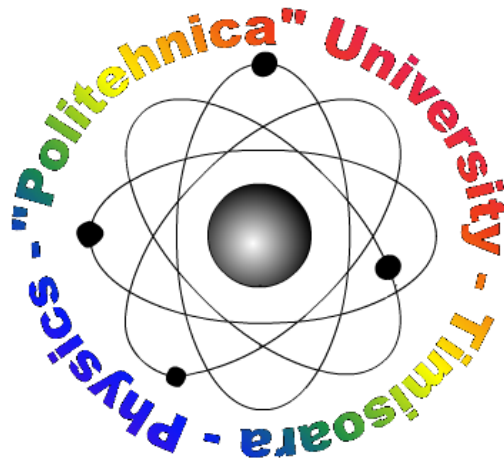


DEPARTMENT OF PHYSICS



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DEPARTMENT OF PHYSICS

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RESEARCH GROUP IN APPLIED PHYSICS

RESEARCH FIELDS in *Studies and investigations in solar energy*

FIELD DESCRIPTION

Energetic and exegetic efficiency of solar systems as a relation between controllable variables (flow, captation surface) as well as between uncontrollable variables (climatic and insulation magnitudes);

ACTIVITIES

Solar systems producing electric energy, thermal energy, hot sanitary water and ventilation;

In the Physics Department:

Innovations for devices used in the intensity of the solar radiation measurement, installations for bitumen fluidization, solar collectors with self-focalization; experimental studies and numerical simulation of the thermal phenomena in solar collectors.

BOOKS

1. Ioan Luminosu: *Physics – experiments*, Publisher - Ed. Politehnica, 2006, ISBN (10)973-625-328-7, (in Romanian), 215 pages;
2. Minerva Cristea, Dușan Popov, Floricica Barvinschi, Ioan Damian, Ioan Luminosu, Ioan Zaharie: *Physics – basics*, 2006, ISBN (10)973-625-337-6 (in Romanian), 260 pages

PUBLISHED PAPERS

1. Ioan Luminosu, Laurentiu Fara: *Numerical simulation of the operation of solar thermal installation by exegetic analysis*, Proceedings of the third edition of the Colloquium “Mathematics In Engineering And Numerical Physics”, Bucharest, October 6-9, 2004, Ed. Credis, ISSN 1842 – 5380, București, 2006
2. Laurentiu Fara, Ioan Luminosu: *Experimental studies concerning active and Passive systems development for Romania case*, Official Journal of Lithuanian Applied Sciences Academy (2006), Nr.3, pp. 30-40
3. Ioan Luminosu, Laurentiu Fara, Cristian Marcu: *Experimental study of a solar heating*

system used for drying ceramic bricks, Official Journal of Lithuanian Applied Sciences Academy, 2006, Nr.3, pp. 42-52

RESEARCH PROJECTS

1. CEEX, 247/3-11.09.2006/CEEX, *Researches in Maximizing the Photovoltaic Efficiency for Nanostructured Cells*

Project manager: Ioan Luminosu
Project value: 260,000 RON

2. C.N.C.S.I.S. 38, *Complex center for studying the concurrent phenomena: physical, energetic, electro-technical, electronic and chemical which occur during the process of thermo solar conversion as well as in the photovoltaic effect. Automation for the operation and working of heliotechnical installations based on thermo solar and photovoltaic conversion*

Project manager: Nicolae Robu,
Project value: 3,385,000 RON

PERSPECTIVES

The setting, through numerical simulation of the parameters which influence the maximizing of the photovoltaic cells efficiency.

RESEARCH TEAM

- Prof.dr. Laurențiu Fara, Polytechnics University of Bucharest
- Dr. Adrian But, Devices & Tools Department, University Polytechnics of Timișoara
- Dr. Ioan Luminosu, dr. Ioan Damian, Dr. Ioan Zaharie, dr. Marius Costache, Physics Department
- Dr. Liviu Cădariu, drd. Ene, Remus, Mathematics Department

Contact: Lecturer Dr. Ioan Luminosu,
ioan.luminosu@fiz.upt.ro

Researches in *OPTICAL FEATURES OF FERROFLUIDS*

FIELD DESCRIPTION

Transmission and absorption of electromagnetic radiation by the ferrofluids in the presence or absence of the magnetic field;

The distribution of magnetite particles after the dimension criteria;

The rheology of colloidal solutions.

ACTIVITIES

Heat pumps, measurement devices, magneto fluid sealing, optical transmission of the information through light signals modulation.

In the physics department:

The invention called Solar Installation for heating through auto pumping

PUBLISHED PAPERS

1. Ioan Luminosu: *The absorption of the unpolarized monochromatic electromagnetic radiation by a very diluted ferrofluid*, Scientific Bulletin of the "Politehnica" University of Timișoara, Romania, 51(65), 1 (2006), pp. 71-80
2. Adrian But, Ioan Silea, Ioan Luminosu: *Five-axis Machining Application with ALPHA CAM-ROI.2*, 50th Conference ETRAN Beograd, 2006

RESEARCH TEAM

- Dr. Adrian But, Devices & Tools Department, University Polytechnics of Timișoara
- Dr. Ioan Luminosu, Physics Department
- Dr. Ioan Silea, Department of automation and applied informatics

Contact: Lecturer Dr. Ioan Luminosu, ioan.luminosu@fiz.upt.ro

Researches in *STRUCTURAL CHARACTERISTICS, MAGNETIC AND MAGNETOELASTIC PROPERTIES OF AMORPHOUS AND NANOCRYSTALLINE ALLOYS. STRUCTURAL PHENOMENA AND MAGNETOELASTIC PROPERTIES IN SHAPE MEMORY ALLOYS*

FIELD DESCRIPTION

Correlation of magnetic and magneto elastic properties with short range order in amorphous alloys. Structural relaxation and crystallization of amorphous alloy characterized by magnetic and magneto elastic measurements, by differential scanning calorimetry, Mossbauer spectroscopy

ACTIVITIES

Investigations of structural relaxation in FeCrPMnCr ribbons and crystallization of FeCrP and FeGdB

ribbons were made. Correlation of magnetic properties with structural information (by XRD, DSC, Mössbauer effect) and magneto elastic properties were examined.

PUBLISHED PAPERS

C.M. Crăciunescu, I. Mihalca, V. Budau: *Signal Modulation by Martensitic Control of Shape memory alloy Thin Film Actuator Architectures*, in: Device Applications of Nonlinear Dynamics, eds. B.Baglia, A.Bulsara, SPRINGER 2006, pp. 51-65

RESEARCH PROJECTS

1. CEEEX no 7/2005-2008: *Nanocontrol și multifuncționalitate în materiale, microstratouri și arhitecturi cu memoria formei*; Beneficiary: MEDC; Value 1,200,000 RON
2. CEEEX no 14/ 2005-2008: *Materiale magnetostrictive multifuncționale pentru sisteme hibride inteligente de senzori, actuatori și traductori*; Beneficiary: MEDC; Value: 1,200,000 RON
3. CNCSIS 205(408)/2005-2007: *Cercetări privind utilizarea unor nanofluid magnetizabile ca agent termic*; Beneficiary: CNCSIS; Value: 1,500 RON

PERSPECTIVES

The increasing scientific and technical interest in highly performant materials led to researches in view to elaborate new RE-TM-M (RE=Nd, Sm, Gd,...; TM=Fe, Ni, Co, Mo,...; M=B, P, C, Si) alloys. Both magnetic (Ms, Hc, Tc,...) and magnetoelastic properties of these materials are interesting for fabrication of different type of sensors and actuators.

RESEARCH TEAM

- Prof. Dr. Ioan MIHALCA
- Assoc. Prof. dr. M.CRĂCIUNESCU
- Assoc. Prof. Dr. Aurel ERCUȚA
- Lecturer Dr. Ioan DAMIAN
- Assoc. Prof. dr. Ștefan HĂRĂGUȘ
- Dr. M. VĂLEANU
- Dr. V. KUNCSEK
- Dr. Nicoleta LUPU

Contact: Prof.Dr. Ioan MIHALCA, ioan.mihalca@fiz.upt.ro
ioan.mihalca@gmail.com

Researches in *PREPARATION OF METALLIC OXIDES SYSTEMS MATERIALS BY SEVERAL METHODS AND STRUCTURAL, ELECTRIC, MAGNETIC PROPERTIES STUDY OF THESE MATERIALS.*

FIELD DESCRIPTION

Preparation of polycrystalline Transition Elements oxides containing samples by using the

coprecipitates thermal decomposition, ceramic and melting methods.

Crystalline structure, dielectric and magnetic properties in low or radio frequency fields, magnetic loops in the static and dynamic regime study.

ACTIVITIES

Elaboration of ternary oxidic samples $\alpha(\text{Fe}_2\text{O}_3\text{-Cr}_2\text{O}_3\text{-Al}_2\text{O}_3)$ with 30% and 50% $\alpha\text{Fe}_2\text{O}_3$ by thermal decomposition of hydroxide coprecipitates. The investigation of these samples by X-ray diffraction and IR absorption spectra in order to correlate structure and physical properties with composition of crystalline samples.

PUBLISHED PAPERS

M. Cristea, V. Chiritoiu, *Some aspects of IR absorption in the isomorphous M₂O₃ oxides ternary system*, Bul. St. Techn. "Politehnica" University of Timisoara, 51(61), 1, 2006, pp 102-110

RESEARCH PROJECTS

CNCSIS. Research Grant, duration three years, Grant A556, No 71GR/ 2006. Additional Document No. 223GR/19.09. 2006. "*Valorisation of some industrial waste containing magnesium and calcium*"; phase 2006: 1. Presentation of some industrial waste containing magnesium and calcium; 2. Preliminary testing of some waste in the agriculture; 20,000 lei.

Collaborator by individual agreement.

Project leader: Sen.Researcher I Lidia Maria Taubert, Institute of Chemistry Timisoara of the Romanian Academy of Science.

PERSPECTIVES

The preparation of various compositions of the same M_2O_3 oxides and the other different oxide systems, containing transition elements oxides, by raw materials melting, by ceramic method and by thermal decomposition of hydroxide coprecipitates. The study of the structure of these solid materials by X-ray diffraction at ambient and low temperature, by IR spectra and visible reflection spectra. Dielectric losses, complex magnetic susceptibility, the hysteresis loops of samples in dynamical and static regime study.

RESEARCH TEAM

- Prof. Dr. Minerva CRISTEA
- Prof. dr. Alicja RATUSZNA (Institute of Physics, Silesian, University of Katowice, Poland)
- Assoc. Prof. dr. C-tin CAIZER (West University Timișoara)
- Lect. dr. Ioan LUMINOSU

- Lect. dr. Nicoleta ȘTEFU (West University Timișoara)
- Lect. dr. Paul BARVINSCHI (West University Timișoara)
- Assist. drd. Viorel CHIRIȚOIU

Contact: Prof. Dr. Minerva CRISTEA,

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Researches in MASTER EQUATIONS AND DIGITAL INDUSTRIAL RADIOGRAPHY

FIELD DESCRIPTION

Nowadays, there is a boom in using master equation for a better understanding of market's price evolution. One tries to find reasonable solution for Black – Sholes equation, for instance. I have proposed to use the Fokker – Planck equation instead of the above one. The Fokker – Planck equation, or forward Kolmogorov equation, intends to find out the probability to have, in future, a price of a stock, if we know the price now. I solved the Fokker – Planck equation for two cases of stocks' price evolution. This field is a part of what is called today Econophysics.

Using the non-destructive methods to find the defects in materials became a usual procedure. In the last time, the radiographic methods with X and gamma rays using semiconductor detection instead of film radiography started to be of extensively use.

Regarding this subject I have proposed, to International Atomic Energy Agency, a research project, which have been approved and it will be extended on three years.

PUBLISHED PAPERS

1. V. Dorobantu: *A Probability Density Function for Google's stocks*, 7 pages, arXiv: physics/0612091, 2006
2. V. Dorobantu: *The Postulates of Quantum Mechanics*, 26 pages, arXiv:physics/0602145, 2006
3. V. Dorobantu: *Do we have enough air?*, 3 pages, arXiv:physics/060, 2006
4. V. Dorobantu: *Do we really need the Anthropic Principle*, 6 pages, arXiv:physics/0603105, 2006

PERSPECTIVES

The research in 2006: focused on the nuclear methods of non-destructive control and digital processing of the image.

RESEARCH TEAM

- Assoc. Prof. dr. Vasile DOROBANTU
- Assist. dr. Simona PRETORIAN
- Prof. dr. Nicolae ROBU
- Assist. drd. Viorel CHIRITOIU
- C.Popescu,
- Assist. Raul ROBU

Contact:

Assoc. Prof. Dr. Vasile DOROBANȚU,
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**Researches in
HEAT, MASS AND MOMENTUM TRANSFER
PROCESSES, SOLIDIFICATION OF THE
MATERIALS**

FIELD DESCRIPTION

The solidification of the crystals (nano-crystals) and of the polycrystals (multi-crystalline Silicon) takes place within various heat, mass and momentum fields. The numerical models of the transfer processes is a very active domain of the research and can provide a deep knowledge of the phenomena associated with the solidification matter. The numerical soft FluentTM is a commercial software, and I am using it for numerical modelling of the heat, mass and momentum fields in various solidification furnaces.

ACTIVITIES

A time dependent 3D numerical model of the solidification process of large size photovoltaic Si ingots is realised. The difficulty of the model is related to the relative movement of various parts of the furnace that we solve by using a dynamic layering mesh approach. This permitted to calculate the thermal gradient, solidification rate and hydrodynamics of the silicon, which are important in order to control and optimise the grain structure of the ingot. The comparison between the numerical predictions and the experimental measurements shows a reasonable agreement. The effect of some geometrical modifications of the equipment on the thermal field is studied in order to improve the solidification process and the structure of the ingot.

BOOKS

M. Cristea, D. Popov, F. Barvinschi, I. Damian, I. Luminosu, I. Zaharie, *Physics - Fundamentals Elements*, Ed. Politehnica, Timisoara, ISBN (10) 973-625-337-6; ISBN (13) 978-973-625-337-9

PUBLISHED PAPERS

1. Y. Delannoy, F. Barvinschi, T. Duffar, *3 D Dynamic Mesh for large Size Multi-crystalline Silicon Ingots for Reducing Grit Occurrence*, 21st European Photovoltaic Solar Energy Conference and Exhibition, Dresda, 4-8 September 2006, Germany
2. F. Barvinschi, Y. Delannoy, T. Duffar, *3 D Dynamic Mesh Numerical Model for Multi-crystalline Silicon Furnace*, 5th International Workshop Modelling in Crystal Growth, IWCMG-5, 10-13 September 2006

RESEARCH PROJECTS:

1. Code project **4257**, No. Contract **410**, type project **PED**; MENER, Bucuresti, "*Researches regarding the combined burn of the urban wastes or of the biomass with carbon and the depuration of the burned gases*"; Director prof.dr.ing. Ioana Ionel; 150,000 lei, collaborator
2. No. CEX05-D11-63/10-10-2005, type CEEEX; University of Bucuresti; "*Optical and electronically phenomena in organic materials with conjugate connections for photonics applications*"; Director prof.dr. Stefan Antohe; 31,925 lei, responsible partner P4
3. REDUCOP, French Research Contract in the *Solar Energy Domain*, financed by the ADEME, France, CNRS-MADYLAM, Grenoble, director: N.Le Quang, collaborator.

PERSPECTIVES

In the future the numerical simulation of heat, mass and momentum transport phenomena should have a very good development and a lot of application in the casting, solidification and crystal growth matter. A good knowledge of the industrial furnaces it is not possible if only experimental way is used. The modelling of the real equipments will be a very appropriate tool for providing design and optimisation.

RESEARCH TEAM

- Assoc. Prof.dr. Floricica BARVINSCHI
- Lecturer Paul BARVINSCHI
- Dr. T.Duffar (Grenoble, France).
- Y.Delannoy (Grenoble, France).

Contact:

Assoc. Prof. dr. Floricica BARVINSCHI,
floricica.barvinschi@fiz.upt.ro

RESEARCH GROUP IN THEORETICAL PHYSICS

**Researches in
QUANTUM INFORMATION AND THE
COHERENT STATES FORMALISM**

FIELD DESCRIPTION

The quantum mechanics and the theory of information are two very prolific scientific fields founded in XX century. The synergetic result of their interaction is the theory of quantum information. In our researches we examine the connection between the information and the quantum states, particularly the coherent states. In this way, the coherent states formalism becomes an useful instrument to characterize the quantum information. On the other hand, a quantum system is connected by the corresponding density matrix. Their trace is the quantum partition function, which contains maximal information about the properties of the systems.

ACTIVITIES

Since 1978, theoretical investigation were made on the description of the multielectronic systems (particularly, diatomic molecules) by means of the density matrix approach. This approach were applied, also, to the harmonic or anharmonic oscillators, especially the pseudoharmonic and Morse oscillators. Some results were used for the elaboration of the doctoral thesis and other scientific works in the physics journals.

PUBLISHED PAPERS

1. Dusan Popov, I. Zaharie, S. H. Dong, *Photon-added coherent states for the Morse oscillator*, Czechoslovak Journal of Physics, 56 (2), pp. 157-176, 2006
2. Dusan Popov, V. Sajfert, B. Totic, *Thermodynamic and kinetic properties of mechanical oscillations in thin films*, International Journal of Modern Physics B, 20 (24), pp. 3507-3532, 2006
3. Dusan Popov, D. M. Davidovic, D. Arsenovic, V. Sajfert, *P-function of the pseudoharmonic oscillator in terms of Klauder-Perelomov coherent states*, Acta Physica Slovaca, 56 (4), pp. 445-453, 2006
4. Dušan Popov, *Some properties of generalized hypergeometric coherent states*, Electronic Journal of Theoretical Physics, ISSN 1729-5254, Vol. 3, No. 11, pp. 123-132, 2006
5. I. Zaharie, *Analysis of the Classical Shift Doppler Formulas*, Scientific Bulletin of the

“Politehnica” University of Timișoara, Romania, 51(65), 1 (2006), pp.88 – 94

6. Dušan POPOV, I. Zaharie, V. Sajfert, D. D. Popov, *Coherent states and their role in quantum information theory*, Book of Abstracts of the 6th International Conference of the Balkan Physical Union, 22-26 August 2006, Istanbul, Turkey, p. 822, 2006
7. V. Sajfert, Lj. Maskovic, Dušan POPOV, *Model explanation of the DNA transcription*, Book of Abstracts of the 6th International Conference of the Balkan Physical Union, 22-26 August 2006, Istanbul, Turkey, p. 1150, 2006
8. Dušan POPOV, M. Grekonic, *Receptivity of Tesla's work in Romania*, Proceedings of the Sixth International Symposium Nikola Tesla, October 18-20, 2006, Belgrade, SASA, Serbia, ISBN 86-7466-264-1, pp. 267-270, 2006
9. Dušan POPOV, S. Popovic, M. Popov, *The use of physical statistics principles for describing some systems of informational ecology*, The XVth Conference on „Instalation of Buildings and Ambient Confort”, Timișoara, april 2006, ISBN (10) 973 – 625 – 305 – 8, ISBN (13) 978 - 973 – 625 – 305 – 8, pp. 327 - 332, 2006

RESEARCH PROJECTS

1. CNCSIS A 647 - *Contribuții la utilizarea formalismului stărilor coerente în fizica informației cuantice*, Director: Dušan POPOV, 2005-2007; Value for 2006: 8,800 lei.
2. *Ecotoxicologic Study of River Tisa Basin (Ekotoksikoloska istraživanja reke Tise i usca pritoka)*, Provincial Secretariat for Science and Technological Development Novi Sad, Serbia, No. Contract: 114-451-00628 / 2005-01, Colaborator: Dušan POPOV, 2005-2007

PERSPECTIVES

The results of the present investigations will be used to begin a CNCSIS Research Grant entitled “Contributions to the use of the coherent states formalism in the physics of quantum information” and to publicate some scientific papers in this field.

RESEARCH TEAM

- Prof. Dr. Dušan POPOV

- Lecturer Dr. Ioan ZAHARIE
 - Lecturer Dr. Mihai PUTZ
 - Dipl. eng. Dejan POPOV
- Contact:** Prof. Dr. Dușan POPOV
dusan.popov@fiz.upt.ro

**Researches in
SOLAR ENERGETIC AND PHYSICS
EDUCATION**

FIELD DESCRIPTION

Energetic and exegetic efficiency of solar systems as a relation between controllable variables (flow, caption surface) as well as between uncontrollable variables (climatic and insulation magnitudes); Teaching physics for engineering students.

ACTIVITIES

SOLAR ENERGETIC:

- Solar systems producing electric energy, thermal energy, hot sanitary water and ventilation;

In the Physics Department:

- Innovations for devices used in the intensity of the solar radiation measurement, installations for bitumen fluidization, solar collectors with self-focalization; experimental studies and numerical simulation of the thermal phenomena in solar collectors.

PUBLISHED PAPERS

1. Ioan Damian, *Malus' Law for a Real Polarizer*
<http://www.arxiv.org/ftp/physics/papers/0604/0604073.pdf>

RESEARCH PROJECTS

CEEX, 247/3-11.09.2006/CEEX, *Researches in Maximizing the Photovoltaic Efficiency for Nanostructured Cells*

Project in charge – UPT manager: Ioan Luminosu,
 Project costs – 260,000 lei.

PERSPECTIVES

The setting, through numerical simulation of the parameters which influence the maximizing of the photovoltaic cells efficiency.

RESEARCH TEAM

- Prof.Dr. Laurentiu Fara, Polytechnics University of Bucharest;
- Dr. Adrian But, Devices & Tools Department, University Polytechnics of Timisoara;
- Dr. Ioan Damian, dr.Ioan Zaharie, dr. Marius Costache, , Physics Department;
- Dr. Liviu Cădariu, Mathematics Department;
- Drd. Daniel Remus, Mathematics Department.

Contact: Lecturer Dr. Ioan DAMIAN

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**Researches in
PHYSICS- TECHNICAL OPTICS**

FIELD DESCRIPTION

Optical materials, algorithms for the evaluation of referential optical characteristics, the optimizing of optical systems, the checking of image quality

ACTIVITIES

Studies concerning controlled variables of optical systems; the constructive and functional optimizing of optical subassemblies (optical erector system, optical condenser)

PUBLISHED PAPERS

1. Costache M., Nicoară I., Gruescu C.: *Study Concerning the Modulation Transfer Function of Complex Optical Systems*, COMEFIM 8, Cluj-Napoca 2006
2. Gruescu C., Costache M., Nicoară I., Hora H.: *Analysis of the Composition Law for the Fourier Parameters of a Complex Optical System – Numerical Modeling and Simulation*, COMEFIM 8, Cluj-Napoca 2006

RESEARCH PROJECTS

1. “Cercetări Privind Creșterea Eficienței Celulelor Fotovoltaice Nanostructurate”, nr.3/247 din 11.09.2006

PERSPECTIVES

The optimal solutions of some types of optical subassemblies used at terrestrial observing apparatus or some types of measuring instruments will be checked. Several criteria of image quality will be analyzed

RESEARCH TEAM

- Assist. dr. Costache M.,
- Associated Professor dr. ing. Gruescu C.,
- Lecturer dr. Luminosu Ioan,
- Lecturer dr. Zaharie Ioan,
- Lecturer dr. Damian Ioan

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**Researches in
THEORETICAL PHYSICS, GAUGE THEORY,
GRAVITATION, X RAYS**

BOOKS

S. Pretorian, M. Costache, V. Chirițoiu, *Fizica-Elemente Fundamentale - Aplicații*, Editura

Politehnica Timișoara, 2006, ISBN (10) 973-625-344-9, 81 pagini

PUBLISHED PAPERS

S. Babeți, V. Chirițoiu, G. Zet, *Methods and models with nonsingular solutions in a gauge theory of gravitation*, International Conference Fundamental and Applied Research in Physics, Iași, 27-29 October 2005, Analele • tiințifice ale Univ. “Al. I. Cuza” Iași, Tom LI-LII/2005-2006, pp. 113-127, http://stoner.phys.uaic.ro/index.php?n=a_main

RESEARCH PROJECTS

Collaboration with Dorobantu for the contract with Vienna

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