temperature difference between the plume and non-plume areas being about 1.5 °C, during summer and fall, is a larger thermal plume up to 5-6 km far along Danube Black Sea Channel, the temperature change being of about 1.0 °C.

**Keywords:** Nuclear power plant environment, thermal plume, satellite data: Landsat TM, ETM; MODIS, Cernavoda Romania.

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### **S8\_P31**

#### **USING AFM IN HUMAN SERUM ALBUMIN DIMENSION ANALYZES**

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The Atomic Force Microscopy (AFM) is a technique that has extensively been used to reveal details on surfaces using different scanning techniques. The human blood components, as opposed to hard condensed matter samples, are soft and do not adhere well to surfaces, therefore imaging soft condensed matter samples requires certain precautions and special care. This article presents details and results on using AFM for imaging and dimension characterization of the human serum albumin (HS A).

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**S8\_P32****Method validation of multielement determination in drinking water by ICP-MS**

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Trace metals contamination in water is a major component in the determination of water quality. The environmental pollution caused by heavy metals is a long-term and irreversible process. Such metals are not required for routine functioning of the human body and can be toxic even at low concentration. Drinking water from a tap, such as a private well or public water system, is a source of potential exposure to environmental contaminants.

A new method was developed for the determination of 11 elements in water samples by ICP-MS. Method validation consisted of testing the parameters of linearity, precision, accuracy, limit of detection, limit of quantification and uncertainty of measurement. The sensitivity of the method was excellent and the determination was very fast for elements including Cr, Zn, Mn, Al, Ni, Cu, As, Se, Cd, Pb and Hg. A precise and accurate background data of various trace elements content of drinking waters was obtained. The results showed that the waters were not dangerous for human health, so the metals considered as toxics (Cd, Pb) did not present problems of contamination. Nutrient trace elements include Mn, Cu, Zn, Se, Cr, some of which become toxic at high concentrations.

Keywords: water quality, heavy metals, contamination, quantitative analysis

References:

- [1]Dag B., Kilicel F.: J. of Animal and Veterinary Advances, *10* (5), 656 (2011).
  - [2]Nalatambi S.: Sunway Acad. J., *6*, 33 (2010)
  - [3] Zhu Y, Hattori R., Fujimori E., Umemura T., Haraguchi H.: Analytical Sciences, *21*, 199 (2005).
  - [4] Al-Rmalli S. W, Jenkins R. O., Watts M. J, Haris P. I.: Environ Health., *9*, 79 (2010)
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**S8\_P33****Effect of radiation UV on textile dyeing**

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As early as 1869, textile dyes and subsequently finishes have been reported to cause various manifestations of contact dermatitis, from mild to severe and debilitating. Reactive dyes are chemical compounds widely used in dyeing textile materials of cellulose fibers (100% cotton and cotton blend), regenerated cellulose (viscose, cellulose acetate), skin fibers (flax, hemp), protein fibers (wool, natural silk). With these compounds, the human body makes contact every day, so it is very important to know their biological action on the human body, in correlation with their physico-chemical properties. Dyes are chemical substances containing chromophore groups and auxochrome. Dyes fixed to a material they absorb a certain wavelength of the spectrum. In this paper the influence polychromic light with  $\lambda > 300$  nm on the properties of colored textile, was investigated. The influence of UV radiation on structural and color changes of colored textiles was also studied. The discoloration is important register of all reactive dyes used. Change is due to structural changes in the dyes, especially in the structure of carbonyl and aromatic structures. In most cases were identified photo-oxidative processes in the structure of dyes. It remains to be determined by toxicology studies if the structures have not changed this way irritating action on living organisms.

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**S8\_P34****PNEUMATIC MUSCLES USED FOR THE MEDICAL DEVICES**

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In this paper, we present a dynamic seat cushion device, actuated by pneumatic muscles, used to prevent the bedsores. We designed the device, chose the materials, have made the seat cushion device. The system is equipped with special sensors and is completely automated. The functional advantages of pneumatic muscles are: low weight and high power capacity to support the corporal weight when the pneumatic muscles are contracted, quick replacement, reliability, reduced cost of acquisition, durability in time.

**Keywords:** Pneumatic muscle, medical device, bedsore, automation

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## S8\_P35

### THE INFLUENCE OF TEMPERATURE, TIME AND ROTATIVE SPEED ON THE FLUIDS HOMOGENIZATION

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In this experimental paper, the fluids homogenization is performed through the mixing process using the reactor station, which is static process equipment and by controlling and monitoring the temperature, time and rotative speed. In order to determine the dynamic viscoelasticity of the mixture, the samples were analyzed by analytical method Quartz Crystal Microbalance (QCM).

**Keywords** Reactor station, QCM, homogenization.

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## S8\_P36

### THERMAL PROPERTIES INVESTIGATION UPON MODIFIED WOOD AFTER TREATMENT WITH EPOXIDIZED VEGETABLE OIL

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Wood originating from a softwood species was modified by reaction with succinic anhydride in dimethylformamide (DMF) at different concentration values. Modified wood samples were further treated with epoxidized soybean oil (ESO), an epoxidized glycerol fatty ester in the presence of triethylamine (TEA), as catalyst. Investigation of thermal properties for non-modified and modified wood samples after treatment with ESO was performed by means of simultaneous thermal analysis method using a Netzsch STA 449 F1 Jupiter system under nitrogen atmosphere.

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## S8\_P37

### Long-term exposure to outdoor urban air pollution with particulate matter for prevalence of asthma symptoms

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While air pollution is a complex mixture of compounds in gaseous (ozone, CO and nitrogen oxides) and particle phases, the strongest evidence of linking air pollution with human health, especially on respiratory effects, centers around the particulate matter (PM) which is comprised of heterogeneous compounds varying in size, number, chemical composition, surface area, phase, concentration and source. Many epidemiological studies examining the relationships between adverse health outcomes and exposure to air pollutants in urban agglomerations use ambient air pollution measurements like as PM10 and PM2.5 levels as a proxy for personal exposure levels.

The measurement of environmental concentrations of particulate matter air pollutants (especially PM10 and PM2.5) in Bucharest tested area in relation with some meteorological parameters in urban area was correlated with the spatio-temporal assessment exposure of people affected by respiratory diseases like as asthma, which incorporates different layers of complexity.

In order to evaluate the impact on health of atmospheric pollutants emitted by the industrial sources and road traffic which are the main contributors to “outdoor” air pollution in Bucharest metropolitan area, this paper provides a useful information on particulate matter seasonal for 2010-2011 period in relation with asthma health state of people living in Bucharest town and peri-urban areas.

The epidemiological study evidenced a better health state regarding asthma symptoms of populations living in periurban areas very far of central urban area, and a worst health state exhibited by people living mostly in central part of Bucharest and close of some industrial sources.

**Keywords** Air pollution, PM10 and PM2.5 air particulates, epidemiology, asthma, Bucharest.

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### S8\_P38

#### **Analysis of climatic effects due to urbanization on vegetation by satellite remote sensing and in-situ monitoring data**

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Due to significant anthropogenic changes that have occurred in the last several decades in Bucharest city's landscape, urbanization has become an important factor affecting urban surface parameters, hence in the surface-atmosphere interaction processes, with a great potential to alter the local climate. Land use and land cover (LULC) influence a variety of processes important in characterizing urban /periurban biophysical parameters' quality, including aerosol deposition rates, biogenic emissions, albedo, surface temperatures, climatic parameters and other.

Analysis of surface biophysical parameters changes in urban/periurban areas of Bucharest town based on multi-spectral and multi-temporal satellite imagery (MODIS, Landsat TM, ETM and IKONOS) provides the most reliable technique of environmental monitoring regarding the net radiation and heat fluxes associated with urbanization at the regional scale. Investigation of

radiation properties, energy balance and heat fluxes is based on information derived from various satellite sensors and in-situ monitoring data, linked to numerical models and quantitative biophysical information extracted from spatially distributed NDVI-data and net radiation. For detailed land cover classifications in a digital form is possible to analyze in a statistical way these properties. Have been derived surface biophysical parameters such as fractional vegetation cover (Fr), surface radiant temperature (Ts) and albedo for 1990 – 2011 period for Bucharest metropolitan zone and its periurban areas. These changes have been then, examined in association with climatic effects of land cover changes to illustrate how these parameters respond to rapid urban expansion in Bucharest and surrounding region. This study attempts to provide environmental awareness to urban planners suggesting that future changes in urban land cover could substantially affect climate and human health by altering biophysical land-atmosphere interactions. The local and regional climate response is of a similar magnitude to that projected for future greenhouse gas concentrations, climatic effects of land cover change should be carefully considered by urban decision makers for managing anthropogenic forcing of the climate system and human health protective measures through increasing urban green.

**Keywords:** Climate effects, urbanization, remote sensing satellite data, surface biophysical parameters, human health, Bucharest.

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## **S8\_P39**

### **Study of correlations between environmental parameters in water lagoon systems. Case Study – Sinoe, Leahova (Romania) and Candelaro (Italy)**

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A key step of European Water Framework Directive (WFD) implementation is the ecological status classification and the achievement of good water statuses for all waters, by 2015. In transitional waters, the changing environmental niche induces responses in the macroinvertebrate guilds and macroinvertebrate responses induce uncertainty in the metrics. In this case, the sources of uncertainty in the ecological classification with benthic macroinvertebrates, is addressed by focusing on two major potential sources: spatial heterogeneity and temporal heterogeneity. A coherent study of the series of correlation between the physics and chemistry parameters is needed in order to succeed in reaching a complete picture. In this paper we present our regression analysis model dependence of chemistry and physics of the biotic environment variables. The consistent experimental data set and the regression computation approach lead to a series of interesting outcomes.

**Keyword:** environmental parameters, statistic analysis, regression analysis

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**S8\_P40****Using UAVs in cadastral application research program. Case-study - Garboavele Forest protected area (Romania)**

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In the last years, the use of UAVs in various fields is, almost, a feature of modern scientific life. In the cadastral applications or in the monitoring programs of environmental parameters, the use of these aircraft are welcome. In this paper we present our results obtained in the our cadastral research program. The prototypes used with success demonstrated the possibility of using in the cadastral and environment protection domain. The case study is of Garboavele Forest protected area from Romania.

Keyword: UAV use, environment protection, cadastral application

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**S8\_P41****Preliminary results on the selective collecting waste management activity optimisation problem. The Galati city case study**

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The Waste Management activity (WM) is an urban action becoming more important in the municipal economy. In many cities, this activity is linked with significant revenues from the selective waste collection services. Because the current economic situation requires an increasing efficiency and profitability in order to succeed in cutting the operational costs, and as an important part of revenue comes from this selective waste collection activity, it should necessarily improve the effectiveness.

In the specific case of Galati city which is presented in this article, WM activity has been redesigned. The main aspect is given by the successful implementation of the selective collecting waste management system in order to succeed in reaching the current economic commands.

The accomplishment for this system was done in two stages: first phase was done in a pilot project which implemented the system in a small area of the city; in the second stage, basing on the



previous results, the selective collecting waste management system was expanded to the entire city. The present study shows briefly the system implementation status and preliminary on the optimization problem.

Keyword: Waste Management activity, environment protection, selective collecting waste management

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## **S8\_P42**

### **Complex environmental studies at BEO Moussala**

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Monitoring and studies of global climate change, natural hazards and technological risks are the main areas of research performed in regional Global Atmospheric Watch (GAW) station BEO Moussala (2925 m a.s.l., 42°17' N, 23°58" E). Real time measurements and observations are performed in the field of atmospheric chemistry and physics. Gas concentration measurements of CO, CO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, NO, NO<sub>2</sub> and NO<sub>x</sub> are performed with automatic atmosphere monitoring system "Environnement S.A". Complex information about aerosol is obtained by using a three-wavelength integrating nephelometer for measuring the scattering and backscattering coefficients and by ? scanning mobile particle sizer. The system for radioactivity and heavy metals measurement in aerosols gives the opportunity to control a large scale radioactive aerosol transport. Gamma background measurements at BEO Moussala are carried out in real time. The obtained information combined with a full set of corresponding meteorological parameters is transmitted via a high frequency radio telecommunication system to the Internet.

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## **S8\_P43**

### **The determination of heavy metals in some groundwater and surface water samples from Romania**

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This main objectives of this paper is to establish the contamination degree with heavy metals of surface water and groundwater in 15 localities (villages and towns) according to some quality indicators (e.g. TDS, pH, conductivity). Concentrations of Pb, Cd, Co, Fe, Zn, Cr, Ni and Cu in water samples were determined by FAAS technique using the AVANTA GBC spectrometer. In most of the analyzed samples the maximum concentrations allowed by the laws of Romania have been exceeded by some metals. Results from this study suggest a significant risk to population who live in this area, given the toxicity of these metals and the fact that for many, are the only sources of water supply in this environment.

Keywords: groundwater, FAAS, heavy metals

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### S8\_P44

#### INDUSTRIAL PLATFORM AIR QUALITY STUDY

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The air pollution monitoring is one of the most pressing environmental problems today. A direct air pollutant is emitted directly from a given source as product of combustion. The air pollutants are classified as directly released or formed by subsequent chemical reactions, the atmosphere being a proper medium to spread pollutants in the environment.

The paper describes the pollutants monitored in the environmental air of an industrial area in the southern-east of Romania, near Calarasi.

Air pollution measurement strategy may differ from area to area, depending on a number of factors such as geographical location, temperature, wind and humidity, the pollution being differently dispersed.

Portable analyzers, part from a complex system of mobile laboratory, were used for in situ analysis. The most air significant pollutants to asses include carbon monoxide, nitrogen monoxide, nitrogen dioxide, nitrogen oxides, sulfur dioxide in ambient atmosphere, and sulfur dioxide in exhaust gases from furnace, particulate matter, ozone, methane and total hydrocarbons. In addition, we have monitored special compounds like NH<sub>3</sub>, H<sub>2</sub>S. The atmospheric concentrations were measured and recorded according with the Romanian legislation no. 592/25.05.2002, and no 462/01.07.1993.

**Key words:** environment, in situ monitoring, ambient air, health risk.

#### REFERENCES

1. Manoj A., Rajput.S.P.S., "Monitoring and analysis of indoor air quality at different heights in industrial room by using CFD", Int. J. Environm.Sci. 1, 1069 (2011).

2. Kansal A., Khare M., Sharma C.S., "Air quality modeling study to analyze the impact of the World Bank emission guidelines for thermal power plants in Delhi", *Atm. Poll. Res.* 2, 99 (2011).
3. Kankal S. B., Gaikwad R. W., "Studies on noise and air quality monitoring at Shirdi(Maharashtra), India" *Adv. Appl. Sci. Res.*, 2, 63 (2011).
4. Reche C. et al., "Variability of levels of PM, black carbon and particle number concentration in selected European cities", *Atmos. Chem. Phys. Discuss.*, 11, 8665–8717, 2011.

### S8\_P45

#### Experimental investigations on the frequency dependence of the Clausius-Mossotti factor for nano/ microparticles contained in the exhausted flue gases of incinerators

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This work presents investigations regarding the frequency dependence of the Clausius-Mossotti (CM) factor performed on nano/microparticles powders resulted from combustion processes waste, taken from the flue gas filters of one hazardous wastes incineration plant. The frequency dependence of the complex dielectric permittivity,  $\epsilon^*(\omega) = \epsilon'(\omega) - i\epsilon''(\omega)$ , over the range 20 Hz – 2 MHz, of the nano/microparticles samples was measured. Based on these measurements we determined the frequency dependence of the real part of the CM factor,  $\text{Re}[K(\omega)]$ , for the powders samples dispersed in different fluid media samples. These preliminary obtained results show the possibility to filter the exhausted combustion gases using dielectrophoresis (DEP), phenomenon that induces spatial movement, depending on the dielectric properties of the particles and the surrounding medium. Due to the specific behavior of the CM factor, DEP can be used for retaining through manipulation and controlled spatial separation of submicron particles suspended in exhausted combustion gases, leading to their purification.

Keywords: complex dielectric permittivity, Clausius-Mossotti factor, dielectrophoresis, combustion gases, purification.

### S8\_P46

#### Applied Research of Vegetation Interactions with Incident Radiation for Agricultural Monitoring

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Physical processes establish the conditions in which all species of life survive and reproduce, and evoke biological responses to the environments. Understanding the complex response of plants to different impacts is essential for natural resources management, crop growth assessment, land covers change detection, ecosystems preservation and many other world significant issues. Remote sensing technologies are widely used in studying these issues and have become a necessity in various environmental investigation and application fields. The destructive processes caused by natural disasters or human activities are in the focus of the scientific research and occupy the attention of social communities and government authorities. Operational monitoring and on-time alerting, information extraction, modeling and forecasting characterize the recent developments in multidisciplinary environmental studies many of which address ecological problems related to anthropogenic impacts on the biosphere and first of all on vegetation. Vegetation vigour and health condition are factors of plant interactions with and effective use of the solar radiation. The understanding of the interrelations between plant canopies and the incident radiation is of critical importance in studying fundamental processes in plants such as photosynthesis, photomorphogenesis, plant nutrition, and others including environmental stress physiology. For instance, the absorption of optical radiation in the range of wavelengths between 300 nm and 930 nm initiates photochemical reactions in plants that are essential for plant growth. On the other hand, the interactions between plant canopies and incident radiation lie at the root of vegetation remote sensing. Knowledge of how solar radiation interacts with vegetation is necessary to interpret and process remote sensing data of agricultural and natural resources.

In the context of all this, our paper studies various characteristics of plant spectral response (reflectance, absorption, transmittance, and fluorescence) to varying environments and presents an approach for using these characteristics to describe and quantify crop growth and dynamics. Multispectral and multitemporal data has been examined for its sensitivity to variations in crop condition and productivity. Agricultural species (wheat, barley, pea, alfalfa) were subjected to different impacts (nutrient deficiency, nitrogen fertilization type and rates, heavy metal contamination) to study plant radiative response and derive relationships between the applied factors and ecophysiological variables (chlorophyll and other pigments content, biomass, leaf area index, and yield). The obtained results indicate that growth conditions cause statistically significant variations of plant radiative properties. Spectral signatures can be used not only to discriminate between depressed and vigorous vegetation but to quantitatively assess stress impacts. Multispectral data provides for successful crop agro diagnostics. The findings yield accurate estimates of functional attributes of plant canopies from spectral data and are of particular interest for precision agricultural practices. These findings highlight a promising strategy for applying remote sensing techniques to characterize dynamic and environmentally sensitive aspects of canopy physiological development.

**Keywords:** incident radiation, radiative response, reflectance, absorption fluorescence, vegetation canopy, growth variables, heavy-metal stress

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## S8\_P47

### Ultraviolet Radiation C on the Earth Surface and Application for Fire Detection

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Recently the UV-C spectral band begins to find wide application in various scientific and technology fields. This interest is justified by the relatively low level of background noise in this spectral band and the new possibilities that it provides. In this paper, the characteristics of different types of sensors working in the ultraviolet C spectral range are discussed as well as their application capability for wildfire detection. Strategies of wildfire prevention, detection, and suppression have varied over the years, and further development of technology and research continues.

A possible detector is the Geiger-Mueller detector, which was originally invented in 1928 for detection of gamma rays. Geiger-Mueller detectors (or GM tubes) can and have been adapted for use as UV detectors. These adapted GM tubes employ the photoelectric effect to strongly reject photons whose energies fall below the work function of a photocathode. Like the original GM tubes, these adaptations employ a low pressure gas to achieve avalanche gain in a strong electric field when an incident UV photon of the correct wavelength succeeds in knocking loose an electron from the photocathode. As different photocathode metals exhibit different work functions, different GM tubes may detect different UV wavelengths. For example, nickel ideally rejects any wavelength longer than 247nm; tungsten ideally rejects any wavelength longer than 274nm; and molybdenum ideally rejects any wavelength longer than 295nm. However, when placed at above absolute zero temperatures and due to crystal structure imperfections, these cut-off wavelength values blur considerably. Furthermore, although GM tubes commonly exhibit a response peak at around 200nm, the presence of atmospheric O<sub>2</sub> shifts the peak of the already weak UV signal from a fire toward 250nm. As a result, the rather unpredictable response of GM tubes to solar UVB radiation around 280 nm becomes critical to maintaining an acceptable signal-to-noise (SNR). For instance, although nickel cathode GM tubes have a much lower response to ultraviolet radiation at 250 nm in comparison to molybdenum or tungsten based devices, nickel devices may also exhibit a high enough responsivity to solar radiation greater than 280 nm so as to make the SNR of the device intolerable in remote fire detection applications. Poisson or "shot" noise in the signal as well as cosmic ray background noise becomes problematic in the attempt to extract the fire signal from the background noise.

Wildfires can cause extensive damage, both to property and human life and may also have negative ecological effects. Early wildfire detection is very important because of its potential to change direction unexpectedly, the ability to jump gaps such as roads, rivers and fire breaks and because of the fact that it doubles its area every few minutes. In this context, the main idea of the paper is to present the development of fire warning network which will cover a large area. Each node of the network will work over one square kilometer and will detect fires by an optical method just when the fire flames. The spectral (wavelength selective) atmospheric attenuation of the

incident solar and the coming from the fire UV-C radiation is also discussed in terms of maximum area to be covered by one node of the fire warning network.

**Keywords** : ultraviolet radiation C, UVC detectors, fire early detection, fire warning network

### S8\_P48

#### Mapping Regional Variation of Cost of Hot Water Produced by Conventional Solar Collectors in Albania

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Solar energy is one of the main alternative future sources of renewable energies in Albania. In sunny, warm locations, like Albania, use of solar collectors to provide hot water residential needs results to be extremely cost effective. Actually, in Albania, in apartment houses, are installed more 79000 m<sup>2</sup> solar collectors, even no incentives are applied. Mean cost of a kWh thermal energy produced by conventional solar collectors is around 0.06 Euro and continues to drop, while the price of electrical energy supplied from the grid costs 0.1 Euro/kWh. The Albanian National Strategy of Energy consider that in next ten years energy produced by solar collectors will reach the level of 1000 GW/(h y) (around 125 MW<sub>p</sub> installed power). One of the main factors determining the cost of hot water, for a given technology, is the mean solar energy available in the region. Albania is characterized by fast changes of weather conditions and insolation. from one region to the other, which will be an important factor influencing solar energy collected and cost. Using data on insolation main cities of Albania, in this study we give a map of distribution of costs of energy produced by solar collectors in most populated regions of Albania.

**Keywords**: solar collectors, solar insolation, cost of heat, regional distribution of cost,

### S8\_P49

#### Natural radioactivity of ceramic tiles used in Serbia

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Natural radioactivity of ceramic tiles for internal usage, produced in Serbia or imported from other countries, was investigated in the work. Activity concentrations of <sup>226</sup>Ra, <sup>232</sup>Th and <sup>40</sup>K were determined by standard gamma-spectrometry with HPGe detector. Corresponding radiation hazard

was assessed, evaluating the equivalent  $^{226}\text{Ra}$  and activity concentration index (gamma index) for each sample.

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## **S8\_P50**

### **Hyperspectral remote sensing for environmental applications**

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In this paper we outline the ways in which hyperspectral remote sensing can be used to diagnose and monitor effects of adverse environmental conditions on vegetation ecosystems. Following the theory of the spectral reflectance and fluorescence to study plant stress relations to environmental conditions, the discussion is widened to cover a range of imaging technologies. The advantage of using a multi-sensor approach for stress diagnosis is highlighted and some recent applications are summarized. The hyperspectral reflectance data were obtained in the visible and near infrared ranges (450÷850 nm) using a portable multichannel fibre-optics spectrometer. Spectral reflectance analyses were performed in four most informative for the investigated species regions: green (520-580 nm), red (640-680 nm), red edge (690-720 nm) and near infrared (720-780 nm). The statistical significance (at  $p < 0.05$ ) of differences between the reflectance of healthy (control) and injured (stressed) species were assessed by means of the Student's t-criterion.

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## **S8\_P51**

### **ASSESSMENT OF HEAVY METALS POLLUTION IN WATER AND SEDIMENTS OF SOME SALT LAKES FROM ROMANIA**

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Heavy metals are important environmental indicators for the impact of anthropogenic activities on natural ecosystems. Therefore, these metals can be indirectly or directly transported into the aquatic environment (e.g. dissolved state), can accumulate to a toxic dose and cause some ecological damage (e.g. natural and therapeutic properties degradation of saline water or mud of lakes) under some environmental conditions. The concentration of heavy metals including iron, manganese,



copper, cadmium, zinc, nickel and lead in water and their sediments, as well as therapeutic mud, in seven salt lakes from Romania (Carpathian region), were investigated. This study evaluates certain chemical properties of these lakes in relationship with the heavy metals concentration, as well. Atomic Absorption Spectrometry (AAS) and Energy Dispersive X-ray Spectrometry (EDXRF) were used for heavy metals determination. The metals concentrations in sediment/mud varied widely and exhibit fluctuations between different lakes, especially in values of Fe, Cu, Mn, Cd and Pb. Metals exhibited a similar pattern of concentration as its abundance in water. Iron appears in the lake sediments as an essential component of clay minerals which is major one in the salt lakes from Romania. By comparing the accumulation of heavy metals in water and sediments/mud, it can be concluded that the heavy metals are highly accumulated in sediments than water, since, it is known, that the solids act as reservoir for all contaminants and dead organic matter descending from the ecosystem. This can be the reason by the certain chemical and, sometime, therapeutically properties of the sediments/mud of salt lakes from Romania were damaged or destroyed.

**Keywords :** heavy metals, pollution, salt lake, AAS, EDXRF

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### **S8\_P52**

#### **ADSORPTION AND RECOVERY OF SOME DYES FROM ACTIVATED CARBON USED IN WATER SYSTEM STUDIES**

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The purpose of this paper relates to determining the adsorption and recovery degrees from activated carbon bags of some dyes as Uranine (Fluoresceine), Rhodamine WT, Eosine and Sulphorhodamine G Extra which can be used as fluorescent tracers in studies of aquatic environments. The effect of the activated carbon is that traces of the used dye are strongly fixed at the surface of the carbon grains. This attribute is used in different water systems studies with fluorescent tracer experiments. Carbon bags are used for the first time in an artificial tracer experiment in our country, in karst system study of Mali me Gropa (2002) and later in the studies of Ohrid-Prespa Lakes (2002 and 2007). Adsorbed tracer can be extracted from carbon bags under the analytical procedures. Based on measurements of dye fluorescence intensity in standard solutions and extracts received from carbon we can calculate its adsorption and recovery degrees from activated carbon bags. The obtained results prove that extreme low traces of dyes, which cannot be detected directly in the water sample, can be determined in carbon extracts.

**Keywords:** Artificial tracer, Fluorescence Intensity ( $I_f$ ), Synchronous scan, Activated carbon.

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## S8\_P53

### The correlation of VLF/LF electromagnetic waves diurnal variation, as recorded by the Romanian VLF/LF radio monitoring system, with earthquake occurrence and volcano eruptions

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The Romanian VLF/LF monitoring system consisting in a radio receiver and the infrastructure that is necessary to record and transmit the collected data is part of the European international network named INFREP.

Information on electromagnetic fields' intensities created by transmitters at a receiving site are indicating the quality of the propagation along the paths between the receivers and transmitters. Studying the ionosphere's influences on the electromagnetic waves' propagation along a certain path is a method to put into evidence possible modifications of its lower structure and composition as earthquakes' precursors.

In this work we pay attention to **the terminator times** in subionospheric VLF/LF electromagnetic waves diurnal variation, which are defined as the times of minimum in amplitude (or phase) around sunrise and sunset. These terminator times are found to shift significantly just around the earthquake. In the case of Kobe earthquake, there were found significant shifts in both morning and evening terminator times and these authors interpreted the shift in terminator time in terms of the lowering of lower ionosphere by using the full-wave mode theory.

A LabVIEW application which accesses the VLF/LF receiver through internet was developed. This program opens the receiver's web-page and automatically retrieves the list of data files to synchronize the user-side data with the receiver's data. Missing zipped files are also automatically downloaded. The application appends daily files into monthly and annual files and performs 3D colour-coded maps with graphic representations of VLF and LF signals' intensities versus the minute-of-the-day and the day-of-the-month, facilitating a near real-time observation of VLF and LF electromagnetic waves' propagation. This type of representation, highlights the modification of the terminator time versus the length of the solar-day, improves the user's capability to detect possible propagation anomalies due to ionosphere conditions and allows a quick visual inspection of unexpected behaviors of transmission channels at different frequencies and paths. A very **special result**, was observed on the recordings made on the propagation path to Iceland (NRK, 37.5kHz). Recordings are made once a minute, for a period of 303 days. Icelandic channel propagation anomalies present in the range of 40-90 days are considered to be precursory phenomena associated with Eyjafjallajökull - Iceland, volcanic eruption occurred in April-May 2010.

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**S8\_P54****THE BIO-LOCATION METHOD USED FOR STRESS FORECASTING IN VRANCEA (ROMANIA) SEISMIC ZONE**

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Large and destructive intermediate-depth earthquakes in Vrancea have been generated about every century during the last millennium. Possible earthquake precursors, such as bio-location data obtained across crustal faults, and three component magnetic continuous recordings, have been used in the last decade in and around the Vrancea region. After-the-fact correlations have been published, but the interpretation was not accepted due to a subjective evaluation. As a result, a real-time methodology was implemented. A successful real-time stress forecasting was possible for a large normal depth regional earthquake at Van, eastern Turkey, and another small-moderate intermediate-depth event in Vrancea. The stress forecasting was able to offer few data for the expected event, so no earthquake prediction was possible for the location and magnitude. Our data suggest the so called earthquake precursors were not related to physical anomalies at an intermediate depth of 70-150 km in Vrancea, but they had been generated by resistivity anisotropy variations and magnetotelluric wave splitting (MWS) around crustal faults. On the other hand, resistivity anisotropy anomalies can be related to principal compressive/extensional stress variations in magnitude and direction observed around tectonic faults before, during and after moderate to large local and/or regional earthquakes. Finally, an earthquake prediction for the next large and destructive intermediate-depth Vrancea earthquake is not possible. Instead, successful stress forecasting in real time can be issued for some local and/or regional moderate-large earthquakes.

**S8\_P55****THE WATER CONTENT DEPENDENCE OF THE DIELECTRIC CONSTANT OF SILT-CLAY-SAND MIXTURES IN LOW FREQUENCY FIELD EVALUATED BY DIELECTRIC MIXING MODELS**

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Capacitance measurements were performed on seven soil samples from the Timis Plain region, Romania, with the aim of determining their dielectric properties. The frequency ( $\omega$ ) and volumetric water content ( $\theta$ ) dependencies of the complex dielectric permittivity,

$\epsilon_r(\omega) = \epsilon'(\omega) - j\epsilon''(\omega)$  over the frequency range of 500 Hz to 2 MHz, have been investigated. Geotechnical laboratory measurements were conducted to determine the soil texture (grain size distribution) and porosity/void ratio of each sample.

The experimental results of the real part of the complex dielectric permittivity were compared using different dielectric mixing models, such as the soil texture independent models of Topp and Wensink, and the soil texture dependent model of Wang-Schmugge. The imaginary part exhibits a maximum for each value of the volumetric water content, correlated to the dielectric relaxation processes.

The results obtained are in a good agreement with the theoretical models used, only for frequencies beginning with 500 kHz, being correlated to the dielectric relaxation and electric conductivity absorption processes over the investigated frequency range.

**Keywords:** complex dielectric permittivity, water content, Topp and Wensink model, Wang-Schmugge model.

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## S8\_P56

### General evaluation of the environmental regime of Karavasta lagoon area and its surroundings

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This study presents a general evaluation of the natural aspects of Karavasta lagoon area and its surroundings. Karavasta lagoon area with its surroundings is situated in the Coastal area of Adriatic Sea, in the Karavasta Bay. The study object is to analyze, evaluate and characterize the abiotic and biotic environmental aspects of Karavasta Lagoon area. It is a very complex study, and includes a wide range of respectively important aspects.

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## S8\_P57

### Physical effect of directivity contribution to the radiated elastic seismic energy: north-eastern Albania (5.4 Mw) earthquake of September 6, 2009 case.

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Radiated seismic energy is an important macroscopic parameter to characterize the dynamics of an earthquake faulting process and the physics of the source, during the coseismic phase. Correspondingly, we estimated the radiated seismic energy for September 6, 2009 event ( $M_w =$

5.4), taking into account appropriate path attenuation correction of the elastic waves, through a frequency dependent quality factor and radiation pattern. The paper that we presents aims the determination of directivity effect factor, from seismic energy, assuming a point source model for this earthquake witch represents the strongest event occurred in Albania since 2007. The results obtained show an insignificant effect of directivity on the radiated seismic energy determined for this source ranging from 0.004 to 0.5 times the cumulative energy determined for each station independently, at different azimuths on the focal sphere. This results supports the active fault plane determination from focal mechanism solution, witch revealed a strike angle equal to approximately  $220^{\circ}$ , a dip angle of  $40^{\circ}$  degree and a slip angle of  $-90^{\circ}$ . We conclude that the directivity effect is more pronounced at TIR station, in the direction of strike, and diminishes at PHP station, nearly at the opposite side of the determined active fault plane shaping the physical radiation properties for this source.

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### **S8\_P58**

#### **Apparent Stress determination from broadband seismic energy and moment of small and moderate earthquakes in Albania**

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We have determined the apparent stress locally for several small to moderate earthquake recordings, from source zones at different tectonic conditions within Albanian territory, based on radiated seismic energy and seismic moments. Prior to this analyze, the correction of source spectra for attenuation and radiation effects, has been carried out. A set of 69 events is selected from witch only the waveforms recorded on horizontal components are processed. Radiated seismic energy and seismic moment have been determined through displacement source spectra using Brune  $\omega^{-2}$  model, generating square velocity spectra and applying discret integration for each source taken in analyze. We have grouped events according to their location taking five source polygons in tectonic regions characterized by different stress regime. Each of the source grouping is named by codes respectively al001, al002, al003, al004 and al005 for longitudinal Adriatic and Ionian outer zones, Elbasani and Dibra transversal zones as well as Mirdita inner source zone. Values determined for apparent stress varies in the interval 0.1-10 MPa, for four as above zones, except for Mirdita zone (al005) in the central northern Albania where these values varies from 0.01 MPa to 10 MPa. For this area, apparent stress shows a great scatter, for witch we thing is attributed to relatively small values of seismic moment and energy released but also to the insignificant number of events taken for analyze respectively. We have concluded from this analyze that apparent stress variation is in accordance with globally determined values (0.03-6.69 MPa) and scales with the seismic moment with the assumption that the shear modulus of the earth medium is taken equal ( $\mu = 0.3 \times 10^5$  MPa). Its values show also a focal mechanism dependence expressed by scale relations,  $M_0^{(0.1) - (-0.26)}$  for oblique type faults, and  $M_0^{[0.69 - 1.75]}$  for pure thrust and normal type faults.

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## S8\_P59

### An overview on the disasters occurred in Poiana Rusca massif's abandoned mines

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In this paper we are presenting results concerning the pollution of the environment with heavy metals and radioactive compounds in the abandoned mines of the Poiana Rusca massif. The massif, which connects the Meridionali Carpatians to the Apuseni Mountains, is characterised by a diverse geography with a maximum height around 1300m. We have chosen this area in particular mainly because throughout time there have been opened here a series of mines, all of which were shut down by 2002, in a more or less ecological way.

The following problems were identified:

The mining galleries, which were filled with waste dump after exploitation, can affect the surrounding terrain due to the risk of collapsing;

Mining galleries bring to surface, by pumping or direct drainage, many dissolved ores that have a very high toxic content. Likewise, through characteristic works, the galleries cross clean underground water layers.

The mining waste dumps are continuously being washed by the waters in the gallery, by the rivers in the area or by the meteoric waters. Due to physical characteristics of the water (incontrollable flows, freezing, pH changing) they can influence the stability of the waste dumps.

The mining decantation devices are strong pollution sources even after their stabilization. The material in the decantation devices can end up in the surrounding water in more than one way.

Continuous pollution with heavy metals and radioactive substances of the rivers and mountains.

The primal processing mining projects are pollution generators even after they are finalized. The soil remains contaminated at a significant depth for an undefined period of time. The migration of the radionuclides and heavy metals are difficult to control.

The nuclear activity measurements were realized using a Polyradiation Meter MIP21 equipped with a SG-2 Gamma scintillator counter. For some radionuclides the measured values of the radioactivity are in the legal limits while for other ones these limits are exceeded. The samples collected from the area were sent to some collaborators for further analysis.

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## S8\_P60

### A statistical study on the elemental composition of Geto-Dacian coins

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This paper is a first attempt of statistical analysis of Geto – Dacian gold and silver coins based on their elemental composition, determined by XRF. The study discusses results obtained for a hoard of 143 gold Koson type coins (37 with monogram and 106 without monogram) recuperated by the Romanian Authorities in the autumn of the year 2009 and one of 202 silver coins: Kosons and Macedonia Prima tetradrachms.

Two statistical methods, Cluster Analysis (CA) and Principal Component Analysis (PCA), were employed in the study. Cluster analysis was used for grouping the coins and for comparison with other contemporary emissions. The results revealed differences and analogies between the emissions connected to their alloy composition.

From the correlations obtained using the PCA we can formulate several hypotheses regarding the source of the material employed: e.g in the case of the gold Kosons without monogram, the Ag-Cu correlation can point to the proximity of the primary source of the alluvial gold used for manufacturing. PCA correlations can also be used to expose manufacturing aspects: e.g a positive correlation between Cu and Pb found in silver coins indicate the deliberate addition of copper for debasement and the addition of lead for decreasing the melting point of the alloy.

### **S8\_P61**

#### **Geological Studies on Transylvanian Native Gold Using micro-PIXE and micro-SR-XRF**

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Very small samples (hundreds of microns) of native gold from Rosia Montana (Apuseni Mts) and from Cavnic (Baia-Mare district) were scanned by micro-PIXE and micro-SR-XRF to obtain information on electrum structure - values of ratio  $Ag/(Au + Ag)$  and on presence of Au and Ag minerals (Te and Sb compounds) – many as micro-inclusions. Rosia Montana is one of the oldest and most interesting gold deposit with both veins and stockworks. Cavnic deposit is located in the eastern part of the Carpathian belt, one of Europe’s major metallogenic provinces. Analyzed samples are from recovery obtained by inhabitants from landfills of former mining plants. For Rosia Montana, using micro-PIXE method at LNL AN2000 accelerator we detected micronic areas (5?m X 5?m) rich in Ag and Sb and without Au, Sb/Ag ratio being 1/5-6, indicating the presence of stephanite -  $Ag_5SbS_4$ . For Cavnic -Roata samples, to investigate Au and Ag minerals, we used micro-PIXE at AGLAE Louvre Accelerator and micro-SR-XRF at ANKA ISS Synchrotron. We analyzed areas of approx. 50 microns diameter. The study was focused on Sb and Te presence and on the variation of  $Ag/(Au+Ag)$  ratio which characterize electrum’s metallogeny. The ratio varies from 0.221 to 0.395 - average value of 0.27, with big differences from point to point illustrating electrum’s inhomogeneities. Ratio values are significantly lower than those given for neighbour

mines Cavnic-Boldut 0.47-0.53, but approaching over Nistru data - 0.25 or rather Herja - 0.36. An interpretation in terms of electrum metallogeny is discussed. One micro-area revealed an important presence of Te (16657 ppm), a significant presence of Sb (2861 ppm) and an increase of Ag content (Ag=32.75% versus Au =50.05%), indicating the presence of a Ag telluride containing also Sb. The high As content (6.64%) could indicate benleonardite -  $Ag_8(Sb,As)Te_2S_3$  highlighted in Kremnica, Slovakia. We can not exclude the presence of a krennerite -  $(Au, Ag)Te_2$  enriched in Sb. A comparison with a micro-mineralogical study

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## S8\_P62

### Time series geospatial and in-situ monitoring data for seismic precursors surveillance

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Earthquake science has entered a new era with the development of space-based technologies to measure surface geophysical parameters and deformation at the boundaries of tectonic plates and large faults. Different criteria can be used to select the remote sensed earthquake pre-signals for which there is an evidence for anomalies in the geophysical observables. Observations from Earth orbiting satellites are complementary to local and regional airborne observations, and to traditional in field measurements and ground-based sensor networks. Rock microfracturing in the Earth's crust preceding a seismic rupture may cause local surface deformation fields, rock dislocations, charged particle generation and motion, electrical conductivity changes, gas emission, fluid diffusion, electrokinetic, piezomagnetic and piezoelectric effects. Space-time anomalies of Earth's emitted radiation (radon in underground water and soil, thermal infrared in spectral range measured from satellite months to weeks before the occurrence of earthquakes etc.), ionospheric and electromagnetic anomalies are considered as earthquake precursors. The GPS data provides exciting prospects in seismology including detecting, imaging and analyzing signals in regions of seismo-active areas. This paper aims at investigating the seismic pre-signals liker as TEC ionospheric and geomagnetic parameters, radon anomalies, air and land surface temperature, for some major earthquakes recorded in the world based on satellite data provided by NOAA, WDC Australian, Space Environment Information Service Japan, British Geological Survey and World Data Center for Geomagnetism, Kyoto and in-situ monitoring geophysical data. Such findings support lithosphere-ionosphere coupling theory.

**Keywords:** Earthquake precursors; geospatial data; in-situ monitoring geophysical parameters, lithosphere-ionosphere coupling;

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## S8\_P63

### Radioactivity in soil of western Serbia and assessment of the annual effective dose

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Western Serbia is a region well-known for potato production. Activity concentrations were measured in the soil in order to evaluate the level of radioactivity and doses. The examined soils (Luvisol and Pseudogley) showed unsuitable agrochemical characteristics (acid reaction, low content of organic matter and potassium). The average radioactivity of <sup>238</sup>U, <sup>226</sup>Ra, <sup>232</sup>Th, <sup>40</sup>K and the fission product <sup>137</sup>Cs were  $60.4 \pm 26.2$ ,  $33.2 \pm 13.4$ ,  $49.1 \pm 18.5$ ,  $379 \pm 108$  and  $36.4 \pm 23.3$  Bq/kg. Enhanced radioactivity in the soils was found. The total absorbed dose rate in air above the soil at 1 m height calculated for western Serbia was 73.4 nGy/h and the annual effective dose was 90  $\mu$ Sv, which are similar to earlier reports for the study region.

**Key words:** Radioactivity; Soil; Dose rate; Annual effective dose

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## S8\_P64

### Determination of the ion production rate and the aerosol concentration based on measurements of air ion concentration

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University of Shkodra

The determination of the mechanical and electrical properties of air in the lower part of the troposphere is a very important question. This is strongly related with the quality of the air we breathe. Two of the most important parameters indicating the quality of the air are radon and aerosol concentration in the air.

Aerosol concentration influences on the optical and the biological properties of the air. Air ions tend to be attached on the aerosols, so the aerosol concentration reduces the air ion concentration and their mobility. The radon and the aerosol concentration influence inversely on the small air ion concentration.

In this paper is treated the problem of determination of the fundamental parameters of the electrical parameters of air; ion production rate and aerosol concentration near the ground. The studied parameters are ion production rate and the aerosol concentration in the lower troposphere. This determination is based on the measurements of the small air ion concentration in these altitudes.

The air ion concentration altitude profile is exponential decay [14]. This function depends on the ion production rate and the aerosol concentration. Measuring the concentration of small air ions in different altitudes, we obtain the altitude profile of air ion concentration. The measurements are done in the altitudes 0-30 m, in the suburbs areas of the city of Shkodra [15]. The parameters of the altitude profile measured experimentally are related with ion production rate and the aerosol concentration. So obtaining the coefficients of the altitude profile of air ion concentration from the



measurements, we find the ion production rate and the aerosol concentration in the altitudes near the ground

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## **S8\_P65**

### **Diurnal and annual variations of atmospheric ion and aerosol concentrations over an urban area**

Mandija Florian, Ahmetaga Shpresa, Lohja Zenel

*University of Shkodra*

In this paper there is presented an overall estimation of annual and diurnal variations of atmospheric ion concentrations. Measurements were carried out in an urban centre, for one year period, during period; August 2009-August 2010.

On this monitoring campaign, there are measured atmospheric ion concentrations of both polarities; positive and negative. Despite of this, there are measured also aerosol number concentrations (accumulation and coarse modes) in monitoring area, and there are recorded principal meteorological parameters; like air temperature, relative humidity, atmospheric pressure and wind speed.

Monitoring results show almost regular annual and diurnal variations of atmospheric ion concentrations of both polarities. This fact is in a good accordance with annual and diurnal variations of aerosol concentrations and measured meteorological parameters.

In the last step of this analysis, there are determined also correlation coefficients between the concentrations of air ions and aerosol particles. These values let to evaluate attachment rates of air ions with aerosol particles, for each polarity and group.

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## **S8\_P66**

### **Estimation of particulate matter concentrations in two populated sites around Shkodra Lake**

Florian Mandija, Enver Hoxhaj

*University of Shkodra*

Lake of Shkodra as the largest lake in the Balkan Peninsula forms a relatively complex ecosystem. One of the most important indicators of this ecosystem is also the quality of air. Air quality can be estimated based on several viewpoints, using physical or chemical parameters. In this study, the work is based on estimation of particulate matter concentrations in the air. Particulate matter is one of the most important physical parameters influencing air quality. There are selected three main locations in the measurement campaign; urban centre of Shkodra city and the tourist center Shirokë. There are monitored PM-s mass concentrations in these centers, and then there are

obtained conclusions about emission sources and transport mechanisms, controlling the concentrations of particulate matter in our study.

Processing the data we have done upon the base of appropriate software. Application of Information and Communication Technologies (ICT) is the base of measurement on air quality standards in nowadays.

PM-s concentrations in both locations are near the thresholds of international recommendations. This fact signifies the necessity of initiation of more profound studies on reducing of emission rate of particulate matter in the city of Shkodra.

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**S8\_P67****Ion-aerosol concentrations in a tourist seashore site during summer season**

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Cluster ions and aerosols are atmospheric particles, which participate and influence on several global processes. On other hand, both these particles interact with each other through recombination and attachment processes. Monitoring the variation of their concentrations give valuable information not only on their reciprocal interactions, but also on their presence and as consequence on their influence on atmospheric processes that these particles take part.

In this paper there is presented a study of the variation of number concentrations of cluster ions and aerosol particles in sub-micrometric and super-micrometric size ranges.

Monitoring campaign was conducted in a tourist site in Adriatic seashore. Entire measurement procedure was spread into three years.

Overall results indicate high presence of both these atmospheric particles. Main sources of these particles in the monitoring area are combustion activities, sea salt and long range transport.

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**S8\_P68****OXIDE LAYER THICKNESS DEPENDENT ELECTRICAL CHARACTERIZATION of Al/Al<sub>2</sub>O<sub>3</sub>/CdS MOS STRUCTURES**

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*Yildiz Technical University, Department of Physics, Istanbul, TURKEY*

For the MOS structures, better quality diodes could be produced by depending on oxide layer thickness. In our study, Al/Al<sub>2</sub>O<sub>3</sub>/CdS, MOS structures were obtained and then these structures were characterized electrically by using current-voltage (I-V), capacitance-voltage (C-V)

measurements. Measurements which were useful for determining metal/semiconductor interface conditions and current transfer mechanism also, were realized depending on the oxide layer thickness and % RH ratio. The main electrical parameters of the Al/Al<sub>2</sub>O<sub>3</sub>/CdS, MOS structures, as ideality factor ( $n$ ), barrier height ( $F_B$ ) and series resistance ( $R_s$ ) were determined. As the oxide layer is sensitive to humidity, the Al/Al<sub>2</sub>O<sub>3</sub>/CdS, MOS structures were found to be suitable for RH sensor applications.

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## **S8\_P69**

### **ELECTRICAL CHARACTERIZATION OF CdS BASED MIS STRUCTURE WITH DIFFERENT METALS**

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Electrical measurements of MIS structures are suitable for determine Metal/Semiconductor surface conditions and current transfer mechanisms. By investigating surface conditions dependency of electrical parameters of Schottky diodes, allow to produce long-lived and better quality circuit equipments. And also, due to the temperature and gas sensitivity MIS structures are suitable for sensor applications.

In this study, Au/Polymer/CdS and Cu/Polymer/CdS MIS structures were produced and the electrical characterization of these structures were realized by using current-voltage (I-V) measurements. Measurements were repeated with different temperatures and gas atmospheres. The main electrical parameters of MIS structures as ideality factor ( $n$ ), barrier height ( $F_B$ ) and series resistance ( $R_s$ ) were found.

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## **S8\_P70**

### **Electrical properties of chitosan -gold membranes**

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Biomaterials for organic electronics have gained considerable attention in recent years. The advantages of biomaterials are that they are biodegradable, biocompatible, typically environmentally friendly, and do not require chemical synthesis. After cellulose, chitin is the second most abundant natural polymer that is associated with the biomineralization of the exoskeleton of crustaceans, molluscs, insects, and other invertebrates [1].

The embedding of noble metals nanoparticles within chitosan matrix proved to be a valid method for diagnostic testing biosensors [2] or drug delivery vehicle [3], but it was not tested until now as active dielectric for microelectronics applications.

Among the recent approaches toward material development for flexible electronics, the combination of flexible polymers with conductive nanoparticles to reach giant capacitance for energy storage and non-linear dielectric properties for tunability seems to be very promising.

In the present paper, the electric properties of chitosan membranes with different gold concentration prepared by dry phase inversion were investigated.

By adding gold particles with controlled size, an increased of dielectric constant has obtained together with a low dielectric constant. At low frequency values, the extrinsic contributions increased with gold particles addition but the samples still have good losses. A strong nonlinear behaviour was obtained for all the samples. By gold addition, an increase of tunability level was obtained together with an asymmetric behaviour for negative/positive field. These characteristics make the chitosan-gold membranes as a suitable composite for microelectronics applications.

**Keywords:** gold nanoparticles, chitosan membranes, flexible electronics

**Acknowledgements:** This study was financially supported by the POSDRU/89/1.5/S/63663 and POSDRU 89/1.5/S/49944 grants.

#### References

- [1] R.A.A. Muzzarelli, C. Jeniaux, G.W. Gooday (Eds.), *Chitin in Nature and Technology*, Plenum Press: New York, 1985.
- [2] U. Pieper-Fürst, W.F.M. Stöcklein, A. Warsinke, Gold nanoparticle enhanced SPR measurement for the highly sensitive quantification of the human tissue inhibitor of metalloproteinases -2, *Anal. Chim. Acta*, 550: 69-76, 2005.
- [3] L. Paasonen, T. Laaksonen, C. Johans, M. Yliperttula, K. Kontturi, A. Urtti, Gold nanoparticles enable selective light induced drug release from liposomes, *J. Controlled Release*, 122:86-93, 2007.

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#### S8\_P71

#### Magnetic properties of transition metal-doped zinc oxide thin film

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Doping ZnO with transition elements (mainly Co and Mn) has been, for the last decade, the most common approach in the quest for a ZnO-based diluted magnetic semiconductor. Although the majority of reports confirm the success of inducing ferromagnetic behavior in the otherwise diamagnetic zinc oxide, the debate whether the new properties are intrinsic to the material or have other causes is still open. So far, results seem to indicate that various synthesis methods and deposition parameters can yield substantially different characteristics.

In the present work we have investigated thin films of ZnO with 5 % Co, Ni and Mn dopant concentration. The samples were chemically prepared via a sol-gel method and deposited onto glass substrates using a spin-coater, then subjected to heat-treatment in air at 400 °C. Hysteresis loops were recorded with a VSM magnetometer (Lake Shore 7410) at different temperatures in the 100-300 K range. Magnetization versus temperature measurements were taken with a PPMS-9 QD with VSM module, with a maximum applied field of 9 T.

Different structural investigation methods (X-ray diffraction, X-ray spectroscopy, electron microscopy) have been used in order to establish the true origin of magnetism and to exclude/confirm the presence and role of secondary phases. The results were correlated and compared with those from other works using a similar sample obtaining method.

**Acknowledgments** This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/107/1.5/S/78342]

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### S8\_P72

#### Study of influence of the $\text{Co}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4$ ferrite series on magnetic resonance imaging contrast

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Contrast agents are used in magnetic resonance imaging in enhancing magnetic relaxation process in such a way that lesions that cannot otherwise be studied can be visualized. The most commonly used are the paramagnetic contrast agents, which have their strongest effect on the T1, by increasing T1 signal intensity in tissues where they have accumulated. Towards this end a lot of *in vitro* and *in vivo* studies on ferrite nanoparticles and iron oxides have been conducted. Barcena et al in 2008 studied  $\text{Zn}_x\text{Fe}_{1-x}\text{O}\cdot\text{Fe}_2\text{O}_3$  hydrophobic and mixt spinel system. These solutions were scanned with a Varian INOVA MRI scanner. Similar concentrations of Feridex<sup>®</sup> were used for comparison. The zinc ferrites nanoparticles influenced the T2 relaxation time.

In our study a series of  $\text{Co}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4$  ferrites, with  $x= 0; 0.2; 0.4; 0.6; 0.8; 1$  were produced. Ferrite nanoparticles were dispersed in agarose gels and scanned with a medical MRI APERTO (Hitachi Japan) facility (0,4 Tesla). For these phantoms the basic T1 and T2 sequences were obtained. The resulted images were analyzed using a commercial program, Spin Software, to highlight the influence of particles on the images' contrast by attributing different colors for different intensity of the pixels. For small values of  $x$ , contrast was enhanced in T2 sequence while for higher values of  $x$  a positive contrast was seen in T1.

**ACKNOWLEDGEMENTS** This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/107/1.5/S/78342 and POSDRU 88/1.5/S/47646].

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**S8\_P73****Occurrence of the REFeO<sub>3</sub> (RE=La, Gd, Dy) orthoferrite phases and their influence on the magnetic and sintering properties of the CoRE<sub>0.2</sub>Fe<sub>1.8</sub>O<sub>4</sub> system**T.POPESCU<sup>1</sup>, G. DASCALU<sup>2</sup>, L. DIAMANDESCU<sup>1</sup>, M.FEDER<sup>1</sup>, O. F. CALTUN<sup>2</sup><sup>1</sup> *National Institute of Materials Physics, Bucharest-Magurele, Romania,* <sup>2</sup>*Faculty of Physics, Alexandru Ioan Cuza University, 700506 Iasi, Romania*

Cobalt ferrite (CoFe<sub>2</sub>O<sub>4</sub>, CF) exhibits reasonable saturation magnetization and a particularly high magneto-crystalline anisotropy generated by the strong LS coupling of the predominantly B-coordinated Co<sup>2+</sup> ions. This magnetic coupling can be modified and controlled by partial substitution with rare earth ions (RE<sup>3+</sup>) substitution for iron cations.

In this view, we studied the crystalline phase composition as well as the magnetic properties of CoRE<sub>0.2</sub>Fe<sub>1.8</sub>O<sub>4</sub> (RE=La, Gd, Dy) system. All materials have been prepared via standard powder ceramic techniques (solid state synthesis) using Fe<sub>2</sub>O<sub>3</sub> and Co<sub>3</sub>O<sub>4</sub> as CF precursors and La<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub> and Dy<sub>2</sub>O<sub>3</sub> as RE cation sources. The mixed precursors were sintered at different temperatures: 950, 1150 and 1350 °C, each for 5h under air atmosphere. The obtained samples were investigated by XRD, Mössbauer spectroscopy, Raman spectroscopy and SEM-EDX analysis. The magnetic and dielectric properties of the samples were obtained using a VSM and a Precision LCR Meter respectively.

XRD analysis revealed the presence of orthoferrite REFeO<sub>3</sub> (OF) phases for all RE elements and all temperatures investigated, indicating the persistency of the OF phases for the given experimental conditions. Rietveld quantitative phase analysis showed similar phase contents for 1150 and 1350 °C sintered samples. Investigations by Mössbauer spectroscopy supported the XRD results regarding the presence of the spinel and OF structures in the tested samples. From VSM curves a decreased saturation magnetization and an increased coercive field was observed as the ionic radius of the RE ions augmented. The magnetostriction curves obtained by strain gauge method indicated a decrease of the saturation magnetostriction coefficient as the ionic radius of the RE ion increased, but the values were still higher than those observed in other ferrite systems.

**Acknowledgments:** This paper is supported by the Sectorial Operational Programme Human Resources Development (SOP HRD), financed from the European Social Fund and by the Romanian Government under the contract number SOP HRD/107/1.5/S/82514.

**S8\_P74****Domain structure in bismuth ferrite thin films and multiferroic heterostructures**S.M. STRATULAT<sup>1</sup>, M. ALEXE<sup>2</sup>, O.F.CALTUN<sup>1</sup><sup>1</sup> *Faculty of Physics, Alexandru Ioan Cuza University, Iasi, 700506 Romania,* <sup>2</sup>*Max-Planck-Institut für Mikrostrukturphysik, 06120 Halle, Germany*

Multiferroic heterostructures have received increasing interest in the last decades, from both applied and fundamental research. A very promising candidate in this respect is the system comprising  $\text{CoFe}_2\text{O}_4$  (CFO)- $\text{BiFeO}_3$  (BFO). Cobalt ferrite (CFO) is a magnetically hard material, with a high magnetostriction coefficient, whereas bismuth ferrite (BFO) is the only known single-phase multiferroic at room temperature showing high ferroelectric polarization value ( $>90 \mu\text{C}/\text{cm}^2$ ) and antiferromagnetic properties in the same time. Both materials have been extensively studied alone as well as in heterostructures with other materials.

The present work entails the study of BFO-CFO vertical type heterostructures (1-3) deposited on various bottom electrodes, including  $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$  (LSMO). The aim is unveiling the strain-mediated magnetoelectric coupling between the two materials in the fabricated heterostructures. For this, piezoresponse force microscopy (PFM) was employed to study the local ferroelectric properties of both single-deposited BFO on LSMO bottom electrode and of the multiferroic CFO-BFO heterostructures, respectively. Magnetic force microscopy (MFM) was also used to probe the magnetic properties of the cobalt ferrite phase, as well as the magnetoelectric coupling in the above BFO-CFO structure.

**ACKNOWLEDGMENTS** This work was supported by the European Social Fund in Romania, under the responsibility of the Managing Authority for the Sectoral Operational Programme for Human Resources Development 2007-2013 [grant POSDRU/107/1.5/S/78342].

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## S8\_P75

### Production and analysis of ZnO nanoparticles doped membranes

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Nanotechnology has many application areas such as health, textile, automobile and electronics technologies. Another use of nanotechnology application is the production of the membranes. In recent years, particularly, scientific studies on the membranes of made by using the nanoparticles have gained increasing importance.

In this study, preparation of zinc oxide doped alginate bio-nanohybrid membranes and their characterizations have been investigated. Surface properties of prepared membranes were examined by using the scanning electron microscope (SEM). Also, contact angle measurements were performed to determine hydrophilic/hydrophobic properties of the membranes. Fourier transform infrared (FT-IR) spectroscopy was used to follow micro-structural changes of the membranes. Thermo-gravimetric analysis (TGA) was used to determine thermal properties of the bio-nanohybrid membranes. Obtained results for pure and loaded membranes were compared.

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**S8\_P76****Photovoltaic systems integrated into THE buildinG**

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In today's context of solar sources used into the buildings and development concept of energy efficient buildings, this paper presents some architectural and energetically solutions for building integration of photovoltaic systems. With significant professional experience in the development and integration of solar systems into the buildings, the authors of this paper presents several types of photovoltaic applications witch will be integrated into the building of Scientific and Technological Institute of Multidisciplinary Research.

In draft form, these solar systems with applications on the building terrace, southern façade and windows sunshades, will serve for electricity generation asset and passive shading.

Finally, the paper presented conclusions on the advantages of each type of application and recommendations for their monitoring and testing.

**Keywords** : photovoltaic system -1; building integration – 2; active and passive solar system - 3.

**S8\_P77****THE ELECTRICAL BREAKDOWN TIME DELAY DISTRIBUTIONS IN “GE 155/500” GAS DIODE (STARTER)**

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The results of the electrical breakdown time delay statistical investigations in the “GE 155/500” gas diode (manufactured in factory General Electric) by the time delay measuring method are presented in this paper. This diode is usually used as a “starter” (with one bimetal electrode) whose function is electrode heating regularization in fluorescent tubes. The experimentally obtained Laue distributions for different voltages (from 240 V to 500 V) and different relaxation times (from 1 ms to 1500 ms), as well as the memory curves for different overvoltages (from 240 V to 500 V), are



presented. The results indicate that time delays in the “GE 155/500” diode don’t depend on the number of switches, and that have god characteristic for commercial using.

**Key words:** Breakdown time delay distributions, Laue distributions, Statistic breakdown voltages, Electrical breakdown, commercial gas diode GE 155/500.

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## S8\_P78

### STATISTICAL THEORETICAL BREAKDOWN VOLTAGE DISTRIBUTIONS IN NEON FILLED DIODE AT 1.33 mbar

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Experimental and theoretical breakdown voltage distributions in the gas diode filled with neon are presented in this paper. Linearly increasing voltage was applied to the diode with the voltage increasing ratio  $k$  in range from 0.3 V/s up to 26 kV/s. The theoretical model - statistical model is based on convolution of the statistical and formative time delay. The statistical model nicely reproduce the experimentally determined the breakdown voltage distributions, especially good for description of the “left tail” of breakdown distributions which are not properly interpreted before. The presence of the “left tail” of the distributions indicates that the formative time delay distribution cannot be neglected in theoretical description of the breakdown voltage distributions.

**Key words:** Breakdown voltage distribution, Statistical convolution model, Electrical breakdown, Neon.

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## S8\_P79

### SENSOR WITH NANOSTRUCTURED SURFACE FOR RESONANT ANALYSIS TECHNIQUES

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The new structure of resonant detector, with three specific resonances and a reference channel, develops a new research direction in single molecule detection with the purpose to eliminate the

requirement of multiple sensitive surfaces functionalized with specific ligand for Surface Plasmon Resonance (SPR) measurements.

The development of detector began from Evanescent-Wave Cavity Ring-Down Spectroscopy (EW-CRDS) technique, that extends the CRDS method to surfaces, thin films and fluid/solid interface. The surface modification with a passivated silver thin film on a sensitive surface half and a silver nanostructured array on another sensitive surface half turns the EW-CRDS detection system into SPR system. The presence of a silver nanostructured array on surface half is similar with a sub-wavelength metallic grating.

The evanescent waves are diffracted through grating in propagating waves into the far-field. An additional Fabry-Perot (FB) cavity formed in the front of a photomultiplier allows the modal selection from the near-field to far-field distribution with a high diluted analyte present into the FP cavity.

The results for testing of detector with high diluted solutions of Stilbene 420 and Rhodamine Chloride 590 in alcohols are presented.

The possible applications of the proposed sensor model are in the range of high sensitivity spectroscopic analyses for chemistry, biology, medicine, pharmacology and environmental science.

### **S8\_P80**

#### **GEOMETRY OPTIMISATION OF SHAPED COMB DRIVE USED AS A MICROTWEEZERS ACTUATOR**

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The purpose of this paper is to determine an optimum design for a dc-actuated, jagged-edge shaped comb drive used in micro electromechanical systems (MEMS) devices where precision micromanipulation and force-controlled interaction are required. Simulations were performed in the 2D domain using the finite element method (FEM) in the Comsol Multiphysics software package. Several geometries were analyzed here, starting with the design having a minimum and maximum gap distances between fingers of 3 and 7  $\mu\text{m}$ , which complies with the Multi-User MEMS Process (MUMPs). Comb displacement with respect to actuation voltage and electrostatic force acting upon the movable comb teeth as a function of finger displacement were plotted and compared for all the designs.

*Keywords:* jagged-edge design, von Mises stress, total displacement

### **S8\_P81**

#### **STAR CONFIGURATION OF POWER FACTOR CORRECTION UNITS IN LED LIGHTING SYSTEMS**

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As a result of rapid development of LED lighting solutions and taking into account the new international regulations (Energy Star<sup>®</sup> and EN61000-3-2:2006) regarding the power factor, the power factor correction unit should be a compulsory component in any system that uses this kind of illumination.

The present paper covers the concept, design, fabrication and testing of a lighting system composed of one major PFC unit and the individual drivers that deliver the power to the LEDs. This new star architecture has many advantages over the conventional parallel one used at the present time, which utilizes low-power individual PFC units. The presented configuration is designed to be used “as it is”, with almost zero modifications on the existing electrical connections in most households or institutions. The system is designed for a maximum absorbed power of 2kW, but virtually any power limit could be achieved, depending on the specific requirements of the space to be illuminated.

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## **S8\_P82**

### **LED OUTPUT SPECTRUM ENHANCEMENTS USING COMMON ORGANIC FLUORESCENT PIGMENTS**

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White LEDs and warm-white LEDs have greatly evolved in recent years, and started to replace on a very large scale the conventional incandescent and even CFL (compact fluorescent lamp) light sources in modern lighting systems. Having luminous flux efficiencies of more than 120lm/W, power capabilities of over 80W (multichip) per LED, lifetimes in the range of tens of thousands of hours and CRI indices of more than 85, current high-power LEDs are the most advanced and efficient light sources.

Despite the great increase in efficiency and degree of miniaturization, the basic construction principles that dictate the spectral characteristics remained almost the same, and although not obvious to the naked eye, the output spectrum of such LEDs greatly differs from the solar spectrum.

The present paper is focused on altering the output spectrum of blue and white LEDs by using common commercially available fluorescent pigments, such as Rhodamine 6G, Rhodamine 123, Fluorescein and Pyranine. The pigments were dispersed in a silicone caulk and deposited on different blue and white LEDs. We recorded the output spectra and we determined the pigment concentrations required for an optimum match to the solar spectral distribution. The resulting chromaticity diagram coordinates, luminous flux efficiency, spatial radiation pattern and stability over time and over a great range of temperatures were also studied.

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## **S8\_P83**

### **THE ESTIMATION OF BAND GAP ENERGIES FOR ZINC OXIDE NANOPOWDERS USING TAUC MODEL**

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Zinc oxide (ZnO) is an important inorganic material, with many applications (*e. g.* optoelectronics, sensors, piezoelectric and wireless devices, spintronics, pharmaceuticals, cosmetics, UV absorbers), some of them being due to its optical and electrical properties, which are dependent on the particles features. The control of nanomaterials morphologies is an important goal of materials science and it can be made by optimizing synthesis conditions.

In our study we focused on the correlation between the synthesis routes, the morphologies of obtained particles, and the optical properties, determined using UV-VIS spectra, respective the band gap energies, whose values were estimated using Tauc relation.

We prepared and characterized (particles size, lattice structure of crystals, optical and electrical properties) ZnO nanopowders, in the presence of PEG-200 and Triton X-100 as surfactants. The nanopowders morphologies were characterized using Transmission Electron Microscopy, High Resolution Transmission Electron Microscopy, Selected Area Electron Diffraction, and IR spectra. The mean diameter values were found in the 20 – 30 nm range and are dependent on the synthesis route. The values of the optical band gap energy, determined according Tauc equation, were around 3.50 eV, higher compared with bulk ZnO (3.37 eV). The results were in good agreement with the dependence of optical and electrical properties on the particles morphologies, and the values of band gap energies recommend the obtained nanopowders as proper materials for electronic devices and photovoltaic cells.

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## S8\_P84

### THE IMPORTANCE OF MOLECULAR ASYMMETRY FOR DYE SENSITIZED SOLAR CELLS PIGMENTS

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We report the results of a combined experimental and theoretical study that compares two metal-free organic pigments with very similar structure and properties, but different symmetry as TiO<sub>2</sub> sensitizers in photoelectrochemical cells. The two dyes are 5, 5' - indigodisulfonic acid disodium salt (indigo carmine, IC) and **5, 5', 7 - indigotrisulfonic acid tripotassium salt (potassium indigotrisulfonate, ITS)**. Both pigments have anchoring groups, -SO<sub>3</sub><sup>-</sup>, which allow binding to the oxide substrate. The UV-Vis spectra show a good and very similar matching to the solar spectrum for both pigments, in the reduced form, with the absorption maxima at 610 nm (IC), respective 600 nm (ITS). Although the dye with lower symmetry was expected to lead to higher efficiency DSSCs experimentally we found the reverse, with efficiencies of 0.044 for IC and 0.016 for ITS. The explanation is provided by DFT calculations, which revealed the role of -SO<sub>3</sub><sup>-</sup> groups in the confinement of the photoexcited electron at the center of the dye molecule, leading to weaker orbital overlap with the semiconductor conduction band states and weaker charge transfer. We also

mention other factors, such as the solubility and, consequently, the quantity of pigment available to be adsorbed onto semiconductor layer, and the stability of pigments reduced forms.

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**S8\_P85****AZODYES METAL COMPLEXES AS PIGMENTS FOR DYE SENSITIZED SOLAR CELLS**

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We compare the performances of an organic dye and of its complexes with metals like Cr(III), Fe(II), Co(II) as sensitizers for dye-sensitized solar cells. The organic dye used both as pigment and as ligand for metallic complex is Mordant Yellow 10 (MY-10), 5-(4-sulfophenylazo)salicylic acid disodium salt. The UV-Vis spectra of the pigments adsorbed onto semiconductor layers show bands shifted from the 394 nm peak of the metal-free dye to higher wave lengths, into the visible (404 nm for Fe(II) complex, 406 nm for Cr(III) complex,). The performance of DSSCs, as evidenced by the values of the efficiencies and the fill factors, demonstrate that, compared to the MY-10 pigment ( $\eta=0.024$ ), the metal-complexes are better candidates as pigments for DSSCs, with  $\eta=0.086$ , 0.053 and 0.027 for Cr(III), Co(II) and Fe(II), respectively. The dependence of the absorption spectrum and the nature of the excited states of the complexes on the nature of the metallic ions and coordination geometries, were investigated by electronic density functional methods. We found that the octahedral coordination provides a better matching between calculated and experimental spectra for all metallic ions, than the tetrahedral or square-planar coordination geometries. All spectra feature weak intensity transitions at large wavelengths and very intense bands in the violet region assigned to  $p \rightarrow p^*$  electronic transitions.

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**S8\_P86****THE INFLUENCE OF NANOCRYSTALLINE TiO<sub>2</sub> AT THE MESOPOROUS TiO<sub>2</sub> /FTO INTERFACE IN Dye Sensitized Solar Cells**

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Since 1991 when dye sensitized solar cells formed a new branch of photovoltaic cells, studies have evolved towards improving results through understanding the processes occurring in the cell structure. Thus it was observed that dye sensitized solar cell performance is improved by an intermediate layer of TiO<sub>2</sub> nanocrystalline between glass substrate and semiconductor mesoporous TiO<sub>2</sub>.

This paper summarizes the results for depositing nanocrystalline TiO<sub>2</sub> layer as follows: from aqueous solution of TiCl<sub>4</sub>, by spin coating of Ti(i-OPr)<sub>4</sub>-based solution and by pulsed laser deposition of TiO<sub>2</sub> powder. It studies these nanocrystalline TiO<sub>2</sub> layer influence on the parameters that characterize the DSSC's.

### **S8\_P87**

#### **Linear approximation ADC**

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Using a linear approximation (signal = m\*time+n) we implement a new ADC configuration using partial linear approximation of input signal. Future development can be carried out using more complex function (polynomial, spline, etc). Linear approximation was carried out using software application design and implemented for Microchip microcontroller, and tested on PIC12F675 development board. Hardware implementation are quite simple, using 2 ADC and one derivator circuit. Derivator circuit and one ADC are used to evaluate the m parameter and second ADC are used for estimate n. Results are send to a PC after conversion using RS232 protocol, build using Software UART library from MicroC PRO for PIC.

Keywords: ADC, linear approximation, Microchip

### **S8\_P88**

#### **Reversals of wind in thermal convection**

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A large-scale circulation velocity, often called the "wind", has been observed in turbulent convection in the Rayleigh-Benard apparatus. The wind undergoes an occasional and relatively sudden reversal of its direction.

Since reversals occur in many contexts such as the magnetic polarity of the earth and the wind direction in the earth's atmosphere the problem is of some broad interest.

The tendency of the wind to reverse its direction in the presence of an insulating layer of polyethylene terephthalate which covers the inside of sidewalls is studied. The range of dynamical control parameter, or Rayleigh number  $Ra$  covered was  $10^9$ - $10^{13}$ . As a result of insulating layer, the sidewall resistance was increased by an order of magnitude with respect to lateral conduction between the fluid and the sidewall, and by a factor of about 2 with respect to conduction along its height between the bottom and top plates. By making this modest change, it is found that the onset of wind reversal has been postponed to a higher Rayleigh number and at  $Ra = 1 \times 10^{13}$  although reversals occur, the mean wind seems to have a preferred direction ( $\log \mu = 0.6535$ );  $\log \mu$  unity correspond to the case when the wind has not average preference for one direction over the other.

**Keywords:** Rayleigh-Bénard convection; mean wind; reversals.

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**S9\_P01****Classical Molecular Dynamics Simulation of PuO<sub>2</sub>**

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Nuclear fuels are generally tough materials to investigate. Radioactivity and toxicity are well known problems. Also it is hard to obtain an undamaged crystal structure because of extreme conditions like irradiation and temperature. Molecular dynamic simulation is a good way to demonstrate without these limitations. Plutonium dioxide (PuO<sub>2</sub>) is a main compound of a mixed oxide (MOX) fuel. We have developed a new semi-empirical rigid ion potential to model interactions between ions. Here we investigate the evolution of nuclear fuel material, PuO<sub>2</sub> with temperature. Preliminary results are promising.

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**S9\_P02****MONTE CARLO SIMULATIONS IN Ar/BF<sub>3</sub> DISCHARGES**

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In this work we present rate coefficients for negative ions in Ar/BF<sub>3</sub> mixtures for the conditions used in plasma assisted technologies for semiconductor production. Boron produced in plasma devices continues to be the main p-type dopant in ion implantation of semiconductor devices. Yet plasma parameters of most frequently used Boron rich gas BF<sub>3</sub>, often in mixture with Ar are not well established. The cross sections for scattering of F and BF<sub>4</sub><sup>-</sup> ions on Ar atom and on BF<sub>3</sub> molecule are calculated by using Nanbu's theory separating elastic from reactive collisions. A Monte Carlo simulation technique was applied to perform calculations of transport parameters in DC electric fields.

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**S9\_P03****Theoretical Models for Magnetic Properties of Iron Pnictides**

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We attempt to describe the magnetic properties of parent pnictide compounds by using both the  $J_1$ - $J_2$  Heisenberg model and its three-dimensional generalization, the  $J_1$ - $J_2$ - $J_c$  model. We also include spin anisotropy in the XY plane. In order to obtain the average magnetization and spin wave dispersion, we use the Green's functions method for spin operators. The equations of motion for Green's functions are decoupled by employing the random phase approximation (RPA) or so-called Tyablikov's decoupling. We obtain estimates for the model parameters by considering the experimental dispersion law for the compounds  $\text{CaFe}_2\text{As}_2$  and  $\text{BaFe}_2\text{As}_2$  and conclude that theoretical dispersion curve can fit the experimental one only if spatially anisotropic Hamiltonian is used. However, although qualitative behaviour is satisfactory, when we calculate the Neel temperature for these compounds with the obtained sets of model parameters, we get results which far exceed the measured values. In three dimensions, this is true regardless of the value of the spin anisotropy parameter  $\gamma$ . In two dimensions, the Neel temperature depends very strongly on  $\gamma$  and one can get a good agreement between theory and experiment, but only if one takes  $\gamma$  to be extremely small, with  $\gamma = 10^{-15}$ . The fact that only this physically unreasonable set of parameters gives a good estimate for the Neel temperature suggests that the itinerant models might be better suited for iron pnictides than the Heisenberg model. Finally, we attempt to determine the temperature range for which the Heisenberg model gives a good description of magnetic properties of parent pnictide compounds. We do this by comparing theoretical results with the experimental data on the neutron diffraction intensities and magnetic susceptibility for the compounds  $\text{SrFe}_2\text{As}_2$  and  $\text{BaFe}_2\text{As}_2$  respectively.

Keywords: Iron Pnictides, Heisenberg antiferromagnet, Green's function, dispersion

ACKNOWLEDGMENTS: This work was supported by research Grants No. OI171009 from the Ministry of Education and of the Republic of Serbia.

## S9\_P04

### Symmetry Preserving Deformations of Carbon Nanotubes

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Single-walled carbon nanotube is example of the structure with maximal symmetry, in the sense that it can be generated from an arbitrary atom by the action of the transformation an atom completely define nanotube conformation. As far as group is considered, it is the line group from the first family  $\mathbf{L}^{(1)} = \mathbf{T}_Q(f) \mathbf{D}_n$  for chiral tubes, and in the achiral cases from the thirteenth family,  $\mathbf{L}^{(13)} = \mathbf{T}_{2n}(f) \mathbf{D}_{nh}$ . Here  $\mathbf{T}_Q(f)$  stands for the infinite cyclic group of the generalized translations, generated by  $(C_Q|f)$ , where  $C_Q$  is the rotation for  $2\pi/Q$  ( $Q$  is real number greater than 1) followed by translation for  $f$  along  $z$ -axis.  $C_n$  is rotation for  $2\pi/n$ , where  $n$  is an integer.

Deformations preserving symmetry are those which do not change symmetry group, or precisely the deformed and nondeformed structures have isomorphic symmetry groups. According to the structure of the line groups [1], it is obvious that stretching of the tube corresponds to the change of the parameter  $f$ , i.e. fractional translation. Analogously, change of the rotational part of the helical transformation leads to torsion. On the other side, change of the radial coordinate of the initial atom is equivalent to the breathing of the tube. Change of the other two coordinates (azimuthal angle and

height of the initial angle) results in a different types of dimmerisations, and not to the global homogeneous deformation. Therefore, we analyze three global homogeneous deformations. We change parameters of torsion, stretching and breading in the range of -5% to 5% and monitor response of the system in terms of electro-optical properties (gap and optical absorption), mechanical properties, diffraction patterns and Raman features . The ost interestin detail is periodicity of the gap, and the derived properties.

[1] M. Damnjanovic, I. Milosevic, Line Groups in Physics, Springer, Berlin, 2010

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### S9\_P05

#### Surface properties of alpha and beta GLUCOSIDASE FROM THERMOTOGA MARITIMA. A computational approach .

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Alpha-glucosidase hydrolyzes 1-4 linked alpha-glucose residues to obtain a single \glucose molecule, whereas beta-glucosidase acts upon beta 1-4 bonds linking two glucose or glucose-substituted molecules. Within this study we analyze their surface properties in order to discover similarities or differences related to their distinct ability to act on alpha 1-4 and beta 1-4 glucose bonds respectively.

The surface roughness is almost similar, the surface fractal dimensions of the two proteins being  $2.41 \pm 0.01$  for alpha-glucosidase and  $2.39 \pm 0.01$  for beta-glucosidase. Also, the two proteins have global hydrophylic character, the grand average of hydropathicity (GRAVY) index being -0.377 for alpha-glucosidase and -0.223 for beta-glucosidase.

Even if the number of amino acids in sequences is not so different (480 for alpha-glucosidase and 415 for beta-glucosidase), sequence alignment shows only 18% sequence similarity between the two glucosidases. The sequence dissimilarity is also reflected by the biggest number of cavities predicted with Fpocket software, 19 for alpha-glucosidase and 34 for beta-glucosidase.

These data are not sufficient to answer to our question and future investigations are needed.

**Keywords:** glucosidase, surface roughness, cavity prediction, hydropathicity.

This work was partially supported by the grant POSDRU 107/1.5/G/13798, inside POSDRU Romania 2007-2013 co-financed by the European Social Fund – Investing in People and by the project IPA-464 ROSNET .

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**S9\_P06****Prediction of Phase Transitions in Liquid Crystals by Using Neural Network**

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Gamma rays bursts (GRBs) are short and intense gamma ray flashes, that are isotropically distributed in the celestial sphere. In general the GRBs exhibit nonthermal spectra, which can be fitted by an empirical function, named Band function. The emission mechanisms continue to be an object of the intense research and debate. There have been suggested several correlations between peak energy in the rest-frame ( $E_p$ ) and luminosity or energy, which might be intrinsically true or a consequence of detectors selection effects. If true, these relations are important to constrain the emission mechanisms of the GRBs and as distance indicators. In this work we study  $E_p$ -luminosity relation (Yonetoku relation), by generating a synthetic population of GRBs and conclude on the origin and dispersion of this relation.

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**S9\_P07****Fast Neutron Radiography Image Enhancement by using Artificial Neural Network**

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Fast Neutron Radiography (FNR) is appropriate and promising for non-destructive inspection methods with nuclear techniques and especially for non-destructive tests of industrial products. In this study, FNR works were done with the 14MeV neutrons which are produced via the D-T reactions on a SAMES T-400 neutron generator. Samples were placed between the neutron source and a fast neutron sensitive scintillator screen which was developed in Research and Development Department in ÇNAEM and their images are acquired digitally with the CCD camera. Image enhancement techniques and Artificial Neural Network (ANN) were applied for efficient and fast acquisition of these images. This is the novel approach for thus with the FNR system, images that are acquired in long irradiation time can be acquired from the images that are acquired in short irradiation time.

**Key Words** : fast neutron radiography, Artificial Neural Network (ANN), image processing

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**S9\_P08****AN OVERVIEW ON MODELLING SIMULATION AND COMPARISON OF DIFFERENT SEGMENT MODELS**

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Walking is a fundamental model of human locomotion and physical activity, characterized by smooth, regular and repeated movements. For a better understanding and identification of the function and the structure of the musculoskeletal system, mathematical programs to simulate a movement can be used.

Dynamic simulations of biomechanical models within a rigid body framework are becoming more and more important. During last decades have been many studies and publications in this field.

The purpose of the present study is to make an overview of different segment models and to compare them, in order to extend our understanding on modeling walking dynamics and studies in muscle function.

For simulation purposes, the number of the segments and muscles can be chosen according to the movements, adopting the processing load to the complexity of the task. A good objective for gait simulation is to obtain a limit cycle showing stability and repeatability.

An overall of the work is to present different models of the body, which could be used to simulate a wide range of locomotion tasks, including walking.

**S9\_P09****The study of AMORPHOUS SELENIUM OBTAINED THROUGH THE VACUUM EVAPORATOR by simulation**

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A number of generated atoms from elementary selenium cell is firstly performed in a first stage; then is accounted the interferential function  $i(S)$  and a Radial Distribution Function (RDF) is found. The optimal conditions about number of generated atoms and the form of model are found as consequence. Secondly, the location of a random atom in the generated model was changed randomly. A comparison between the new interferential function and the interferential function obtained before (*Guda B., Dede AIP Conference Proceedings; Journal Volume: 1203, Jan 2010*) is done. If the difference is smaller than that old one, then the changed position of this of atom is

saved and we proceed successively, until this difference become negligible. The definitive atoms positions for generated model are finally obtained.

This method enabled to define the optimal conditions about generated model. The used program has generated one cubic elementary cell according to three directions. Referring the Debye relations:

$$i(S) = \frac{2}{N} \sum_n B_n \frac{\sin Sr_n}{Sr_n} \quad \text{and} \quad 4\pi \int_0^\infty \rho(r) \frac{2r}{S} \int_0^S Si(S) \sin(rS) dS$$

where  $N$  the atom model number,  $B_n$  the repetition distance number of atomics couples,  $\rho_0$  the average density of selenium, is found RDF  $\rho(r)$ . Taking the starting point the center of model the RDF is also calculated; finally the difference between these two RDFs is compared.

During this practice are changed both the atomics number and the model form. As the optimal conditions a spherical shape of model and the number of atoms must be greater than 80 were resulted.

Latter is generated the hexagonal cell of Selenium (the space group  $P3_221$ ). The effects associated with thermal motion and tension defects are taken into consideration by a normal distribution for the repetition distance number  $B_n$ . The comparative method, which is also used between (RDF) (1) of amorphous Selenium and generated model RDF, yield compliance for the first peak only.

A second stage consisted at random change of the location for one random atom in generated model. Our model was the sphere and 88 generated atoms placed into this sphere. The atoms were generated through hexagonal cell of selenium, composed of three atoms  $(u00, \bar{u}\bar{u}1/3, 0u2/3)$  with  $a=4.6406 \text{ \AA}$   $c=4.9495 \text{ \AA}$  and  $u=0.217$ ). In this case is done the comparison between the interferential function (*defined before by authors*) and that which is calculated from generated atoms of sphere model. (The interferential function is chosen instead of RDF because the RDF calculated from interferential function carries even more the limitations of diffraction equipment about upper and the lower limits  $S$ ). Finally is received a satisfactory compliance between two above mentioned interferential functions, and the definitive positions of atoms are fixed.

## S9\_P10

### A novel non-polynomial Schrodinger equation for high-density cigar-shaped condensates

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The dynamics of a high density cigar-shaped condensate is investigated using a one-dimensional non-polynomial Schrödinger equation specifically designed for high-density cigar-shaped condensates. The key ingredient of the equation is a q-Gaussian ansatz which accurately describes the high-density regime of a Bose-Einstein condensate.

**S9\_P11****Light hadron spectrum from LQCD**

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We present simulations for the light hadron spectrum with the Wilson action in quenched QCD carried out on the BG HPC cluster, using Fermiqcd. Simulations are made with the plaquette gauge action on  $8^4$ ,  $12^4$ ,  $16^4$  lattices at three lattice spacings, for a total number of 100 SU(3) gauge configurations. We study the dependence of the hadron masses on the lattice spacing, while the physical volume is constant and the finite volume effects when the lattice spacing is constant.

For the quenched hadron spectrum we find that after chiral and continuum extrapolations, the agreement of the calculated mass spectrum with experiment is at a 10% level.

Key-words: chiral fermions, hadron spectroscopy, quantum chromodynamics, Fermiqcd.

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**S9\_P12****A Study of Low Temperature Thermal Expansion and Structural Behaviour of Stromeyerite AgCuS**

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We have studied thermal properties of orthorhombic  $\beta$ -AgCuS in the range of from 10 K up to 360 K. We present molecular Dynamics simulation results for the temperature dependence of thermal expansion and structural behaviour of  $\beta$ -AgCuS. The interaction potential used in this calculation was the functional form proposed by Vashishta and Rahman. The results of this study corroborate with the results in the literature.

## References

- 1) P. Vashishta and A. Rahman. Phys. Rev. Lett. 40. 1337 (1978).
  - 2) D. M. Trots et al. J. Phys.: Condens. Matter 19 136204 (2007).
  - 3) M. Knapp et al. Nucl. Instrum. Meth. A 521, 565 (2004)
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**S9\_P13****Monte Carlo simulation on Projectile Spectator Detector**

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The traverse momentum, the sphericity and Fourier analysis have been the most common methods applied to analyzing the experimental data regarding the collective flow. Using these techniques we discuss the feasibility of the reaction plane determination for 15 A GeV energy range for Au-Au collisions in CBM experiment by using Monte Carlo simulations on Projectile Spectator Detector. The Compressed Baryonic Matter Experiment at the upcoming Fair accelerator aims to create highest baryon densities at energy range from 2 to 40 GeV/u and to explore some properties of the matter like short-lived light vector mesons, mesons containing charm or anti-charm, collective flow of all observed particles, little studied in this region.

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**S9\_P14****AN OVERVIEW ON MODELLING SIMULATION AND COMPARISON OF DIFFERENT SEGMENT MODELS**

Bendo Aida, KovaAşi Fatbardha, SkA«nderi Dhimitraq, VeveAşka AfA«rdita

Walking is a fundamental model of human locomotion and physical activity, characterized by smooth, regular and repeated movements. For a better understanding and identification of the function and the structure of the musculoskeletal system, mathematical programs to simulate a movement can be used.

Dynamic simulations of biomechanical models within a rigid body framework are becoming more and more important. During last decades have been many studies and publications in this field. The purpose of the present study is to make an overview of different segment models and to compare them in order to extend our understanding on modeling walking dynamics and studies in muscle function.

For simulation purposes, the number of the segments and muscles can be chosen according to the movements, adopting the processing load to the complexity of the task. A good objective for gait simulation is to obtain a limit cycle showing stability and repeatability.

An overall of the work is to present different models of the body that could be used to simulate a wide range of locomotion tasks, including walking.

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**S9\_P15****Social networks with preferential attachment have lognormal degree distribution**

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We consider the effect of introducing preferential attachments rules to social networks. The social networks created according to the rule "friends of my friends are my friends" have been introduced a decade ago. In them, if A knows B and C knows B, then A and C are introduced and become friends, too. We modify these rules of behaviour so that A and C become friends with a probability that depends on the number of links the nodes already have, i.e. preferential attachment rules. While the degree distribution of the former networks follows a power-law, we show that the modified rules of attachment produce a lognormal distribution. The repercussions could extend to opinion formation models, economics, etc.

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**S9\_P16****A model of opinion formation in majority election systems**

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We study the behaviour of the number of votes cast for different electoral subjects in majority elections, and in particular, the Albanian elections of the last 10 years, as well as the British and Canadian elections. We report the frequency of obtaining a certain percentage (fraction) of votes versus this fraction for the parliamentary elections. In the distribution of votes cast in majority elections we identify two regimes. In the low percentages we see a power law distribution, with exponent about -1.7. In the power law regime we find over 80% of the points, while they relate to 20% of the votes cast. Votes of the small electoral subjects are found in this regime. The other regime includes percentages above 20%, and has Gaussian distribution, followed by a long tail. It corresponds to big parties. A similar pattern is observed in other first past the pole (FPP) elections, such as British and Canadian. However, the poll-by-poll elections results for Canada show that the distribution is power-law, with an exponential cutoff, rather than a Gaussian at the tail. By comparing distributions for Albania, Russia, and Canada, we build a model that reproduces the observed data. We show that this distribution can be reproduced by a model of opinion formation that treats the voters as spins in an external field created by electoral campaigns of different electoral subjects. The presence of the neighbours is felt via the voters' perception of their opinion. This model agrees very well with the real life data.

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**S9\_P17****Simulations and comparison of different methods of cleaning chromium pollution from soils**

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We present results of Monte Carlo simulations of Chromium transport and run off in soil. The processes taken into consideration that influence transportation are physical transportation, adsorption, chemical reaction, and plant uptake. We have evaluated the influence of each of them separately and combined. The process occurs in a two dimensional lattice in which there are randomly distributed adsorption sites. The system is continuously supplied with chromium molecules which randomly walk through the lattice until it reaches equilibrium. We pay special interest to the process of cleaning the pollution, comparing different methods of doing this, such as: rinsing, chemical cleaning, and using plants that capture the chromium ions.

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**S9\_P18****MODELING OF FRICTION AT DIFFERENT SCALES**

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In macroscopic sense friction force of sliding is the force that opposes relative motion of solid surfaces, layers of liquid, liquids and solids. Friction force is, in general, complex manifestation of the effect as a result of the different physical phenomena: elasticity, adhesion, viscosity, capillarity, phonon and the electrostatic interaction, etc. All of these are manifested as irreversible transition of mechanic energy in heat.

Depending of the depth going into the essence of friction, or scale where it is investigated, modern tribology (scientific and technical discipline of frictional phenomena) is divided into: macrotribology, microtribology and nanotribology. Macrotribology studies big objects and it doesn't enter into consideration of structure of matter. Nanotribology explains friction as interaction of individual atoms. Microtribology is between nanotribology and macrotribology.

Construction of the model used for describing friction, in crucial sense, depends of the scale at which we observe the matter. As the possibilities for performing measurements and simulating effects on different scales were developed, so the models were changing that were used in such situation. The paper gives the analysis of several such kind of models, among which are: Prandtl-Tomlinson model and Frenkel-Kontorova model.

**Keywords:** friction, modeling

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**S9\_P19****ABOUT SOME GENERALIZED ANALYTICAL MODELS FOR THE QUASISTATIC BENDING OF A BERNOULLI-EULER BEAM**

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Addressing the problem of the quasistatic bending of homogenous straight beams (bars), the paper presents, from simple to complex, the analytical models for some general situations individualized by the combination of: (a) the absence / presence of an elastic base (bed, support); (b) the absence / presence of a compressive / tensile axial force; (c) beam with constant / variable moment of inertia, and (d) beam with constant / variable distributed load. The generality of these (mathematically both beautiful and powerful) models enables their application in the study of the quasistatic bending of any mechanical structure equivalent to a homogeneous straight beam (bar), examples for a NPP being: fuel elements, pressure tubes, pipes, structural beams etc.

**Key words: bending of beams, analytical models**

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### **S9\_P20**

#### **PC method in front of ITLC method for investigation of radiochemical purity of $^{99m}\text{Tc}$ -eluate**

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The prevalent use of radiopharmaceuticals labeled with  $^{99m}\text{Tc}$  has created the need for a rapid accurate technique to test the radiochemical purity of these compounds. Because the different chemical states of technetium show different biologic behaviors, knowing the relative amounts of each is important to the proper evaluation and use of  $^{99m}\text{Tc}$ -labeled radiopharmaceuticals. The conventional ITLC tests tend to show relatively higher level of free pertechnetate, which could be significant. But ITLC-SG papers are very expensive. The main objective of this study is to replace ITLC method with a simpler alternative one, PC method, as a rapid, inexpensive and chemically reliable process that may be used in any nuclear medicine department where it is desired to test water-soluble  $^{99m}\text{Tc}$ -labeled radiopharmaceuticals for labeling efficiency before administration to patients. A comparative evaluation of different systems is accomplished using different chromatographic papers (Whatmman S&S 2698C, Whatmman No. 4, Whatmman Chr.1, Whatmman S&S 2598a, Whatmman No. 31 ET Chr), as stationary phases and eluents (Acetone, NaCl 0.9%, Acetonitrile 50%, MEK, Alcohol absolute, Ethyl acetate: MEK 3:2, Sodium acetate 13.6%), as mobile phases. The results show that the PC method, for some of the above mentioned systems, can replace ITLC methods (expensive methods) to control radiochemical purity of pertechnetate.

**Keywords:** radiopharmaceuticals, radiochemical purity, technetium,  $^{99}\text{Mo}$ - $^{99m}\text{Tc}$  generator.

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### **S9\_P21**

#### **Computational Tools in Neutron Scattering Instruments Design and Optimization and for Experimental Data Processing**

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In neutron spectrometry the optimal use of the neutrons supplied by the available neutron sources is of the greatest importance. The usual way to do it is to maximize the neutron flux at sample by using neutron guides, supermirrors [1] or spatial focusing effects. Optimization of an experimental configuration and a proper design of it, mainly by using Monte Carlo procedure, received a special attention since many years.

A different approach [2] is to obtain a very good resolution not by getting focused beams at sample or anywhere else, but only by decreasing as much as possible the scan variable variances. During the last period special configurations using inverse-space focusing to get high resolution properties have been developed.

To design and optimize such a configuration both Monte Carlo and matrix procedure [3] were used. The **DAX** program and the adapted Monte Carlo program will be presented in this paper.

Two programs for the experimental data processing, **LSQ1 program for the grain size and the second order strain determination** and a **Rietveld refinement program to process the pattern measured on inverse space focussing diffractometer** were developed and will be presented in this paper too. The Rietveld program has to be further modified to be suited for an inverse-space focusing instrument using a position sensitive detector.

References:

[1] **P. Boni**, *J. Neutron Research*,5, (1996), 59-63.

[2] **I. Ionita, A.D. Stoica, M. Popovici, N.C. Popa**, *Nuclear Instruments & Methods in Physics Research, A 431* (1999), 509-520.

[3]**I.Ionita, A.D.Stoica**, *Journal of Applied Cryst.*, **33** (2000) 1074- 1087

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## S9\_P22

### PERFORMANCE SIMULATION OF THIN-FILM COMPOSITE BAW RESONATORS USING A FINITE ELEMENT METHOD

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Resonators based on bulk acoustic waves (BAW) are extensively used in wireless applications such as cellular phones, data communication, navigation, pager and satellite communication. In this paper is showed how can be modeled a thin film BAW resonator based on ZnO/Al/Si trilayer using a Finite Element Method(FEM) implemented with Comsol Multiphysics simulation software. The simulation was performed in two steps: first was computed and investigated the eigenmodes of a 950  $\mu\text{m}$  wide structure and in the second step was analyzed the frequency response of the resonator. A graph of the admittance as a function of the frequency was computed, in the range of 0.215 GHz

- 0.235 GHz. The electro-mechanical quality factor of the resonator as a function of the frequency was also revealed.

*Keywords:* frequency response, bulk acoustic mode, eigenfrequency

### S9\_P23

## STUDY OF THE PRESENT STAGE OF THE INVERSE PROBLEM OF THE DARK CURRENT SPECTROSCOPY IN CCDs

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Due to their unprecedented sensitivity levels, the Charge Coupled Devices (CCDs) became also extremely vulnerable for their ultra-low dark currents (of the magnitude order of few pA/cm<sup>2</sup>), which make important the presence of even only a single nano-defect [1]. Taking into account the huge number of possible nano-defects types, their identification became extremely important and the Dark Current Spectroscopy (DCS) method was pointed as very efficient due to its reduced sensitivity range ( $E_F \pm 50$  meV) around the Fermi level. Given being the defects contributions to the dark current are brought by the depletion currents, in order to improve the accuracy of the depletion dark current description by means of the Shockley-Read-Hall (SRH) rigorous quantum model, this work introduced the new parameter "polarization degree of capture cross-sections of free electrons and holes, respectively" [2].

Besides its ability to provide considerably more accurate evaluations of the depletion dark current in semiconductors, this new parameter represents a useful tool for: a) the analysis of some "anomalies" of the generation rate values, b) the assignment of deep-level traps for each CCD pixel, starting from the experimental data concerning the temperature dependence of the dark current in CCDs.

References:

1. a) WIDENHORN R., MÜNDERMANN L., REST A., BODEGOM E., *Meyer-Neldel rule for dark current in charge-coupled devices*, J. Appl. Phys. 89, 8179 (2001); b) WIDENHORN R., *Charge Coupled Devices*, VDM, Saarbruecken, Germany, 2008.
2. a) TUNARU I., WIDENHORN R., IORDACHE D., BODEGOM E., *Computational Approach to Dark Current Spectroscopy in CCDs as Complex Systems. II. Numerical Analysis of the Uniqueness Parameters Evaluation*, Sci. Bull. "Politehnica" Univ. Bucharest, Applied Mathematics and Physics, **73**(4), 149-162(2011); b) BODEGOM E., WIDENHORN R., IORDACHE D., TUNARU I., *Study of some Additional Possibilities and of the Evaluation Limits of the Dark Current Spectroscopy (DCS) Method*, Annals of the Academy of Romanian Scientists, Series on Science and Technology of Information, **4**(1) 23-42(2011).

**S9\_P24****Study on electron diffraction calibration methods**

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The calibration of electron diffraction pattern are major problems when we use an electron microscope. Electron microscope are very complex apparatus, and development of efficient algorithm to perform calibration task are difficult. Many factors, ie high tension stability, power amplifiers used for lens supply, external noise, can affect the calibration. Also, the sample geometry, alignements of microscope gun and column can act to disturbe calibration settings.

We try to solution calibration problems, without use of etalon sample. We implement a mathematical algorithm that works for any sample, but only til a constant. The idea of this algoritm is are based on capabilities of microscope to form images and variation of eucentric high. In electron diffraction case we can obtain a pattern using C2 lens or C3 lens (upper pole of objective lens). Second case are not suitable for our algorithm, the pattern dimensions (circle radius and distance spot to spot) are not affected by eucentric high value. Using this algorithm we adjust calibration setting to a constant that depends only by geometrical future of image acquisition system (pixel dimension).

Keywords: SAED, C2 C3 lens, calibration

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**S10\_P01****QUALITY OF EVALUATION IN TEACHING PHYSICS**

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Improvement of quality in education is today an important topic. Quality education must be relevant to each individual, for community but also for global development trends. The educational system and policies must redefine their goals and content. What is relevant today? There are important informations or skills, attitudes the school should develop? Thus, educational policies must anticipate future needs.

Physics has the role of forming scientific conception about life and relationships between physical phenomena and other sciences. The students can achieve models and concepts, they can use tools and devices for investigating the surrounding world and be able to communicate. A quality evaluation of teaching results can improve the pedagogical strategies. Communication plays a defining role. That is what quality education should develop communication skills.

*Keywords:* quality of education, self-assessment, initial and continuous evaluation, feedback, competencies, communication skills, research and understanding.

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**S10\_P02****Learning Science through creative writing and drama activities in primary and secondary school classes**

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Science and technology play an important role in our modern society. It is important to know the scientific concepts, their usefulness to society, but also the ethical and moral issues, respectively the possibility of multiple choices. Thus, the question is not only the connection, interdependence between science and society but the influence of science on the social and natural world today and especially in the future.

Science is often perceived as elitist, accessible only to the elect. On the other hand, artistic activities (drama, literature, art) offer a more lively, non-traditional way of learning and involve the majority of the students in the science class. Young students are willing to draw, play or write stories. And so, science and games, drawing or creative writing, are braided to form the students' scientific thinking and to acquire specific concepts.

In this study we investigate how art, drama or creative writing can be applied in teaching natural sciences (physics, chemistry, biology) course at primary and secondary level in Romania. We also emphasize the need for inter- and trans-disciplinary training of future teachers, and the improvement in this direction of teachers already active.

**Keywords:** science education, creative methods, pre-service teacher training.

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## **S10\_P03**

### **HANDS-ON SCIENCE IN ELEMENTARY SCHOOL**

DHOQINA Polikron

The article describes the author's experience in learning science in elementary school children. Having been the co-author of physics textbooks for students of different ages, this study describes research in the field of learning from these students, science in general and physics in particular, based on their hands-on science experiences.

The study was conducted with two groups of students aged eleven and twelve years.

They were given a series of lessons, focusing primarily on the practical application of knowledge as well as experiments with building tools encountered in everyday

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## **S10\_P04**

### **PHYSICAL BACKGROUND OF PHOTOSYNTHESIS**

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Energy used by the living beings for growth and development originates from organic compounds which in the process of photosynthesis are made of water and carbon dioxide with the help of light. This ability of the plants to synthesize inorganic materials from outer environment into organic compounds is called autotrophy. The process of photosynthesis was thoroughly studied not before the fifties in the 20th century. Melvin Calvin was given the Nobel Prize for chemistry in 1961 for the research in this field. Although the process of photosynthesis is thought to be a pure chemical process, there are underlying physical processes which because of their complexity are not mentioned in the school books. For example, in 2007 it was shown that almost 100% of efficiency of photosynthesis is due to its quantum nature. In this paper the accent will be on the physical background with an attempt to adjust adequate explanations to the knowledge of the high school graduates and the students of the first year of faculty.

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**S10\_P05****Specific Introductory Lessons of Computational Physics for Electrical Engineering**

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This study presents basic aspects of certain introductory lessons of Computational Physics suitable for students at Electrical Engineering. Since the teaching of fundamental aspects in mathematics and physics is highly recommended for students at Technical Universities, it results that introductory lessons for Computational Physics should present also such basic aspects in connection with specific simulation problems. This goal can be achieved using singular functions from Mathematical Physics (as Dirac and Heaviside functions) used for modelling the effect of some spatial or temporal sources acting in a certain physical medium.

Starting from an approximation of Dirac function based on test-functions, it is shown that such test-functions can not be represented as solutions of differential equations. For this reason, the students are taught that some truncated test-functions are necessary for simulation, and different simulation results (some presenting erroneous results when singular points are not detected) are presented so as to define the so-called Trust Interval. Then simulation aspects for the integral of Dirac function (the Heaviside function) and for the derivative of Dirac function (the second order function) are analyzed through simulation techniques, so as simulation errors due to sharp Step-Functions (represented using the Heaviside function) and to the juxtaposition of a set of oscillations (represented using second order Dirac functions) to be noticed by students.

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**S10\_P06****Experiment as a problem-based task**

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The characteristics of a problem-based task is that it contains the contradiction between our knowledge, our experience and the given data. This paper presents several experiments set as problem-based tasks that students cannot solve by applying the usual scheme, in which way, among other things, interest and critical thinking are developed.

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**S10\_P07****Science and art: a dialogue through literature and visual arts**

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At the eve of the 21th century the dialogue between science and art has received noticeable interest. This is reasonable since both help understand how we make sense of the world. In some respects literature (as well as poetry) and visual arts are considered as vehicles that can assign meaning to science concepts. Typical is the example of ancient Greek philosophers who made use of a language with literal significance for describing basic principles that govern our cosmos. Actually that language was free of strict mathematical codification. Indeed, from the era of ancient thinkers to nowadays iconicity, metaphor, analogy and the dynamism of narration in general, help introduce science notions. Furthermore, quite a few visual artists, physicists and physics teachers revisit scientific knowledge by means of installations and artifacts. In that context, 3-D constructions, interactive or non-interactive, offer fertile connections between science, art and technology. This study focuses on the ability of artistic 'texts', written or visual, to narrate aspects of physical world. Such an approach serves to create patterns of teaching and learning, bridging the conceptual gap between students' empirical knowledge with scientific one.

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## **S10\_P08**

### **Transdisciplinarity - a bridge between physics, literature and art**

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Tackling the study of physics from physical, literary and artistic point of view creates the strong links between disciplines, helping the student to develop their culture, creativity, spirit of observation, divergent thinking, reflection and skills necessary for to express their opinions. Also, it avoids the mechanical learning and it ensures a greater degree of retention of the knowledge. Such an approach leads to the formation and to development of skills, values and attitudes that the students are need for the personal and social success in the context of the dynamics of the contemporary society. A learning which exceeds the frontier of the traditional disciplines, the stiffness of the academic canons can meet the need of contemporary man for knowledge. Such approaches are the real challenges of the intellect. Of course, such an approach will not lead to "abolish" the classic disciplines, they will continue to exist in the curricula but will allow reinforce the connections with other disciplines. Thus, interdisciplinarity and transdisciplinarity will become more and more, not just a new way of restructuring the contents but also a manner from organization of the

learning. Therefore, the paper presents how a physics subject may be treated in several ways, becoming a bridge between physics, literature and art.

**Keywords** – art, literature, modern education, physics, student, transdisciplinarity.

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### **S10\_P09**

#### **Another approach of the physics lessons which take account the thought processes and allows the development of the multiple intelligences at the students**

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Each person represents a unique combination of development and manifestation of intelligence. From manner in which these potentials latent are stimulated depend their subsequent development and manifestation. Such the teachers must adapt their style to the student's strengths points, and the students must become aware of their own skills, talents and abilities. "Students can learn anything if the matter is addressed through ways consistent with the strengths points of their learning style, the same students can register the failures when the matter is addressed by methods incompatible with their strong points." (R. Dunn, 1990). The development of the multiple intelligences at the students must take into account and the thought processes. Thus, it can stimulate the student's intrinsic motivation for learning. Students will know how to coordinate whole cognitive approach for learn and to express learning outcomes in a personal and characteristic manner. When the students understand their own learning style, the manner in which make the efforts for to learn, then they can better integrate into the society in which they live. Therefore the paper presents a manner for approach of the physics lesson that takes into account the levels of thinking and allows the development of the multiple intelligences of the students. It promotes the development of connections between the different curricular areas. Also, the evaluation and the analysis of the student achievement are made based on the Bloom's taxonomy. Thus, the stress should not put on finding the perfect student, but on attracting as many students as possible towards perfection, even if this is not entirely achieved!

**Keywords** – Bloom's taxonomy, computer, LabView, modern education, multiple intelligences, student.

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### **S10\_P10**

#### **Michael Pupin's camp**

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Extracurricular activities in the work of this type with potentially gifted students require special conditions and procedures: identification of potentially gifted children, the choice of the lecturers always present, the selection of guest speakers, work plan, the detailed organization of all activities during the camp. It is necessary to provide adequate space (offices, classrooms, laboratories) as well as special conditions for field work, where students perceive, measure, collect data, process them and draw conclusions. This is important for ecology sections and camps where children are in the nature learning how to preserve the environment, which directly affects sustainable development through implementation of education.

Camp Mihajlo Pupin in Idvor 2011<sup>th</sup>, was an opportunity for students from several schools in Serbia to work together, multiply and enhance the knowledge in the friendly and working atmosphere. Also, the camp of the physical ecology and programming was implemented.

**Key words:** Extracurricular activities, students, identification of potentially gifted children, ecology camps

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### **S10\_P11**

#### **Adapting teaching methods to modern technologies**

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Studies on the evaluation of Romanian education at the European level have shown a low rate of the performance, situation largely caused by the teaching methods used. In this direction is needed the modernization of education by introducing innovative techniques for teaching in secondary education level leading to increase the student's performances. In this paper we propose to present the intermediate results for the implementation of the "Program to improve theoretical and practical skills by training and university teachers of physics and technical disciplines" program developed by Petroleum Gas University of Ploiesti from European Social Funds.

The project aims at developing the competence of experimental and theoretical scientific investigation applied to physics and technical disciplines using modern methods of modeling, acquisition and processing of data and innovation of the educational act by introducing modules dedicated to the phenomenon of e-learning, in a globalized society,

that imposes the adoption and using new information technologies in education like instruments for developing the digital pedagogical resources and virtual laboratories. The acceptance of these methodologies can lead to improvement of the educational act in technical disciplines and physics also the adaptation of the programs from the physics and technical disciplines to the realities of modern society and to increase student performance in these areas.

The results are intermediate because they relate to work carried out during the first series from November 2011 to February 2012.

**Keywords:** teaching physics, physics laboratory, experimental setup, data acquisition.

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### **S10\_P12**

#### **Influence of multimedia on the efficiency of teaching physics in the first grade of secondary vocational school**

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Application of modern teaching media, such as multimedia, fundamentally changes the traditional forms and methods in the teaching process. The purpose of an educational simulation is to motivate the learner to engage in problem solving, hypothesis testing, experimental learning, schema construction and development of mental models (Lunce, 2006). Learning with computer simulations is closely related to a specific form of constructivistic learning, namely scientific discovery learning (de Jong & van Joolingen, 1998). Simulations used in Physics teaching are computer programs that have an implicit model of the behavior of a physical system and that allow students to explore and to visualize graphic representations. This paper presents research carried out in order to verify the effects of applying multimedia in teaching physics in comparison with classical method of teaching. The research was conducted as a pedagogical experiment with parallel groups in a sample of 98 first-grade students of vocational Technical School. An independent variable, in the research, was application of multimedia in teaching, which is introduced as an experimental factor, while the dependent variable was the level of adoption of educational content. Curriculum topic covered in this experiment was Kinetic theory of gases. In the experimental group the material was presented through multimedia, while in the control group it was done in the usual manner, using an oral presentation. To examine the level of pupils' prior knowledge and the level of adoption of teaching content presented during the experiment, knowledge tests were used (initial and final). Statistical analysis of the obtained results showed that there was a significant difference in pupils' achievements

in the experimental compared to control group of pupils, and in that case, it proved that application of multimedia in teaching physics was more efficient method than traditional teaching.

**Keywords:** teaching physics, multimedia in teaching, kinetic theory of gases, pedagogical experiment

**ACKNOWLEDGMENTS** This work was supported by research Grants No. 179010 from the Ministry of Education and of the Republic of Serbia, and Provincial Secretariat for Science and Technological Development No. 114-451-01938/2011.

### References

1. Lunce L (2006), Simulations: Bringing the benefits of situated learning to traditional classroom, *Journal of Applied Educational Technology*, Volume 3, Number 1.
2. de Jong T, van Joolingen W R (1998), Scientific discovery learning with computer simulations of conceptual domains. *Review of Educational Research*, 68(2), 179-201.

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### S10\_P13

#### Scientific Method in Realization of Project Based Learning in Treatment Theme Electricity

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This paper presents the importance of the implementation of scientific method in the creation of student mini-projects, with the aim of encouraging independence and creativity of students in the study of basic science content. The application of scientific method enables students to acquire new knowledge through independent research, using the procedure that is used by scientists in scientific inquiry. The scientific method provides clearly defined steps that students need to complete in order to study certain natural phenomena and is of particular importance for the realization of project based learning.

In this paper it is proposed how to realize some of the students mini-projects in treatment theme ‘Electricity’. The suggested projects can be realized by the first grade elementary school students. Students engaged in proposed projects acquire knowledge of terms that are good basis for formation and development of science concepts about electricity at higher grades. Also they gain skills for scientific inquiry and practice to use verbal and written means to report results. By investigating what happens at certain conditions they learn about electric charge, static electricity, electrical current... Based on given examples it is

possible to create science themes by similar pedagogical design of engaging students in projects.

Keywords: project based learning, scientific method, electricity, static electricity, electrical current

ACKNOWLEDGMENTS This work was supported by research Grants No. 179010 from the Ministry of Education and of the Republic of Serbia, and Provincial Secretariat for Science and Technological Development No. 114-451-01938/2011.

### **S10\_P14**

#### **Analysis of the opinions of students and lecturers of Department of Physics about advantages and disadvantages of the Bologna system**

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The most significant changes in the number, organization and content of the university occur in the twentieth century with the scientific-technical revolution. Knowledge is becoming the most important resource. Contemporary role and importance of higher education is evidenced by its ability to continuously improve the scientific research, modernize the way work and upgrade the quality and efficiency of education and teaching. Therefore it is very important to point out the opinion of the advantages and disadvantages of the Bologna education system of direct participants of the system – students, teachers and assistants.

This is a pilot study, carried out in November 2010, at the Department of Physics, Faculty of Science, University of Novi Sad. The sample consisted of 70 undergraduate students of Physics and about 65% of teachers and assistants. The study was undertaken to investigate the opinions of students and teachers on the advantages and disadvantages of the Bologna education system.

Therefore, evaluation processes are focus on establishing relationships between the set and achieved goals and objectives of teaching and learning.

Keywords: physics students, teachers, the Bologna system, the perception of the advantages and disadvantages.

Acknowledgments This work was supported by research Grants No. 179010 from the Ministry of Education and of the Republic of Serbia.

## **S10\_P15**

### **Review of Fizeau's and Michelson's experiments**

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The construction of the theory of special relativity (TSR) is based, par excellence, on the interpretation of Michelson's experiment and on the Maxwell's equations, while the interpretation of Fizeau's experiment is taken as a proof of TSR. Even today there are dilemmas about Michelson's experiment. A very simple explanation for this experiment will be given in this paper. We will prove that Michelson applied the principle of Galileo in his experiment, but he implemented it only partially. Now we will implement this principle completely. As a consequence we will have a conclusion that Michelson's expectation (the idea of the experiment) was wrong. Next, we will point out the confusion of the physicists regarding the nature of the relative motion being studied. One such confusion appeared in Fizeau's experiment. The kind of relative motion studied in this experiment is not of such nature to which the principle of Galileo is valid. Therefore, this experiment can not be counted as deserved for assessing the principle of Galileo. For the same reason it can not be taken as proof for the theory of special relativity. The Maxwell's equations will not be reviewed here.

Key words: Fizeau's experiment, Michelson's experiment, Galileo principle, special relativity

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## **S10\_P16**

### **PHYSICS THROUGH FUN EXPERIMENTS**

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The electronic Physics Journal "Quasar" which represents the final step of every activity within the scientific project "Physics and Computer". The journal is realized by the high school students under the guidance of physics teachers. Within this project it in may 2012 was carry on an activity " Physics Through Fun Experiments", which was conducted by students.

Keywords: the electronic Physics Journal "Quasar", the high school students

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