THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

Abstract Book:

5th Annual International Conference on **Physics**

17-20 July 2017, Athens, Greece

Edited by
Gregory T. Papanikos

2017

Abstracts
5th Annual International Conference on Physics
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(In Alphabetical Order by Author's Family name)

Preface

This book includes the abstracts of all the papers presented at the *5th Annual International Conference on Physics, 17-20 July 2017*, organized by the Athens Institute for Education and Research (ATINER).

In total 20 papers submitted by 24 presenters, coming from 14 different countries (Brazil, Bulgaria, Croatia, Egypt, France, India, Israel, Mexico, Morocco, Pakistan, Russia, Turkey, Ukraine and USA). The conference was organized into 10 sessions that included a variety of topic areas such as theoretical physics, applied physics, and more. A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this conference will be considered for inclusion in one of ATINER's many publications.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which to discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world could meet to exchange ideas on their research and consider the future developments of their fields of study.

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world regularly meet to discuss the developments of their discipline and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published nearly 200 books. Academically, the institute is organized into seven research divisions and 37 research units. Each research unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this conference and its subsequent publications together. Specific individuals are listed on the following page.

Gregory T. Papanikos
President

5th Annual International Conference on Physics
17-20 July 2017, Athens, Greece
Organizing and Academic Committee

All ATINER's conferences are organized by the Academic Committee (https://www.atiner.gr/academic-committee) of the association.

This conference has been organized with the additional assistance of the following academics, who contributed by chairing the conference sessions and/or by reviewing the submitted abstracts and papers:

1. Gregory T. Papanikos, President, ATINER.
2. Ethel Petrou, Academic Member, ATINER & Professor and Chair, Department of Physics, Erie Community College-South, State University of New York, USA.
3. Haiduke Sarafian, Academic Member, ATINER & Professor, The Pennsylvania State University, USA.
4. Itzhak Orion, Head of the Nuclear Engineering Department, Ben-Gurion University of the Negev, Israel.
5. Daniel Schertzer, Professor, Ecole des Ponts ParisTech, France.
6. Nikos Mourtos, Head, Mechanical Engineering Unit, ATINER & Professor, San Jose State University, USA.
7. Bala Maheswaran, Academic Member, ATINER & Professor, Northeastern University, USA.
8. Robert Moonsamy Gengan, Associate Professor, Durban University of Technology, South Africa.
9. Jasim Salman, Deputy Dean and Assistant Professor, Al-Nisour University College, Iraq.
10. Mehmet Yuksel, Academic Member, ATINER & Specialist, Cukurova University, Turkey.
11. Branko Pivac, Senior Scientist, Ruder Boskovic Institute, Croatia.
12. Vassilis Skianis, Research Fellow, ATINER.
13. Olga Gkounta, Researcher, ATINER.
14. Hannah Howard, Research Assistant, ATINER.

FINAL CONFERENCE PROGRAM
5th Annual International Conference on Physics,
17-20 July 2017, Athens, Greece
PROGRAM
Conference Venue: Titania Hotel, 52 Panepistimiou Avenue, Athens, Greece
C O N F E R E N C E P R O G R A M

Monday 17 July 2017

08:00-09:00 Registration and Refreshments

09:00-09:30 (Room B-10th Floor) Welcome and Opening Address

Gregory T. Papanikos, President, ATINER.

09:30-11:00 Session I (Room C-10th Floor): Theoretical Physics I

Chair: Ethel Petrou, Academic Member, ATINER & Professor and Chair, Department of Physics, Erie Community College-South, State University of New York, USA.

1. Itzhak Orion, Head of the Nuclear Engineering, Ben-Gurion University of the Negev, Israel. Quark Model versus Shell Model for the Neutron: Electrical Field Simulations.
2. Evaldo Mendonca Fleury Curado, Professor, Centro Brasileiro de Pesquisas Físicas – CBPF, Brazil. A Lorentz Invariant Velocity Distribution of a Relativistic Gas.
3. Haiduke Sarafian, Professor, The Pennsylvania State University, USA. Kinematics of a Point-like Charged Particle in a Dynamic Super Nonlinear Electric Field.

11:00-12:30 Session II (Room C-10th Floor): Materials Design and Characterization I

Chair: Itzhak Orion, Head of the Nuclear Engineering, Ben-Gurion University of the Negev, Israel.

1. Victor Manuel Duran Ramirez, Research Professor, Universidad de Guadalajara, Mexico, Alejandro Martinez Rios, Research Professor, Centro de Investigaciones en Óptica, A.C., Mexico, Jesus Munoz Maciel, Research Professor, Universidad de Guadalajara, Mexico & Gerardo Peña Lecona, Research Professor, Universidad de Guadalajara, Mexico. Laser Diffractometer for Measuring the Refractive Index of Liquids.
2. Aleksei Koniashkin, Senior Scientist, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia, Andrei Korolkov, PhD Student, Moscow Institute of Physics and Technology, Russia & Oleg Ryabushkin, Head of Department, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia. Probe Piezoelectric Crystals as Temperature Sensors for Optical Materials.
3. Ali Azab, Researcher, National Research Centre, Egypt. Effect of Cobalt on Structural, Magnetic and Dielectric Properties of Fe3O4 Nano-Particles Prepared by co-Precipitation Method.

12:30-14:00 Session III (Room C-10th Floor): Applied Physics

Chair: Daniel Schertzer, Professor, Ecole des Ponts ParisTech, France.

1. Liudmyla Kozak, Associate Professor, Taras Shevchenko National University of Kyiv, Ukraine, Bogdan Petrenko, Student, Taras Shevchenko National University of Kyiv, Ukraine, Elena Kronberg, Scientist, Max Planck Institute for Solar System Research, Göttingen, Germany, Elena Grigorenko, Scientist, Space Research Institute, RAS, Russia & Antony Lui, Principal Professional Staff, Johns Hopkins University Applied Physics Laboratory, USA. Characteristics of the Turbulence Processes in the Magnetohydrodynamic Environment.
2. Zafar Wazir, Associate Professor, Riphah International University, Pakistan. Study of the Cumulative Number Distribution of Charged Particles Produced in $p^{12}C$-Interctions at 4.2 A GeV/c.
3. Mehmet Yuksel, Specialist, Çukurova University, Turkey. Theoretical Study on Heating Rate Effect Using Simulated Thermoluminescence Glow Peaks.
4. Tamer Dogan, Instructor, Çukurova University, Turkey. A Preliminary Thermoluminescence Dose Response Results of Jadeit Mineral as Dosimetric Material.

5. Nikita Voronkov, Postgraduate, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia, Victor Sypin, Moscow Institute of Physics and Technology, Russia & Oleg Ryabushkin, Head of Department, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia. Longitudinal Temperature Distribution inside Active Optical Fiber in Lasing Condition.

14:00-15:00 Lunch

15:00-16:30 Session IV (Room C-10th Floor): Special Topics in Sciences I

Chair: Robert Moonsamy Gengan, Associate Professor, Durban University of Technology, South Africa.

1. Daniel Schertzer, Professor, Ecole des Ponts ParisTech, France & Ioulia Tchiguirinskaia, Ecole des Ponts ParisTech, France. Spatial Chaos, Multifractal Vector Fields and Stochastic Clifford Algebra.
2. Isai Urasa, Professor, Hampton University, USA. Citizen Science in the Context of Indigenous Knowledge.

16:30-18:30 Session V (Room B-10th Floor): *A Symposium on The Future Developments and Prospects of Engineering and Science Education & Research in a Global World I*

Chair: Nikos Mourtos, Head, Mechanical Engineering Research Unit, ATINER & Professor, San Jose State University, USA.

1. Bala Maheswaran, Professor, Northeastern University, USA. Engineering Education via Innovations and Inventions (E2 via I2).
2. Itzhak Orion, Head of the Nuclear Engineering, Ben-Gurion University of the Negev, Israel. Nuclear Science Research and Education in Israel.
3. Jin He, Professor, Peking University, Shenzhen SOC Key Laboratory, China. New teaching technique and method function in the engineering and science education and research.
4. Haiduke Sarafian, Professor, The Pennsylvania State University, USA. The Research Aspect of College Education.
5. Thomas J. J. Mueller, Professor, Makromolekulare Chemie der Universität Düsseldorf, Germany. Life Science – Society.

For details on the discussion please click here.

21:00-23:00 The Pragmatic Symposium of the Conference as Organized in Ancient Athens with Dialogues, Food, Wine, Music and Dancing but fine tuned to Synchronous Ethics

Tuesday 18 July 2017

07:30-10:30 Session VI: An Educational Urban Walk in Modern and Ancient Athens

Chair: Gregory Katsas, Vice President of Academic Affairs, ATINER & Associate Professor, The American College of Greece-Deree College, Greece.

Group Discussion on Ancient and Modern Athens. Visit to the Most Important Historical and Cultural Monuments of the City (be prepared to walk and talk as in the ancient peripatetic school of Aristotle)

11:00-12:30 Session VII (Room C-10th Floor): Materials Design and Characterization II

Chair: Olga Gounta, Researcher, ATINER.

1. Branko Pivac, Senior Scientist, Ruder Boskovic Institute, Croatia, Pavo Dubcek, Senior Research Associate, Ruder Boskovic Institute, Croatia, Jasna Dasovic, Ruder Boskovic Institute, Croatia, Sigrid Bernstorff, Elettra-Sincrotrone Trieste, Italy & Branislav Vlahovic, North Carolina Central University, USA. Photoluminescence in Ge Nanoparticles Grown in Dielectric Matrix.
2. Dzmitry Protasenya, PhD Student, Moscow Institute of Physics and Technology, Russia & Oleg Ryabushkin, Head of Department, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia. Surface Defects Detection in Optical Materials by

Radiofrequency-Optical Spectroscopy.

3. Pavo Dubcek, Senior Research Associate, Ruder Boskovic Institute, Croatia, Branko Pivac, Ruder Boskovic Institute, Croatia, Jasna Dasovic, Ruder Boskovic Institute, Croatia, Vesna Janicki, Ruder Boskovic Institute, Croatia & Sigrid Bernstorff, Elettra Sincrotrone Trieste, Italy. Cu Nanoparticles Formation, Growth and Properties in and on Dielectric Film.

12:30-14:00 Session VIII (Room C-10th Floor): Theoretical Physics II

Chair: Branko Pivac, Senior Scientist, Ruder Boskovic Institute, Croatia.

1. Valentina Markova, Bulgarian Academy of Sciences, Bulgaria. New Axioms to Describe Gravitation.
2. Feliks Gorbatcevich, Scientist, Kola Science Centre Russian Academy of Science, Russia. The Basis for Propagation of Electromagnetic Waves.

14:00-15:00 Lunch

15:00-16:30 Session IX (Room C-10th Floor): Special Topics in Sciences II

Chair: Jasim Salman, Deputy Dean and Assistant Professor, Al-Nisour University College, Iraq.

1. Santhi Sambamoorthy, Associate Professor, Bharathidasan University, India & Amala Subbiah, Lecturer, Bharathidasan University, India. Highly Selective and Sensitive Dual Channel Schiff Base Chemosensors for the Detection of Al(III), Fe(III) & Cu(II).
2. Latifa Bouissane, Assistant Professor, Sultan Moulay Slimane University, Morocco & Issam Forsal, Assistant Professor, Sultan Moulay Slimane University, Morocco. Novel Polysubstituted Indazoles Derivatives as Potential Antitumor Agents: Growth Inhibition and Apoptosis Induction.

16:30-18:30 Session X (Room B-10th Floor): *A Symposium on The Future Developments and Prospects of Engineering and Science Education & Research in a Global World II*

Chair: Bala Maheswaran, Professor, Northeastern University, USA.

1. Nikos Mourtos, Professor, San Jose State University, USA. Teaching & Learning Engineering in the 21st Century: Challenges and Opportunities.
2. Lluis Jofre, Professor, Universitat Politecnica de Catalunya (UPC), Spain. Catalonia Engineering and Science Educations and Research trends in the European Context.
3. Dong-Wook Jerng, Professor, Chung-Ang University, South Korea. Some Thoughts for Future Direction of Engineering/Science Education with Insights from a K-POP Story of BTS.
4. Isai Urasa, Professor, Hampton University, USA. International Higher Education: A Vehicle for Global Cooperation and Development in Science and Engineering.
5. Santhi Sambamoorthy, Associate Professor, Bharathidasan University, India. Creative and inimitable role played by Indian universities in science, engineering and research in a global world.
6. Ethel Petrou, Professor and Chair, Department of Physics, Erie Community College-South, State University of New York, USA. Emerging trends in New York State Community Colleges-SUNY.

For details on the discussion please click here.

21:00- 22:30 Dinner

Wednesday 19 July 2017
Educational Island Tour or Mycenae and Epidaurus Visit

Thursday 20 July 2017
Delphi Visit

Ali Azab
Researcher, National Research Centre, Egypt

Effect of Cobalt on Structural, Magnetic and Dielectric Properties of Fe3O4 Nano-Particles Prepared by co-Precipitation Method

$Fe^{2+}_{1-x}Co_xFe_2O_4$ ($0 \leq x \leq 0.8$) nano-particles were synthesized by a chemical co precipitation method. The effect of Co^{2+} substitution on structural, magnetic and dielectric properties of Fe_3O_4 was studied. Structural studies were carried out using X-ray diffraction (XRD), Fourier transform infrared (FTIR) and high resolution transmission electron microscopy (TEM) techniques. XRD confirmed the single spinel ferrite phase formation. Particle size of the synthesized materials lies in the range of 8-17. The magnetic properties of the samples were investigated by vibrating sample magnetometer, in which saturation magnetization (Ms) and coercivity (Hc) were determined. The value of Hc increases with increasing Co content, while Ms decreases with increasing Co content up to x = 0.4. The dielectric constant, dielectric loss and ac conductivity at different frequencies (100 kHz–5 MHz) were studied.

Latifa Bouissane
Assistant Professor, Sultan Moulay Slimane University, Morocco
&
Issam Forsal
Assistant Professor, Sultan Moulay Slimane University, Morocco

Novel Polysubstituted Indazoles Derivatives as Potential Antitumor Agents: Growth Inhibition and Apoptosis Induction

Cancer is the second mortal disease with irregular cellular proliferation and metastasis after cardiovascular and cerebrovascular disease in the world. All cancer types cause a fifth of all cancer-related deaths [1] and are usually diagnosed in advanced stages [2]. The great cancer incidence worldwide increases the search for new, safer and efficient anticancer agents, aiming the prevention or the cure of this illness. Indazole core is the best skeleton to develop anticancer agents. It is recognized to be a highly effective pharmacophore in medicinal chemistry as well as being the core of important nitrogen-containing heterocycles that show a broad range of biological activities [3-6].

Trying to develop potent and selective anticancer agents, a series of novel polysubstituted indazoles (scheme) were synthesized and evaluated for their *in vitro* antiproliferative and apoptotic activities against two selected human cancer cell lines (A2780 and A549). Several compounds showed interesting antiproliferative activity with IC_{50} ranging from 0.64 to 21 μM on both cell lines. The most active indazoles were then tested in different pharmacological dilution conditions, adding three new cell lines (HGC-27, MDA-MB-231 and T47D) as targets, thus confirming their antiproliferative activity. Furthermore, these selected compounds were able to trigger apoptosis to a significant extent and to cause a block of cells in the S phase of the cell cycle, with a concomitant decrease of cells in the G2/M and/or G0/G1 phases and the generation of hypodiploid peaks.

Tamer Dogan
Instructor, Çukurova University, Turkey

A Preliminary Thermoluminescence Dose Response Results of Jadeit Mineral as Dosimetric Material

Natural minerals as dosimetric materials have been investigated with thermoluminescence procedure. Jadeite $NaAlSi_2O_6$, has long been observed to emit green, blue, or red luminescence. The goal of the present investigation is to explore the dose response properties using Thermoluminescence (TL) method of natural jadeit mineral. Dose response experiments were carried out β-irradiation ($^{90}Sr/^{90}Y$) source attached to Lexsyg Smart TL/OSL reader at room temperature. The incandescent background was subtracted from the TL data. The relationship between dose and the TL response of the jadeit sample was studied over the dose range of 1-400 Gy of beta irradiation.

Acknowledgement: This work was supported by Research Fund of the Cukurova University (Project Number: ID 9223). Tamer Dogan would like to thank Research Fund of the Çukurova University for financial support.

Pavo Dubcek
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Branko Pivac
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Jasna Dasovic
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Vesna Janicki
Ruder Boskovic Institute, Croatia
&
Sigrid Bernstorff
Elettra Sincrotrone Trieste, Italy

Cu Nanoparticles Formation, Growth and Properties in and on Dielectric Film

Metallic particles, such as Cu, Ag and Au that are grown to nanometric sizes, exhibit specific optical properties due to the presence of a plasmon band. This band originates from the collective oscillations of the conduction electrons, the plasmons, and it corresponds to a narrow absorption band in the visible spectral range. The plasmonic oscillations induce modification of the properties of the adjacent dielectric material in which the nanoparticles are included. Macroscopic properties of the host matrix are substantially modified in a controllable manner, when the chemical environment of nanoparticles and their size and shape are tuned properly. Cu nanoparticles that were synthesized in or on silica, thus forming a composite material, are the focus of this work.

A single Cu layer on top of Si substrate and/or one capped with a thin SiO2 layer was produces by high vacuum thermal evaporation. Substrate temperature was varied during the deposition, and the samples were additionally annealed ex situ in high vacuum.

Simultaneous grazing incidence small and wide angle X-ray scattering (GISAXS and GIWAXS) were applied in the study of the formed nanoparticles morphology and development. The obtained results ware compared to those of Atomic Force Microscopy on the samples without capping layer. It is shown that the Cu production is critically dependent on the starting configuration of the layers. Finally, the plasmonic effect was monitored by UV-Vis reflectance spectroscopy, while the oxidation of nanoparticles was further studied by photoluminescence spectroscopy.

Feliks Gorbatcevich
Scientist, Kola Science Centre Russian Academy of Science, Russia

The Basis for Propagation of Electromagnetic Waves

Analysing the shear wave propagation in solid bodies [1] and propagation peculiarities of electromagnetic waves in the matter one can find that these processes are very similar. The mathematical description and practical observations of the following phenomena are also similar for the two types of waves [2] - electromagnetic and shear acoustic in anisotropic heterogeneous media in which the waves propagate:

- A birefringence phenomenon for electromagnetic and a similar phenomenon for acoustic waves;
- Pleochroism phenomena for electromagnetic and linear acoustic anisotropic absorption for acoustic waves;
- Optic activity (electromagnetic waves) and rotating polarization vector in some media (acoustic waves);
- An increase of an ellipticity degree of polarized (electromagnetic and shear acoustic) waves during their propagation in a randomly-heterogeneous medium.

There are some other analogies.

From these phenomena one can conclude that the visible space, where electromagnetic waves propagate, is filled with a special medium. This is an ethereal medium. The ethereal medium has a certain electromagnetic density and elasticity [2]. The electromagnetic and gravitational influence of one physical body on the other is realized by means of the ethereal medium. Establishing a gradient of the ether elastic pressure by a physical body in the vicinity of another physical body that creates a gradient of the ether elastic pressure in the vicinity of the first one, results in the rise of a force making these bodies approach each other. That is the reason for gravitation.

1. Feliks Gorbatsevich. “Acoustopolariscopy of minerals and rocks.” VDM Verlag, Saarbrücken 2009.
2. Feliks Gorbatsevich. The Ether and Universe. The Ether is the Basis for propagation Electromagnetic Fields and Gravitation. VDM Verlag, Saarbrücken, 2010.

Aleksei Koniashkin
Senior Scientist, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia
Andrei Korolkov
PhD Student, Moscow Institute of Physics and Technology, Russia
&
Oleg Ryabushkin
Head of Department, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia

Probe Piezoelectric Crystals as Temperature Sensors for Optical Materials

Development of high power laser systems is limited by the problem of optical materials overheating by laser radiation. For optical absorptance testing laser calorimetry is widely used. Its main part is temperature kinetics measurement of the sample exposed to laser radiation. Temperature is measured mostly by indirect methods with sensors adjusted to the sample surface. However, absorption of scattered radiation can induce additional heating of the sensor. It was shown that piezoelectric resonance impedance spectroscopy can be applied for precise noncontact temperature measurement of nonlinear optical crystals [1]. Nevertheless this method is inappropriate for examination of nonpiezoelectric materials.

For precise temperature measurement of any sample interacting with laser radiation we propose to use tiny probe piezoelectric crystals placed in thermal contact with the sample. Probe crystals temperature is determined noncontactly by measuring its piezoelectric resonance frequency (Rf) shift induced by heating. We demonstrate utilization of this method for the temperature and low absorption coefficient measurement of Nd:YAG laser crystal at wavelength of 1064 nm.

To measure absorption coefficient of Nd :YAG sample kinetics of its heating under exposure to laser radiation of 3 W power at 1064 nm wavelength was studied according to laser calorimetry technique. dRf/dt slope coefficient measured right after the laser was turned on could be recalculated to dT/dt using previously performed calibration Rf(T). This initial heating is caused by absorption of laser radiation. Therefore we can obtain absorption coefficient which appeared to be $\alpha = (8.8 \pm 0.3) \cdot 10^{-3}\ cm^{-1}$. Main advantage of presented approach is that probe piezoelectric crystal sensor is transparent and its heating by scattered radiation is eliminated. Moreover, this technique is applicable to control temperature of laser material directly during laser generation.

Liudmyla Kozak
Associate Professor, Taras Shevchenko National University of Kyiv, Ukraine
Bogdan Petrenko
Student, Taras Shevchenko National University of Kyiv, Ukraine
Elena Kronberg
Scientist, Max Planck Institute for Solar System Research, Göttingen, Germany
Elena Grigorenko
Scientist, Space Research Institute, RAS, Russia
&
Antony Lui
Principal Professional Staff, Johns Hopkins University Applied Physics Laboratory, USA

Characteristics of the Turbulence Processes in the Magnetohydrodynamic Environment

Turbulence is the natural state of the hydrodynamic flows and cosmic plasma; therefore, studying its characteristics is essential for the understanding of the fundamental properties of nature. In magnetohydrodynamics, the properties of turbulence can be dramatically affected both by flow boundaries and the scales of the structures (waves, vortices, etc.) formed by magnetic and electric fields. The turbulence of plasma flows can be generated by many classes of instabilities: drift dissipative, kinetic, magnetohydrodynamic, etc. In addition, the turbulence is characterized by a large number of degrees of freedom and nonlinearly interacting modes. Scientists typically use statistical physics and the theory of probability to describe such a medium. This way they can obtain information about average variations in the macroscopic parameters of the plasma medium in time (or space) without scrutinizing the conditions of excitation of specific nonlinear processes. In this work, we address the features of turbulent processes in the magnetospheric tail.

The analysis of magnetic field fluctuations in the tail of the magnetosphere at various spatial and temporal scales for the events of 20/07/2013 and 12/08/2014 observed by the Cluster-2 and THEMIS missions was carried out.

Multiracial analysis, spectral and wavelet analysis was done. The features of the turbulent processes on the different time scales were obtained. Moreover, the temporal profiles of the time dependence of

the fluctuation power for the gyrofrequencies of hydrogen, oxygen, and helium ions are established.

The work is done in the frame of the grant Az. 90 312 from the Volkswagen Foundation («VW-Stiftung»).

Valentina Markova
Bulgarian Academy of Sciences, Bulgaria

New Axioms to Describe Gravitation

In the present work an attempt has been made to extend the theory of electromagnetic field into a more general field theory. It is known that Maxwell's laws are based on an axiom, which states that the even movement of vector E leads to movement in a closed loop (div rot E = 0). The author replaces this axiom with a new one, which states that the uneven movement of vector E results in an open loop (div rot E ≠ 0) or open vortex. In the subsequent two axioms and four laws the following results are obtained: the even movement is replaced by an uneven one (decelerating or accelerating) and movement in 3D is received (from movement in 2D); pairs of objects are constructed as transformations of uneven vortex (decelerating into accelerating and vice versa) and movement in two resultant mutually perpendicular loops in 3D. Thus, in the expansion of the base, defined by the new axioms, the number and complexity of the structures that are built on top is increased. As a result of the unevenness of open vortex a number of very interesting effects appear. An effect which is obtained directly relates to Gravity and Antigravity.

Evaldo Mendonca Fleury Curado
Professor, Centro Brasileiro de Pesquisas Físicas – CBPF, Brazil

A Lorentz Invariant Velocity Distribution of a Relativistic Gas

We examine the problem of the relativistic velocity distribution in a 1-dim relativistic gas in thermal equilibrium. We use numerical simulations of the relativistic molecular dynamics for a gas with two components, light and heavy particles. However in order to obtain the numerical data our treatment distinguishes two approaches in the construction of the histograms for the same relativistic molecular dynamic simulations. The first, largely considered in the literature, consists in constructing histograms with constant bins in the velocity variable and the second consists in constructing histograms with constant bins in the rapidity variable, which yields Lorentz invariant histograms, contrary to the first approach. For histograms with constant bins in the velocity variable the numerical data are fitted accurately by the Jüttner distribution, which is also not Lorentz invariant. On the other hand, the numerical data obtained from histograms constructed with constant bins in the rapidity variable, which are Lorentz invariant, are accurately fitted by a Lorentz invariant distribution whose derivation is discussed in this presentation. Our derivation is based on the special theory of relativity and the central limit theorem. For v^2/c^2 << 1 and k_{B}T/(m_0 c^2) <<1 the distribution tends to the Maxwell–Boltzmann distribution.

[1] E.M.F. Curado, F.T.L. Germani and I. Damiao-Soares, Physica A 444 (2016) 963-969.

Itzhak Orion
Head of the Nuclear Engineering, Ben-Gurion University of the Negev, Israel

Quark Model versus Shell Model for the Neutron: Electrical Field Simulations

The neutron, an electrically neutral particle, has internal charge distribution that causes it to have a non-zero magnetic moment. The quark model explains this phenomenon due to charged sub-particles content of the neutron as of (+2/3e,-1/3e,-1/3e), which are the (u,d,d) quarks, respectively.

On the other hand, neutral atoms in nature consist of positive charges (protons) with orbital electrons that also sum-up to an external zero charge.

Two electrical field simulation codes were written in this study in order to model and compare the two possible charge arrangements in the neutron. A strait electron beam was transmitted toward the structure. Electron transport was simulated using the differential special-relativity trajectory equation. Neutron, as a triple quark structure, was computed by three point charge fields in the first code, and fields of a positive charge (+2) and two orbital electrons in two radii were formulated in the second code.

Each simulation code output the electrons tracks through the system, and were analyzed using the CGVIEW 3-D viewer program. The differences between the two neutron's models were viewed, and to be presented here for the first time.

A shell-model-like alternative neutron model, is suggested due to the findings.

Branko Pivac
Senior Scientist, Ruder Boskovic Institute, Croatia
Pavo Dubcek
Senior Research Associate, Ruder Boskovic Institute, Croatia
Jasna Dasovic
Ruder Boskovic Institute, Croatia
Sigrid Bernstorff
Elettra-Sincrotrone Trieste, Italy
&
Branislav Vlahovic
North Carolina Central University, USA

Photoluminescence in Ge Nanoparticles Grown in Dielectric Matrix

We applied magnetron co-sputtering to deposit alternating layers of pure dielectric and Ge doped dielectric. After a suitable thermal treatment a superstructure of Ge QDs in dielectric matrix was formed. The crystallinity and structural properties like: size, shape concentration, distribution and self-organization of QDs were monitored by grazing incidence X-ray diffraction and Small Angle X-ray Scattering and Raman scattering. It is shown by GIXRD that already in as deposited films Ge forms small clusters. The dielectric spacer layer separated well adjacent layers rich in Ge nanodots, and introduced a good vertical repeatability confirmed by the appearance of Bragg sheets in GISAXS patterns. It was further shown that the selected processing induced a large compressive stress on the formed Ge QDs. The stress development during QDs growth affects the interface dot/matrix and a layer close to the dot surface. This dynamics of such layer formation and the fractal properties of QDs surfaces were explored analyzing the GISAXS data. The optical properties of QDs superstructure were monitored by PL and time-resolved PL in visible and NIR region and Raman measurements. The high density of crystalline Ge QDs in amorphous dielectric matrix produced a strong luminescence in the visible at 2-2.5 eV. Due to the fast decay dynamics of PL in this energy range, it is attributed to matrix defects present in the vicinity of the Ge dot surfaces (interface region with the matrix). The visible PL peak of these structures demonstrate complex structure, however it is described with the same decay dynamics suggesting the same mechanism of relaxation.

Dzmitry Protasenya
PhD Student, Moscow Institute of Physics and Technology, Russia
&
Oleg Ryabushkin
Head of Department, Kotelnikov Institute of Radio Engineering and Electronics of RAS, Russia

Surface Defects Detection in Optical Materials by Radiofrequency-Optical Spectroscopy

Various optical crystals and glasses are widely applied in high power lasers. Unwanted optical absorption of these materials is a significant barrier for power scaling. Some methods of crystal quality assessment based on measurement of crystal heating by laser radiation were proposed. The result of all such measurements are spatially averaged crystal temperatures. We propose a method for local surface temperature measurement.

We put into contact optical glass or crystals with small piezoelectric crystal, such as LiNbO3.Thus, micro-crystal comes into thermal equilibrium with glass surface. Then acoustic vibration modes of crystal are excited and resonance frequency is measured. The dependence of frequency on temperature is calibrated in advance, so surface temperature can be unambiguously defined.

The key component of our system is a fiber-optic probe. It is a tapered fiber with 6 electrodes in its cladding. We create electric field at the tip of the probe by voltage application to one pair of electrodes. It is a field that excites piezoelectric resonance in micro-crystal. The laser radiation propagates inside the core of the fiber, reaches the surface and locally heats a small piece of a sample. Both experiment and numerical simulation were conducted, their results are qualitatively the same.

To sum up, make conclusions about proposed technique. Firstly, our method doesn't include auxiliary absorbing radiation components, such as thermopile sensors, that artificially overestimate measured temperature. Secondly, it makes possible to measure practically every medium, both crystals and glasses. Thirdly, the greater part of crystal defects are surface defects and we can visualize their locations!

Victor Manuel Duran Ramirez
Research Professor, Universidad de Guadalajara, Mexico
Alejandro Martinez Rios
Research Professor, Centro de Investigaciones en Óptica, A.C., Mexico
Jesus Munoz Maciel
Research Professor, Universidad de Guadalajara, Mexico
&
Gerardo Peña Lecona
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Laser Diffractometer for Measuring the Refractive Index of Liquids

Methods to measure the refractive index of liquids, in which the liquids are contained in a rectangular cell, have been reported. One of these methods is based on the measuring of the displacement of the propagation axis of the laser beam at the output of the cell [1]. In this method is necessary to rotate the cell for each measurement of a beam displacement. In other methods, the rectangular cell is used in combination with a diffraction grating [2-4]. The described technique in reference [2] determines the refractive index by intensity measurements of the diffracted first order of the light after passing through a sinusoidal relief grating immerse in the studied liquid. In this method is not necessary to know the frequency of the grating but is necessary to know its refractive index. In the procedure of the reference [3], the diffraction grating is engraved on the inner face of one of the walls of the rectangular cell, and the refractive index is obtained by measuring of the deviation of the diffraction orders. In reference [4], the refractive index is obtained by measuring of the displacement of the first-order. In this method the effect of the glass cell is ignored, so that it is an approximate technique.

A method for measuring the refractive index using a laser diffractometer is presented. The diffractometer consists of a laser, a diffraction grating and a rectangular glass cell filled with the liquid to be measured. When the laser beam hits on the diffraction grating, the propagation axes of the diffraction orders are displaced when they pass through the cell. By measuring of the displacement of the diffraction orders we can obtain the refractive index of the liquid. Here, we show that the calculus of the refractive index is independent of the position of the diffraction grating; namely, the diffraction grating can be placed close or tied at the outer surface of the first wall of the cell, or even immersed in the studied liquid.

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Highly Selective and Sensitive Dual Channel Schiff Base Chemosensors for the Detection of Al(III), Fe(III) & Cu(II)

Chemosensor may be defined as a device which can convert a chemical signal into an electrical signal indicative of the presence of an analyte. Though many Schiff bases which find application as chemosensors are in the literature, schiff bases which are highly cost effective as well as of inimitable quality are not only limited in number but also much saught after.

The element aluminium is intertwined with our day to day activities. The proliferation of aluminium in human bodies retards numerous enzyme activities, thereby hampering iron metabolism coupled with severe damage to central nervous system. Aluminium absorption also causes alzheimer and parkinson's diseases. Besides, aluminium affects the life of aquatic animals by causing osmoregulatory failure in them.

Iron plays a vital role in human as well as animal health. However high levels of accumulation of Fe^{3+} ends up with many metabolic disorders, certain type of cancers and malfunction of organs like heart and liver.

Copper is essential for the growth and development of many organs like heart, brain and also bones. It plays a vital role in iron absorption as well as synthesis of various proteins and enzymes. It increases immunity and paralyzes free radicals that cause considerable damage to the cells.

The present report focuses on the study of cation sensing properties of two Schiff base receptors formed by the facile condensation of 2,4-dihydroxy acetophenone first with toluidine and then with anisidine and characterized by IR,UV, ^{1}H NMR and Mass spectral studies. Both the Schiff bases were grown into single crystals from 1:1 ethanol acetonitrile medium by slow evaporation technique and found to belong to monoclinic type with space group $P2_1/c$. Hirshfeld surface analysis based on DFT method with 3-21G as basis set was used to calculate various intermolecular interactions. Fingerprint plots were made to find out the percentage of different types of interactions and pie chart was also portrayed.

Cation recognizing profile of the two receptors was explored by UV-visible and fluorescence spectroscopy methods. Receptor 1 was ascertained to detect Al^{3+} ions and receptor 2 had a response for Fe^{3+} & Cu^{2+} ions , both over a panel of several other similar metal ions.

Absorption Studies

To evaluate the sensing ability, receptors 1 & 2 were made to interact with two equivalents of various metal ions such as Na^{+}, Mg^{2+}, Ca^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, $Fe^{3+,}$ Cu^{2+}, Zn^{2+}, Sr^{2+}, Cd^{2+}, Ba^{2+}, Hg^{2+}, Pb^{2+} & Al^{3+} . While receptor 1 had a successful interaction with Al^{3+} ions , receptor 2 had the same with Fe^{3+} & Cu^{2+} ions. These interactions were evidenced by the emergence of a new peak at 303nm in the absorption spectrum of receptor 1 and at 365nm & 461nm in the case of receptor 2. The synergistic ability was further corroborated by incremental titrations. These changes in the absorption behaviour of the receptors may be imputed to the formation of complexes between the receptors and the metal ions, thus paving the way for LMCT transitions.

Binding Constant and Stoichiometry

Binding constant of receptor 1 with Al^{3+} was determined to be $11.17x10^{3}$ and that of receptor 2 with Fe^{3+} & Cu^{2+} were $1.43x10^{2}$ and $1.65x10^{2}$ respectively.

Job's plot analysis hinted a 2 : 1 stoichiometry for complex formation between the receptors and metal ions.

Fluorescence Studies

As done in absorption studies, the two receptors were examined for fluorescence sensing properties with different metal cations. An enormous enhancement of fluorescence intensity of about 117 fold with a substantial blue shift to an extent of 50nm was caused during the trapping of Al^{3+} ion by receptor 1; whereas a bathochromic shift of 60nm & 50nm was the result of sensing of Fe^{3+} and Cu^{2+} ions by receptor 2. A very small amount of quenching was also observed with receptor 2. The fluorescence enhancement may be ascribed to the formation of rigid complex chelate system indicating the presence of CHEF effect and the quenching may be probably due to electron or energy transfer process between the metal ion and receptor 2.

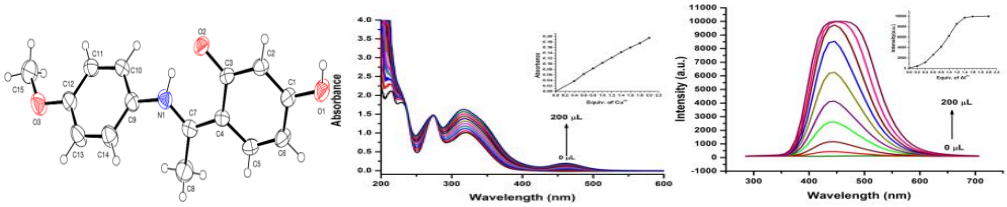
Selectivity and Reversibility

To ascertain the selectivity and reversibility of receptor 1 towards Al^{3+} and that of receptor 2 towards Fe^{3+} & Cu^{2+} ions in the midst of various competing ions, fluorescence behaviour of the receptors was scrutinized in the presence of all other metal ions taken for study.While we could notice no interference by competing species in receptor 2, we could understand that interference was induced by Fe , Mg and Pb in the case of receptor 1.

The reversibility of the receptors' sensing action was evaluated by EDTA titrations. Upon addition of two equivalents of EDTA to a solution of receptor 1 & Al^{3+}, receptor 2 & Fe^{3+} and receptor 2 & Cu^{2+}, absorption as well as emission patterns similar to that of a free receptor were procured, proving indubitably the reversible nature of the sensing function of receptors.

The detection limit of receptor 1 for Al^{3+} was 6.5318×10^{-9} M and limits of receptor 2 for Fe^{3+} & Cu^{2+} were 1.265×10^{-6}M & 4.086×10^{-6}M respectively.

It can be concluded that Schiff base receptors prepared from commonly available reagents could act as cost effective, selective, sensitive and reversible sensors for Al^{3+}, Fe^{3+} & Cu^{2+} ions over many other metal ions.



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Kinematics of a Point-like Charged Particle in a Dynamic Super Nonlinear Electric Field

Literature search reveals that the characteristics of motion of a point-like charged particle in static, time-independent electric fields have been extensively investigated. In this context a variety of fields are introduced, some with practical applications and some fulfilling pure theoretical curiosities. For relevant reasons research investigations encompassing physics issues of non-static, time-dependent electric fields are overlooked. The rationale is although the impact of a time-dependent field on a charged particle is curiously interesting, its detailed analysis is challenging; time-dependent field adds an extra mathematical layer of complexities. Our investigation has the potential of augmenting the field of electrodynamics. We consider a set of innovative dynamic scenarios. Generally speaking in addition to the peculiar nature of the proposed problems the analysis of each scenario encounters a super non-linear differential equation describing the motion. We claim these equations are analytically unsolvable. We detail the complexity of the equations associating their potential numeric solutions with the cutting-edge advances in Computer Algebra System (CAS), *Mathematica* in particular. Solutions are conducive to producing a wealth of insight.

Specifically in this article we consider a rod that either is charged a) uniformly or b) half positively and the other half negatively and that either it 1) rotates or 2) oscillates about an axis perpendicular to the rod through its center. The rod creates a time-dependent electric field within its plane. We then investigate the motion of a loose point-like charged particle within the planar field. The investigation entails kinematics such as: a time-dependent coordinate, a dynamic trajectory, velocity, acceleration, and a set of unusual phase diagrams. For comprehensive understanding the article includes dynamic animations.

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Spatial Chaos, Multifractal Vector Fields and Stochastic Clifford Algebra

There have been numerous attempts to analyse and simulate chaotic systems whose spatial extension is of prime importance, such as turbulence, weather and climate. This was done at first with mono/uni-scaling approaches (e.g. structure functions, rescaled range or spectral analyses), however multifractal techniques are required to grasp the fundamental feature of intermittency, to track and simulate the scaling singularities of the underlying equations instead of relying on numerical, scale truncated simulations of these equations (e.g. Royer et al., 2008, Lovejoy and Schertzer, 2013 for climate).

Domains of multifractal fields can arbitrarily large, but on the contrary their codomains have been rather restricted to be 1D. This prevents to deal with the key question of complex component interactions and their non trivial symmetries. The latter are unfortunately indispensable to answer to challenging questions such as the climatology of (exo-) planets based on first principles (Pierrehumbert, 2013) or to fully address the question of the relevance of quasi-geostrophic turbulence and to define an effective, fractal dimension of the atmospheric motions (Schertzer et al., 2012).

Orthogonal rotations and mirror symmetries are used to generate a Clifford algebra of stable Levy generators of multifractal cascades with arbitrarily large codomains, e.g. large dimensional manifolds. These processes are endowed with universal statistical and robust algebraic properties, both defining the basic symmetries of the corresponding fields (Schertzer and Tchiguirinskaia, 2015).

In this presentation, we will emphasise respective role of the spherical and hyperbolic geometries depending on the signature of the quadratic form of the algebra. This should help to overcome current obstacles to the use of multifractal analysis and simulation at their full extent.

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Citizen Science in the Context of Indigenous Knowledge

The conduct of scientific work by members of the general public is broadly called "Citizen Science". The attention and popularity that this practice has gained in recent years stem from the realization of the vital role it can play in the acquisition of knowledge about the natural world. Modern technological advances have also played an important role in its proliferation. Citizen science has been practiced for years in a variety of forms. This presentation will discuss the practice of citizen science in the context of Indigenous Knowledge.

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Longitudinal Temperature Distribution inside Active Optical Fiber in Lasing Condition

Fiber laser output power scaling is important issue nowadays. It requires higher pump levels leading to intense overheating of the active medium. One of the main reasons of active fiber heating is a quantum defect, which is the difference between pump and generated photon energies. Active medium heating also occurs due to passive losses of pump and generated radiation and due to other various non-radiative processes.

Active fiber temperature change leads to variation of absorption and emission cross-sections of active ions that eventually results in output power decrease, laser wavelength shift, and lasing threshold increase. Strong overheating also causes variation of fiber waveguide properties changing radiation mode structure, and leading to polymer cladding degradation. Several approaches were introduced for determination of active fiber temperature in lasing conditions, for example longitudinal temperature distribution of Yb/Er-doped fiber was measured using an adjacent sensor fiber with written array of fiber bragg gratings (FBGs). Temperature of the active Yb/Er fiber core can be calculated using measured reflectance spectra of FBGs that shift with temperature. Also impedance spectroscopy has been successfully applied for temperature measurements of active fiber polymer cladding under lasing conditions. It is based on measurement of polymer cladding dielectric constant change with temperature in radio frequency range.

Lately one more relatively simple and novel method for precise measurement of active fiber temperature was demonstrated. It is based on exploiting temperature dependence of the electrical resistance of the metal wire being in heat contact with fiber polymer cladding. In present work further development of this technique is introduced. Number of

sensors was increased for more precise measurement of the longitudinal temperature distribution.

Experimental results reveal that optical absorption inside polymer cladding considerably effects active fiber heating. Theoretical model taking into account this absorption allows determination of 3D temperature distribution of active fiber in lasing conditions.

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Study of the Cumulative Number Distribution of Charged Particles Produced in $p^{12}C$-Interctions at 4.2 A GeV/c

The behavior of the cumulative number distribution of protons, π^+- and π^--mesons, produced in $p^{12}C$-interctions at 4.2 AGeV/care studied and also with maximum values of cumulative number in an event too. The experimental data were compared with ones coming from the Dubna version of the cascade model.We have got that:

- there are four different regions in the cumulative number distributions for all charged particle and protons, the last region is correspond to values of cumulative number great than 1 - cumulative regions;
- in case of pions number of regions decreased to 2 for negative ones and 3 for π^{-+}-mesons;
- there is absent the cumulative area for π^--mesons but there are a few π^+-mesons in the cumulative area;
- Cascade cannot describe satisfactorily the distributions of the cumulative protons and cumulative π^{-+}-mesons, it gives less number for the mentioned particles.
- in case of particles with maximum values of cumulative number cascade can describe the behavior of cumulative number distribution well

The last two results point out that there exist some events with two cumulative particles which could not describe by the cascade dynamics. May be collective nucleon effect could be reasons of the observation two cumulative particles events.

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Theoretical Study on Heating Rate Effect Using Simulated Thermoluminescence Glow Peaks

Luminescence describes the emission of light. Luminescence emission occurs after an appropriate material has absorbed energy from a source such as ultraviolet (UV) or X-ray radiation, electron beams, chemical reactions, and so on. Thermoluminescence (TL) is a form of luminescence that is exhibited by certain crystalline materials, such as some phosphors, when previously absorbed energy from alpha, beta, gamma radiation or other ionizing radiation is re-emitted as light upon heating of the material. The phenomenon is distinct from that of black body radiation. TL glow peaks of obtained from thermoluminescent materials are characteristics of the different trap levels for the band gap of the material. In this study, heating rate (HR) effects on TL glow peaks were studied in details using first order simulated TL glow peaks. In order to determine thermal quenching and temperature lag effects, which are depend on the HR, non-overlapping TL glow peaks were obtained from Mathematica software. In all calculations, different 15 HR values, between 0.5°C/s and 50°C/s, were used and then all results related to HR values were evaluated.

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