5th International Conference on MODERN TRENDS IN PHYSICS RESEARCH

Abstracts & Projects Book

NANOTECHNOLOGY & APPLICATIONS

LASERS AND APPLICATIONS & HIGH POWER LASERS

NUCLEAR, HIGH ENERGY & PARTICLE PHYSICS

CONDENSED MATTER PHYSICS

ATOMS

ATOMIC & ASTROPHYSICS

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15-19 December 2014
The 5th International Conference on

MODERN TRENDS IN PHYSICS RESEARCH

MTPR-014

15-19 December 2014

UNDER THE PATRONAGE OF
Prof. Dr. GABER NASSAR
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PI OF The Project Pilot plant for High Density Laser Induced Thermal Energy for Water Desalination

ORGANIZED By
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بِبِلَّاتِ اللَّهِ أَحْمَدَ.
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INTRODUCTION

The MTPR-014 held on \(\text{\textbackslash 5}\) Dec. till 19 Dec. 2014, at Cairo University, is the fifth continuation of the conferences to be biannually organized by the Physics Department, Faculty of Science Cairo University on International bases. This year we have the occasion of establishing an High Density Laser Induced Thermal Energy for Water Desalination HDLITE. We would like to announce the importance of this field and to get deeper knowledge from the distinguished experts who already started this field especially at Guangzhou, Advanced photonic institute. For all the other Topics we also are lucky to get to our final aim by several experts in Astrophysics, Atomic, Molecular, Condensed matter, Nano-Materials and Nuclear & particle Physics, Accepting our invitation to Participate in MTPR-014.

The GOAL & MOTIVATION of the meeting could be summarized as:

- Innovate knowledge about recent breakthroughs in PHYSICS fundamentals and technological aspects
- Develop greater understanding of physics research and its applications to promote new research fields
- Elaborate the existing possibilities to perform systematic studies on the vast expanding fields of PHYSICS
- Activate methods for implementing local, regional and international cooperation in PHYSICS RESEARCH
- Lay down ways to perform projects forwarded by INDIVIDUALS, GROUPS or AUTHORIZED Researchers in Novel PHYSICS Fields

IDEAL to implement greater understanding of the importance of developing new facilities to perform research in new PHYSICS fields.

IDEAL to encourage International Collaboration with Egyptian Teams in R&D projects to catch up Modern Trends in Physics Research

TECHNICAL PROGRAM

MTPR-014 technical program will fall in 12 sessions 3.5 hours each. Sessions are combined, for Keynote and Plenary presentations of invited speakers. 3-4 parallel sessions for Oral presentations are devoted to the four topics given below. Two evening sessions are devoted to the Posters & Projects.
TOPIES & SCOPE

TOPIC I: Atomic, Astrophysics & Condensed Matter

The encountered subjects could possibly be classified into: Atomic Physics, Iso-electronic sequences, Ionic states, Vibrational Levels of Molecules, Resonant Transfer Excitations, Clusters an Intermediate State of Matter, Ferromagnetics, Semiconductors, Thin Films and Ion Sources, Application to biology and technology. Physical Processes in the solar system from the sun to the plants, Climate Phenomena.

TOPIC II: NanoTechnology& Applications


TOPIC III: Lasers and Applications& High Power Lasers

The presentations deal with: Physics at Ultrahigh Laser Intensities leading to New fields of HIGH DENSITY SCIENCES, Femto-chemistry, PHOTONICS, Plasma Physics, Quantum effects Entanglement in Atoms, Quantum Cavity QED, ULTRA HIGH Laser Particle & Electron Acceleration, Nonlinear Optical Processes, Computational and Simulation Models, New Lasers, Laser Spectroscopy, Laser Induced Processes, Laser Applications in Medicine and Biological Aspects, Laser Application in Environmental research, Laser Application in Industrial Fields..

TOPIC IV: Nuclear, High Energy & Particle Physics

PROGRAM AT A GLANCE

MTPR-014 FROM 15 – 19 DECEMBER 2014
# PROGRAM of MTPR-014

**MONDAY 15 DECEMBER 2014**

<table>
<thead>
<tr>
<th>SESSION</th>
<th>ACTIVITY</th>
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<th>TIME</th>
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</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>Registration</td>
<td>CU Library</td>
<td>16:00</td>
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<tr>
<td></td>
<td>Opening</td>
<td>CU Library</td>
<td>17:00</td>
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<tr>
<td></td>
<td>CU Museum</td>
<td>CU Library</td>
<td>18:30</td>
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</tbody>
</table>

### Break Dinner Guest House 20:00

During the opening Professors: Lotfia, Khaled, Elsayed & Mostafa will each give 10 minutes talk to introduce the concept of the expected importance & scope of MTPR-014. Then Professors Gamal Esmat & Gaber Nassar will explain the university vision concerning research strategy. Professor Mahmoud Sakr will impose the policy towards innovative research plans.
TUESDAY 16 DECEMBER 2014

All Participants are kindly advised to be at the Marine Club, Magless Kiadet Al Thawra St., at maximum 09:30 to catch the Falandra boat in order to enjoy the Nile Cruz during session 2&3.

Int. Invited Speakers are requested to kindly catch the minibus in front of the guest house at 08:30 to take them to the Marine Club in time.

SESSION ACTIVITY PLACE TIME
Session 2 M. A. El-Sayed Falandra 10:00

Break Coffee Falandra 10:45

Session 3 Sultana Nahar Nile Cruz 11:00

Hassan Talaat Nile Cruz 11:45

Fazal-e- Aleem Nile Cruz 12:15

Salah Obayya Nile Cruz 12:45

Break F a l a n d r a L u n c h 13:15

Heading to Luxor, two buses infront of Cairo University Guest house, will leave at 15:30.

ALL PARTICIPANTS ARE KINDLY REQUESTED TO BE ON TIME

REACHING LUXOR PYRAMISA HOTEL IS EXPECTED 22:00
### WEDNESDAY 17 DECEMBER 2014

<table>
<thead>
<tr>
<th>SESSION</th>
<th>ACTIVITY</th>
<th>PLACE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Session 4</td>
<td>A. Ionov</td>
<td>Pyramisa CR</td>
<td>09:00</td>
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<tr>
<td></td>
<td>Alim H. Nagiv</td>
<td>Pyramisa CR</td>
<td>09:45</td>
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<tr>
<td>Break</td>
<td>Coffee</td>
<td>Pyramisa CS</td>
<td>10:30</td>
</tr>
<tr>
<td>Session 5</td>
<td>Lotfia El Nadi</td>
<td>Pyramisa CR</td>
<td>11:00</td>
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<td></td>
<td>Hosam Ghrieb</td>
<td>Pyramisa CR</td>
<td>11:45</td>
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<tr>
<td></td>
<td>A. Abdelsalam</td>
<td>Pyramisa CR</td>
<td>12:15</td>
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<tr>
<td></td>
<td>A. Garamon</td>
<td>Pyramisa CR</td>
<td>12:45</td>
</tr>
<tr>
<td>Break</td>
<td>Lunch</td>
<td>Pyramisa CS</td>
<td>13:15</td>
</tr>
<tr>
<td>Session 6</td>
<td>P. Loukakos</td>
<td>Pyramisa CR</td>
<td>14:30</td>
</tr>
<tr>
<td>Break</td>
<td>Tea</td>
<td>Pyramisa CR</td>
<td>14:50</td>
</tr>
<tr>
<td>Session 7</td>
<td>Kh.Khasanov</td>
<td>Pyramisa CR1</td>
<td>15:10</td>
</tr>
<tr>
<td>Session 8</td>
<td>M. Osman</td>
<td>Pyramisa CR1'</td>
<td>15:10</td>
</tr>
<tr>
<td>Session 9</td>
<td>M. Badawy</td>
<td>Pyramisa CR2</td>
<td>15:10</td>
</tr>
<tr>
<td>Break</td>
<td>Lounge</td>
<td>Pyramisa CS</td>
<td>16:10</td>
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<tr>
<td>Session</td>
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<tr>
<td>Session 10</td>
<td>Oral</td>
<td>Pyramisa CR1</td>
<td>16:30</td>
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<tr>
<td>Session 11</td>
<td>Oral</td>
<td>Pyramisa CR1'</td>
<td>16:30</td>
</tr>
<tr>
<td>Session 12</td>
<td>Oral</td>
<td>Pyramisa CR2</td>
<td>16:30</td>
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</table>

**Visit to Karnak Sound & Light** 18:00
<table>
<thead>
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<th>SESSION</th>
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<tr>
<td>Session 13</td>
<td>C. Hee Nam</td>
<td>Pyramisa CR</td>
<td>09:00</td>
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<tr>
<td></td>
<td>Amr Zaher</td>
<td>Pyramisa CR</td>
<td>09:45</td>
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<tr>
<td></td>
<td>M. El Nagdy</td>
<td>Pyramisa CR</td>
<td>10:30</td>
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<tr>
<td>Break</td>
<td>Coffee</td>
<td>Pyramisa CS</td>
<td>10:30</td>
</tr>
<tr>
<td>Session 14</td>
<td>S.I. Bozhko</td>
<td>Pyramisa CR</td>
<td>11:00</td>
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<td></td>
<td>S.I. El Dek</td>
<td>Pyramisa CR</td>
<td>11:30</td>
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<td></td>
<td>Tarek M.</td>
<td>Pyramisa CR</td>
<td>12:00</td>
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<td></td>
<td>A.I. Refie</td>
<td>Pyramisa CR</td>
<td>12:30</td>
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<tr>
<td>Break</td>
<td>Lunch</td>
<td>Pyramisa CS</td>
<td>13:15</td>
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<tr>
<td>Session 15</td>
<td>H.Mansour</td>
<td>Pyramisa CR1</td>
<td>14:30</td>
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<tr>
<td>Session 16</td>
<td>M.M.Saad</td>
<td>Pyramisa CR1'</td>
<td>14:30</td>
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<tr>
<td>Session 17</td>
<td>Mongur H.</td>
<td>Pyramisa CR2</td>
<td>14:30</td>
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<tr>
<td>Visit Valley of The Kings</td>
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<td>15:00</td>
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<tr>
<td>Session 18</td>
<td>Oral</td>
<td>Pyramisa CR1</td>
<td>17:30</td>
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<tr>
<td>Session 19</td>
<td>Oral</td>
<td>Pyramisa CR1'</td>
<td>17:30</td>
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<tr>
<td>Session 20</td>
<td>Oral</td>
<td>Pyramisa CR2</td>
<td>17:30</td>
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</tbody>
</table>
Session21        Poster        Pyramisa Hall        18:00

Conference Banquet   (Winter Palace)  20:00
<table>
<thead>
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<th>SESSION</th>
<th>ACTIVITY</th>
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<tbody>
<tr>
<td>Session 22</td>
<td>A. Ionov</td>
<td>Pyramisa CR</td>
<td>09:00</td>
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<td></td>
<td>Alim H. Nagiv</td>
<td>Pyramisa CR</td>
<td>09:20</td>
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<td>Fazal-e- Aleem</td>
<td>Pyramisa CR</td>
<td>09:40</td>
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<td>M. El Sayed</td>
<td>Pyramisa CR</td>
<td>10:00</td>
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<tr>
<td></td>
<td><strong>Closing Session and Certificates of Attends</strong></td>
<td><strong>Pyramisa CR</strong></td>
<td><strong>10:20</strong></td>
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<td></td>
<td><strong>Friday Prayers</strong></td>
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<td><strong>11:30</strong></td>
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<td></td>
<td><strong>Check Out &amp; Free Shopping</strong></td>
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<td><strong>12:30</strong></td>
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<td><strong>Back trip by bus Hurghada</strong></td>
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<td><strong>16:00</strong></td>
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<td></td>
<td><strong>Dinner at Hurghada</strong></td>
<td></td>
<td><strong>21:00</strong></td>
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<tr>
<td></td>
<td><strong>Sleep the night at Pyramisa Hotel</strong></td>
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</tbody>
</table>
SATURDAY 20 DECEMBER 2014

Breakfast at Pyramesa Hurghada Hotel       08:00

Glass boat and Submarine under see life     10:00

Check out and back trip to Cairo           12:30

Attends of Session Keynote (45 min.) and Plenary (30 min.) is for all participants

Attendance of Session invited talks (20 Min.) and oral presentation (15 min) is specializing for each topic. (Parallel Sessions).

The best posters will be awarded.
PROGRAM OF THE OPENING CEREMONY MTPR-014
NEW CENTRAL LIBRARY – CAIRO UNIVERSITY

Monday 15 December 2014

16:00 REGISTRATION

17:00 OPENING – HOLY QURAN

17:10 CONFERENCE ADMISTRATION WORDS

17:10 WORD of the CONFERENCE
LOTFIA EL NADI
STEARING CHAIRMAN MTPR-014

17:20 WORD of the PHYSICS DEPT.
KHALED A. AZIZ
HEAD OF PHYS. DEPT.
VICE CHAIRMAN OF MTPR-014

17:30 WORD of the FACULTY OF SCI.
EL SAYED FAHIM
DEAN FACULTY OF SCIENCE
CHAIRMAN OF MTPR-014

17:40 WORD of CAIRO UNIVERSITY
GAMAL ESMAT
CAIRO UNIV. VICE PRESIDENT
CONFERENCE PATRONAGE

17:50 WORD of ACADEMY ASRT
MAHMOUD SAKR
PRESIDENT OF ACADEMY SRT

18:00 WORD of HONOR
MOSTFA EL-SAYED
HONARAY CHAIRMAN MTPR-014

18:10 MEDALS OF APPREIATION TO INVITED PROFESSORS TO MTPR-014
CONFERENCE PHOTOGRAPH AT THE ENTERANCE OF THE LIBRARY

18:15 THE VISIT TO CAIRO UNIVERSITY PANORAMA SHOW & THE MUSIUM

20:00 CONFERENCE DINNER AT THE GUEST HOUSE OF CAIRO UNIVERSITY
MTPR-014

Session 1: HONOREY PRESENTATION
Plasmonic Gold Nanoparticles meet laser light in the Cancer cell: following cell cycle, cell death, drug delivery dynamics and drug efficacy.

Mostafa Amr El-Sayed ’s Group.
Laser Dynamics Laboratory, Georgia Institute of Technology, Department of Chemistry, Atlanta, Georgia, http://ldl.gatech.edu

ABSTRACT

When metallic gold is reduced in size to the nanoscale, it becomes possible with weak resonant light to coherently excite large number of its conduction band electrons resulting in very intense electromagnetic fields. This intense field can decay by being either converted into heat that is used for the photo-thermal therapy of cancer or converted into strong scattered light. The strong scattered light is used for imaging of cancer cells for diagnosis. If the enhanced scattered light from particles in cancer cells is spectrally analyzed, information about molecular changes occurring within the cell during its life functions or as it dies or drug treated can be revealed.

By conjugating small concentrations of gold nanoparticles to the nucleus membrane of the cancer cells we were able to record its SERS (Raman vibrations) and/or its Rayleigh scattering images in the different phases of its full cycle, or as it dies if given cancer drugs, and enabled us to follow the dynamics of drug delivery and measure the relative efficacy of different cancer drugs using either Rayleigh or SERS method of detection. Finally, SERS technique was used in developing a technique that enabled us to follow the time profile of the different processes involved in the death mechanism of a cancer cell caused by use of a cancer drug.

KEYNOTE (KN) PRESENTATION

PLENARY (PL) PRESENTATION

INVITED LECTURE (IL)
High Density Laser Induced Thermal Energy for Water Desalination

*A.M. Aboulfatouh, *Khaled A. ElSayed, *A. I. Refaei,  
1 Mohamed Ramadan,  
2 Mohamed Ezzat,  
3 Yasser ElBaz,  
4 Hisham Imam  

*Laser Physics Lab., Physics Dept., Faculty of Science, Cairo Univ. Giza  
1 Inspection Research Lab., Ministry of Interior Affairs, Cairo, Egypt.  
2 Center of Nanoelectronics and Devices, Zewail City of Science &Technology, 6 October City, Egypt.  
3 Private Sector, Cairo, Egypt.  
4 NILES, Cairo University  
*Corresponding author: mtprlotfia@gmail.com

ABSTRACT

We emphasize the importance of Creating facilities and programs for performing systematic studies at Cairo University relevant to Energy Production. Our goal is to utilize the thermal emery of inertial fusion induced by high density laser interaction with solid targets to desalinate sea water.

We suggest catching up with what others already reached by establishing a pilot plant for studying the feasibility of turning the high density laser power to thermal energy.

We plan to initiate unprecedented large experiments provided by high technological measuring equipments that are widely used in international laboratories, namely VULCAN in UK, HIPER in Europe, QBF in Korea, and NIF in LLNL in USA Such Laboratory for advanced HD Physics would be dedicated to the pursuit of Inertial Fusion Energy as a sustainable, clean and long term solution to mankind’s energy needs whilst simultaneously provide a unique tool to do scientific and applied research that has direct impact on innovative industrial materials serving the Egyptian and the international Society. Other fields of applications are wide open to turn Cairo University to an International domain of advanced research. This would place Egypt on the Map of international research devoted to serve and upgrade society needs.

It is worthwhile to mention that in Japan there are now more than 20 labs. In China 8, in Korea 4 in India 3, in Israel 2, in Russia several and in USA there are about 22 like laboratories. New Scientific young generation of researchers capable of handling and performing High Density Physics could easily be created through such project.
Development of x-ray sources using PW laser systems at APRI GIST

Hyung Taek Kim; Kyoung Hwan Lee; Hyeok Yun; I Jong Kim; Chul Min Kim; Ki Hong Pae; Jae Hee Sung; Sung Ku Lee; Tae Jun Yu; Stéphane Sebban; Fabien Tissandier; Julien Gautier; Adrien Depresseux; Jaroslav Nejdl; Michaela Kozlová; Tae Moon Jeong; Chang Hee Nam

X-Ray Lasers and Coherent X-Ray Sources: Development and Applications X
Annie Klisnick; Carmen S. Menoni
San Diego, California, United States | August 25, 2013

abstract
A PW Ti:Sapphire laser with 30-J energy and 30-fs pulse duration has been developed at GIST and applied to generate x-rays and energetic charged particles. We present the status and plan of developing ultrashort x-ray sources and their applications. We successfully demonstrated x-ray lasers and their applications to high-resolution imaging. In addition, we plan to generate high flux x-ray/gamma-ray sources using the PW laser.© (2013) COPYRIGHT Society of Photo-Optical Instrumentation Engineers (SPIE). Downloading of the abstract is permitted for personal use only.

Topics
Lasers ; X-ray sources ; X-rays ; Particles ; X-ray lasers
Citation
http://dx.doi.org/10.1117/12.20239
Innovative Applications of Nanotechnology in Preservation of Vegetables & Fruits, Agriculture and Biofuels

Saiyed Alim Husain Naqvi
Coordinator, Centre of Excellence in Materials Science (Nanomaterials), Aligarh Muslim University

“When nature finishes to produce its own species, man begins, using natural things, in harmony with this very nature, to create infinity of species” --- Leonardo da Vinci

The power of science and technology is expressed through innovations which often results in rewards for society. The basic needs of society like food, health, clean water, cheap energy, transport, information and communication, good environment etc. are relevant even today. The society is still looking towards the technological advances to solve the age old problems related to its needs and alleviation form poverty. With the emergence of the nano-scale technology i.e. Nanotechnology, hopes are high in every segment of social development for discovering novel solutions of the problems. The great physicist, R. P. Feynman who prophesied about the emergence of new technology had said with certainty that there will be enormous number of technical applications of this technology. The beauty of this discipline is that it is interdisciplinary, cuts across all industrial and technological sectors and is expected to lead next industrial and agricultural revolution. The soul of nanotechnology lies in the art of manipulation and control of matter at nano-scale, which has been employed by Nature for making things both living and nonliving since ages.
Nanotechnology now leads an unending quest for knowledge and has provided a novel opportunity to climb a limitless ladder. This unconventional and interdisciplinary bottom up approach of manipulation of matter is sure to create wonders, provide simple solutions to difficult problems of human health and longevity, energy, water, agriculture, environment and may ultimately be successful in the creation of a prosperous and healthy society.
ABSTRACT

TOTEM measurements give us clearer picture of diffractive scattering at TeV energies. Together with measurements at GeV energies, theory faces a challenge. In our recent work, it was observed that by using Generalized Chou Yang model we can give a consistent picture of hadronic radii. In this talk, we will give an overview of current and future TOTEM measurements together with theoretical explanation.
Diagnostics of Electron Temperature in Laser Produced Plasma From Iron Target Using Plasma X-ray Emission

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ABSTRACT

X-rays emitted from iron plasmas were used to calculate the temperature from the X-ray line intensity ratio. We used a Nd:YAG laser system, frequency doubled 532 nm, emitting 40 ps pulses at repetition rate 1 to 10 Hz. The energy on iron target was about 30 mJ corresponding to an intensity of $10^{13}$ Wcm$^2$. X-ray spectra in the range 12 - 17 Å from iron targets were detected. According to Boltzmann law, a plot of the logarithmic term versus ΔE yields a straight line with slope equal to $-1/T$. The plasma electron temperature determined in this way was $\sim$ 250 eV for Fe.
Synthesis and Characterization of Graphene/zirconium oxide nanocomposite and its application in Photocatalysis

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Abstract

In this study, we have synthesized Graphene/zirconium oxide nanocomposite (Gr@ZrO2-NC) by in-situ polymerization method. The structural, optical, thermal, electrical and photocatalytic properties of the as synthesized Gr@ZrO2-NC were studied. The XRD analysis ensures that zirconium nanoparticles (ZrO2-NPs) have a monoclinic structure. The characterization data confirmed that the ZrO2-NPs were successfully incorporated into the graphene sheets. TGA/DSC results exhibited an enhanced thermal stability of the ZrO2-NPs as compare with graphene owing to the strong interaction between the ZrO2-NPs and graphene. The energy band gap as calculated through the Tauc relation was found to be lower of synthesized Gr@ZrO2-NC. We have applied the synthesized Gr@ZrO2-NC for the efficient photocatalysis of a Rhodamine B (RhB) dye. The photocatalysis results exhibited the promising photo-degradation of the RhB dye under UV light irradiation through the production of reactive oxygen species (ROS). Thus, it is encouraging to conclude that Gr@ZrO2-NC has environmental significance.
Radiation of Directed Gravitation High-Energy Photon

Kholmurad Khasanov

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In electromagnetic field gravitation emits high-energy photon with direction reverse to direction of gravitation. This phenomenon was observed during gas electric discharge in [1]. Radiation of high energy gravitation photon was experimentally observed in numerous experiments [2]. The peculiarity of such phenomenon consists in the fact that while pumped by IR photon the range of the gravitation photons energies lies in UV range. The application of gravitation photon emission may be in energy source due to difference of photon energies mentioned above.

References


Ultrafast processes on semiconductor surfaces irradiated by temporally shaped fs laser pulses: Tuning & controlling micro/nanostructures

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The application of temporally shaped femtosecond laser pulses in the micro/nano-structuring of semiconductor surfaces is investigated. As an initial step towards full pulse shaping, sequences of double pulses with variable temporal spacing in the ps time domain with equal intensity have been used. Craters decorated with nm-sized ripples are formed following the laser-surface interaction depending on the irradiation conditions. The area, depth and strikingly the ripple periodicity show a dependence on the temporal delay between the individual components of the double pulses. Our analysis and explanation for the dependence of the micro and nano-morphological features on the pulse delay is based on our recently developed theoretical model that combines the laser-triggered ultrafast excitation and relaxation mechanisms on a semiconductor surface such as carrier excitation, ultrafast carrier-lattice energy exchanges and energy transport along with the slower phenomena of melting, the corresponding hydrodynamics and re-solidification that follow until the final surface morphology is established. The details of our model and our recent experimental investigations on laser-irradiated Si and ZnO surfaces will be discussed [1-4].


Vicinal surfaces Si(hhm): templates for nanostructures fabrication

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Atomically precise triple step staircase with a periodicity of about 6 nm can be fabricated on clean Si(557) surface using special sample treatment under ultra-high vacuum [1]. This semiconducting template is very promising for fabrication of low dimensional (1D, 2D) metallic and molecular structures with unique physical properties. However, despite numerous studies of metal/Si(557) systems, the precise atomic structure of clean Si(557) surface is still controversial [1-4]. The results of previous studies suggest that it can be related to the formation of different step arrays with different local surface orientations, i.e. Si(557) [1-3], Si(7 7 10) [4], Si(223) [5,6]. Here we report high resolution STM and LEED studies of well-ordered step array fabricated on a Si(557) sample with a miscut of 9.5° from the (111) plane using special annealing procedure with electric current directed perpendicular to the steps.

The STM data show that after precise sample preparation the triple step array is extremely uniform: On some micrometer-scale surface areas the number of periodicity breakings can be as low as one per more than one hundred hill and valley sequences. According to our LEED and atomically resolved STM data the periodicity of this regular grating on the vicinal silicon surface is 5.9±0.2 nm that is most close to the Si(557) surface orientation. STM studies show that despite the high uniformity of the fabricated grating, there are at least four possible step and terrace configurations maintaining exactly the same groove periodicity throughout the surface. The atomic structure of the staircase and sample preparation strategy for fabrication of high quality step array and different nanostructures on the Si(557) surface are discussed.

References
Electronic growth of Pb nanoislands on Si(557) surfaces- STM studies and DFT modeling.

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The Pb-islands growth on a clean vicinal Si(557) surface at room temperature has been studied using Scanning Tunneling Microscopy. We observed anisotropic tilted wedge-shaped Pb-islands to grow following the Stransky-Krastanov scenario. The elongation of the islands along the step edges of Si is associated with the anisotropic potential of the vicinal template. It was demonstrated that the growth of tilted Pb bulk islands is accompanied by their separation into layers which is clearly observed in the STM images as a slab-like stacking morphology, and also appearing from the statistical analysis. The single layer preferable thickness in the slab-like stacking like structure was found to be 2nm, which corresponds to 7 Pb monolayers. The results discussed in terms of electronic growth model.

Using DFT simulations we argue that such growth mode is realized due to the minimization of the electron energy owing to the quantum confinement inside the created quantum wells. The growth mechanism can be explained in the framework of the electronic growth model including the interfacial strain and twin boundary formation. DFT simulation support that preferable position for Pb atom during growth of the 8th layer is hcp i.e. twinning boundary creation.


STUDY OF OUR STAR THE SUN

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Abstract:
Our sun is studied extensively as it is the standard for a typical star. However, knowledge about the Sun still has large discrepancies. Recent determination of abundances of common elements such as carbon, nitrogen, oxygen, etc. are up to 30-50% lower than the current standard values. Much of these discrepancies could be reduced if a fundamental quantity, the opacity of solar plasma, is revised upwards. Propagating radiation in plasmas is absorbed and emitted by the constituent elements that constitute the opacity effect. Recently measured opacities at the Sandia National Laboratory on the Z-pinch nuclear fusion device, under stellar interior conditions created on the Earth for the first time, are 30-400% higher than predictions for the most crucial element Iron. Theoretically, new large-scale calculations under the Iron Opacity Project reveal the existence of extensive and dominant resonant features in high energy photoionization. I will illustrate these and discuss how their inclusion should provide more accurate opacities, and close the gap between observed and predicted opacities and elemental abundances in the Sun.

This work was supported partially by the U.S. National Science Foundation and the Department of Energy.

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The real time understanding of the suicidal gene effects on the cytoskeletal and nano-mechanical behaviors of cancer cells may provide new, effective ways in cancer gene therapy. Here, 4DAFM was applied to monitor the effect of targeted suicidal gene-nanoparticles on the morphological and nanomechanical properties of individual, dividing cancer cells in their environment. The mechanisms of forming the suicidal gene nanoparticles were also seen in 4D.

Left; The transfection of single plasmid into a cancer cell, Right; the transfection of single plasmid-nanoparticles reaching the nucleous and kill the cancer cell.
Dispersion of single-walled carbon nanotubes (SWCNTs) by using dimethylformamide (DMF) solution

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Abstract
The dispersion of carbon nanotubes (CNTs) in liquid plays a crucial role in fundamental research and applied science. Ultrasonication is the most common technique to disperse CNTs. The surfactants used for CNT dispersion are ethanol, sodium dodecyl benzenesulfonate (SDBS), dodecyltrimethylammonium bromide (DATB), sodium dodecyl sulfate (SDS) and sodium dodecylbenzene sulfonate (NaDDBS). This research work presents the dispersion of SWCNTs by using a dimethylformamide (DMF) solution. The DMF is adsorbed on the surface of the nanotubes by a hydrophobic interaction. Ultrasonication helps DMF debundle the nanotubes by Coulombic or hydrophilic interaction, allowing the Van der Waals forces among the individual nanotubes to be overcome. UV–Vis spectra of dispersed CNTs in solution showed a maximum at 209 nm and decreased from UV to near IR. Field Emission Scanning Electron Microscope (FESEM) used to characterize the morphology of the SWCNTs thin films. And finally, the Fourier transform Spectroscopy was used to determine the interaction between surfactants and Carbon Nanotubes (CNTs).
USE OF MULTILAYER TARGETS FOR ACHIVING HIGH PRESSURE OFF-HUGONIOT STATES USING INTENSE LASERS

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TOPIC I: Atomic, Astrophysics
Ionization And Excitation Rate Coefficients For Ar XVI

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Abstract.

Absolute ionization and excitation rate coefficients have been evaluated for arbitrary excited states at certain electron temperatures $kT_e$ and electron densities $N_e$ of the Lithium-like ions Ar XVI. The populations of 24 excited levels are calculated for the doublet state of the Li-like Ar ion. The calculations have been carried out by using the coupled rate simultaneous equations in which the monopole and quadruple transitions have been introduced in the calculations in addition to the dipole transitions.

A theoretical population model has been developed to study the influence of the different processes that might contribute to the population of the different levels at the plasma parameters. The population densities of these different levels were then derived from these rate coefficients.
The Correlation between Sea Level Oscillations and Earth’s Orbital Perturbation

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Abstract

The source of Earth's volatiles especially water is subject of our paper. The orbital perturbation of the Earth correlated with the sea level oscillations and sea level rising, as an additional factor besides gravity of celestial bodies and shape of the Earth. The sea level rising leads to motion of the central mass of the Earth. In addition, this indicates that the Earth loses water vapor to space and gains water vapor from space through its motion around the sun. The reason of the rising in the sea level is not restricted only to global warming and melting of icebergs according to mass balance, but the outer space is an important factor for this rising. The green house helps poles iceberg melt to increase the sea level. Oceans evaporate water vapor into atmosphere. Some of the atmospheric water vapor escapes to space, the mechanism of water vapor passing through atmosphere needs future studies.
Empirical CME-SSC Listing Model

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3. Space Weather Monitoring Center, Helwan University.

Abstract

The association listing of CME-SSC events is the aim of our research, our study depended on the CME data obtained from SOHO/LASCO CME Catalog (15877 events) and SSC (381 events) from NOAA, during the period 1996-2010. Some of previous studies created lists manually according to some criteria and conditions. We presented such a condition to select the CME-SSC pair events automatically. We concluded that travel time of the CME shock could be estimated from empirical equation depends on spatial, temporal, CME angular width and projection effect conditions. We found high correlation according to our algorithm between the initial speed and the travel time of the CME shock, $R=0.81$ with mean arrival time error 16.67 hours for 269 events during the period 1996-2010.

Keywords: Coronal mass ejection, CME, CME Travel time, CME arrival time, ICME, Interplanetary coronal mass ejection, storm sudden commencement, SSC.
Solar Forcing on Cyclones - Case Study: Gonu 2007

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Abstract
This paper establishes the physical cause and effect relationships between solar stimuli and terrestrial responses. The solar stimuli in our case is a fast stream of solar wind emanated from a coronal hole. This stream got through the Earth's magnetosphere like a bullet and hit a particular spot of the troposphere above the Arabian Sea on 31 May 2007. There the protons, ions and electron energies were deposited and heated the atmosphere. The hot spot expanded and formed a low pressure spot above the Sea thus accelerated evaporation. The electric charges in this particular spot act as nuclei for water condensation and formation of intense clouds.
As a second step, solar wind streams hit the two polar atmospheres, inducing two surface Meridional wind velocities that moved equator wards. The northern wind and the southern winds met at the cloud spot over the Arabian Sea and formed a torque that caused the clouds to rotate about the central eye. Thus Hurricane Gonu was fully developed on early June 2007. Thus the stimuli is the coronal hole stream and the response is the hurricane.

Key Words: Solar wind, coronal hole, hurricane, Arabian Sea, magnetosphere, Gonu, Oman.
On the Solar Stimuli That Initiate Makkah Al Mukaramah, Al-Madinah Al-Munawarrah And Jeddah Flash Floods

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Abstract:
Severe solar events manifested as highly energetic X-Ray events accompanied by coronal mass ejections (CMEs) and proton flares caused flash floods in Makkah Al-Mukaramah, Al-Madinah Al-Munawarah and Jeddah. In the case of the 20 January 2005 CME that initiated severe flash on the 22nd of January,[ it is shown that the CME lowered the pressure in the polar region and extended the low pressure regime to Saudi Arabia passing by the Mediterranean. Such passage accelerated evaporation and caused Cumulonimbus clouds to form and discharge flash floods over Makkah Al-Mukaramah.

On the other hand, solar forcing due coronal holes have a different technique in initiating flash floods. The November 25 2009 and the 13-15 January 2011 Jeddah flash floods are attributed to prompt events due to fast solar streams emanated from two coronal holes that arrived the Earth on 24 November 2009 and 13 January 2011. We present evidences that those streams penetrated the Earth's magnetosphere and hit the troposphere at the western part of the Red Sea in Sudan, dissipated their energy at 925mb geopotential height and left two hot spots. It follows that the air in the hot spots expanded and developed spots of low pressure air that spread over the Red Sea to its eastern coast. Accelerated evaporation due to reduced pressure caused quick formation of Cumulonimbus clouds that caused flash floods over Makkah Al-Mukaramah and Jeddah.

Keywords: Makkah, Al-Madinah, Jeddah, Coronal mass ejections, Coronal holes, X-ray events, flash floods.
The Control of the Sun of North Atlantic Oscillation And Expectation of Rainfall Abundance Over Egypt

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Abstract

The North Atlantic Oscillation (NAO) is a climatic phenomenon in the North Atlantic Ocean of fluctuations in the difference of atmospheric pressure at sea level between the Icelandic low and the Azores high. Through fluctuations in the strength of the Icelandic low and the Azores high, it controls the strength and direction of westerly winds and storm tracks across the North Atlantic. It is part of the Arctic oscillation, and varies over time with no particular periodicity.

It is found that the sun controls the Sign of the NAO index. When the index is positive rain is abundant over North Europe and less rain falls over the Mediterranean. However, a negative index brings excessive rain to the Mediterranean and drought over Northern Europe.

According to our expectation the NAO switches to negative with weak solar cycles and this brings glad tidings to Egypt.

Several deluges over Egypt are explained in this context.
A Revolutionary Theory on The Origin of the Moon

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Abstract

We propose that the moon was a binary star with the sun. Mass transfer occurred with the sun dragging the outer envelope of its binary leaving only its hot core. This core was captured by the earth and became its locked moon. The core was cooled rapidly only from the side facing the earth. This made it possible for day and night to alternate on the earth.

Evidence for the moon being an ex core of the sun binary are as follows:

1- The excessive existence of He3 on the lunar surface on the dark positions.
2- The moon is seen to glow in gamma rays.
3- the solar corona has a temperature exceeding million degrees while the solar surface is only 6000 degrees. No acceptable theory can account for heating of the corona. It is proposed that the solar corona is actually the accretion disk captured by the present sun from its binary, the present moon.
Empirical CME-SSC Listing Model

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³. Space Weather Monitoring Center, Helwan University.

Abstract

The association listing of CME-SSC events is the aim of our research, our study depended on the CME data obtained from SOHO/LASCO CME Catalog (15877 events) and SSC (381 events) from NOAA, during the period 1996-2010. Some of previous studies created lists manually according to some criteria and conditions. We presented such a condition to select the CME-SSC pair events automatically. We concluded that travel time of the CME shock could be estimated from empirical equation depends on spatial, temporal, CME angular width and projection effect conditions. We found high correlation according to our algorithm between the initial speed and the travel time of the CME shock, R=0.81 with mean arrival time error 16.67 hours for 269 events during the period 1996-2010.

Keywords: Coronal mass ejection, CME, CME Travel time, CME arrival time, ICME, Interplanetary coronal mass ejection, storm sudden commencement, SSC.
A New Theory on
THE CREATION OF THE UNIVERSE

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Abstract

In the present research paper we have discussed the followings:
(I). The previous theories published on the birth and the development (Evolution) of the universe, namely:
(a) the Big Bang Theory, (b) the Oscillating Universe Theory, and (c) the Steady State Theory.

(II). We presented our criticism directed to such theories concluded with a statement that NO BIG BANG HAD OCCURRED IN THE PAST OR IN THE FUTURE and that ALLAH is the God and there is no God but He, He is the Creator, the Maker, the Shaper and all that is in the heavens and the earth glorifies him. He is the Almighty, the ALL-Wise, the ALL-Knowing and the Most Merciful. The Universe is expanding as His will and He is the ALL-Powerful and such expansion is not due to anything like a big bang.

(III). In this section are giving the first four items of the New Theory on the Creation of the Universe.

i. ALLAH had ordained the measures of the creation of everything in the preserved Book before creating the Heavens and the Earth by fifty thousand years and His Throne upon water.

ii. ALLAH prepared the Universe for Prophet Adam (Grandfather of the mankind) and his progeny.

iii. ALLAH created everything.

iv. ALLAH has honoured Adam and his progeny till the day of Resurrection.

DARWISH: Publishing my NEW THEORY the World starts a new ASTRONOMICAL PERIOD.
TOPIC II: Condensed Matter, Nanotechnology & Applications
Structural and magnetic properties of samarium bismuth strontium iron garnet Sm$_{2.8-x}$Bi$_x$Sr$_{0.2}$Fe$_5$O$_{12}$ (0.00 ≤ x ≤ 0.15)

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Abstract

Garnet nanoparticles Sm$_{2.8-x}$Bi$_x$Sr$_{0.2}$Fe$_5$O$_{12}$ (0.0 ≤ x ≤ 0.15) were prepared by standard ceramic technique where the pre and final sintering were 950 and 1400 °C respectively for 10 hours with heating/cooling rates of 2 °C/min. X-ray diffraction (XRD) analyses were carried out to study the role of bismuth content on the phase formation as well as on the lattice parameter, density, porosity and crystallite size of these samples. The data revealed that the crystallite size decreased with increasing Bi-content from 102 nm at x = 0.0 to 28 nm at x = 0.15. Scanning electron microscope (SEM) showed that, the porosity of the samples was decreased with increasing Bi-content. The magnetization loop (M-H) was measured at room temperature using the vibrating sample magnetometer (VSM). The magnetic measurements clarified that the Curie temperature, the effective magnetic moment and the saturation magnetization increase with increasing Bi content. The obtained results were interpreted based on the garnet structure, the role of Bi as a thermal catalytic agent and the effect of particle size on the magnetic properties. This work recognized that, Bi substitution on samarium strontium iron garnet revealed to establish new nano material used for different technological fields.

Keywords: Garnet, Bismuth Substitution, Magnetic Susceptibility and Magnetic Parameters.

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Tuning of energy gap with Al content in SmFe$_{1-x}$Al$_x$O$_3$ multiferroic

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Abstract:

Al doped SmFeO$_3$ (SmFe$_{1-x}$Al$_x$O$_3$; $0.0 \leq x \leq 0.15$ with step 0.05) were synthesized by double sintering ceramic technique. XRD and FTIR were used to probe the structure of the nucleated perovskite. XRD and FTIR analysis confirmed the formation of single-phase orthorhombic crystals of perovskite structure. The optical properties of the sample were monitored by diffuse reflectance spectroscopy (DRS) and photoluminescence (PL) techniques. Diffuse reflectance spectra were used to study the surface properties of the samples. It shows three reflection bands at different regions. It was found that the band gap is tunable with Al content. PL spectra show UV, blue and red emissions slightly shifted with Al content. The PL intensity of multiferroic material enhanced with increasing Al content.

Keywords: SmFe$_{1-x}$Al$_x$O$_3$; XRD; SEM; FT-IR; UV-Vis-NIR (DRS); PL.
Spin and Charge Density Maps of Nd$_2$Fe$_{14}$B

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**Abstract**

The total charge density and the spin density are obtained by taking the sum or the difference of the spin-up and spin-down charge densities, respectively. We performed a pure spin polarized calculations on Nd$_2$Fe$_{14}$B using the self consistent Full Potential Linearized Augmented Plane Wave (FPLAPW). In this paper, we present the spin and charge density contours for rare-earth transition metal compounds e.g. Nd$_2$Fe$_{14}$B in the (001) and (110) planes using spin-polarized without spin-orbit coupling. The charge density map and the spin density map on the (001) and (110) plane of the tetragonal cell show the evidence for covalent bonding between Fe and B atoms.

**Keywords:**

Density functional theory (DFT) - Full Potential Linearized Augmented Plane Waves (FPLAPW) - spin polarized calculations - Generalized Gradient Approximation (GGA).
Influence of (Glycine /Nitrate) Ratio on The Physical Properties of Gd$_3$Fe$_5$O$_{12}$

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Abstract

Gadolinium iron garnet (Gd$_3$Fe$_5$O$_{12}$–GdIG) was prepared using auto combustion method and glycine as fuel. The GdIG samples reveal single phase garnet with cubic symmetry. The effect of (glycine/ nitrate) ratio on the structural and magnetic properties of the investigated garnet is reported. The results of the study show that the lattice parameter decreases while a remarkable improvement of the densification is obtained with increasing (glycine/ nitrate) ratio.

Keywords: GdIG nanoparticles; (Glycine/nitrate) ratio; XRD; TEM; Magnetization.

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ABSTRACT

The effect of Cr\(^{3+}\) ion substitution on the structural, magnetic and electric properties of \(\text{Ni}_{0.7}\text{Zn}_{0.3}\text{Cr}_y\text{Fe}_{2-y}\text{O}_4\), where \(0.0\leq y\leq1.0\) is studied. All the investigated samples prepared by co-precipitation method and calcined at different temperatures. X-ray diffraction analysis for all samples show that, the nanoferrite samples are pure single phase spinel structure up to \(y=0.3\).

Both of the crystallite size and lattice parameter decrease with increasing Cr content. Discussion has been made on the basis of a comparison of the effect of the average crystallite size and Cr\(^{3+}\) ion concentration on the electrical and magnetic properties of Ni Zn ferrite.
Influence of B-site cation size variation of the physical properties of a canted AFM La$_{0.7}$Sr$_{0.3}$Fe$_{1-x}$Ni$_x$O$_3$ multiferroic samples

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Abstract

Multiferroic La$_{0.7}$Sr$_{0.3}$Fe$_{1-x}$Ni$_x$O$_3$; 0.0 ≤ x ≤ 0.2 nanometric samples were successfully synthesized using citrate-nitrate auto combustion method and their properties were systematically studied. All the samples were crystallized in a perovskite structure. The Goldschmidt tolerance factor for the perovskite decreased from 0.91 for La$_{0.7}$Sr$_{0.3}$FeO$_3$ to 0.86 for La$_{0.7}$Sr$_{0.3}$Fe$_{0.8}$Ni$_{0.2}$O$_3$ confirming that the crystal structure is orthorhombic. All the magnetic parameters such as effective magnetic moment ($\mu_{\text{eff}}$), molar magnetic susceptibility ($\chi_M$), and room temperature magnetization ($M_{\text{RT}}$) decreased as Ni content increased, while the Néel temperature indicates the highest value (834 K) at x = 0.1.

Keywords: Multiferroic; Tolerance factor; Magnetization; XRD; HRTEM; Hysteresis.
Optimum Condition for Applied Ceria Nanoparticles as UV absorbance

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Abstract:
Three different techniques have been considered to prepare ceria nanoparticles with and without Tween 80 as a surfactant. Phase formation and crystal structure were examined by X-ray diffraction (XRD) and high resolution transmission electron microscope (HRTEM). The particle sizes of the three prepared samples are 15nm, 5nm and 4nm. The measurements clarified the role of each of Tween 80 as a surfactant and the nanoparticle size on the values of zeta potential (ζ). The maximum zeta potential of un-surfactant nano-ceria in water medium was obtained at pH=5, accordingly, a neutral colloidal solution with small particle size without surfactant is suitable for medical applications. On the other hand, the results clarify that, UV absorbance depending on the refractive index of the dispersion medium and increases with decreasing the particle size for surfactant samples. These are interesting applicable results as a good coating, where the dispersed of small amount of nano-ceria in neutral water medium used to prevent UV hazards for essential fields such as furniture and medical bottles.

Keywords:
Nano-ceria – UV absorbance – Zeta potential

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Piezoresistive behavior of Multi Walled carbon nanotubes and Multiferroic nanoparticles / cement mortar composites

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Abstract

A new stain/stress sensor technology was developed, based on the concept of using Multi walled carbon nanotubes (MWCNTs) and Multiferroic nanoparticles. This new technology was manifested in concrete and mortar which greatly serve to decrease the crack depth. The use of sensors in civil structures is far from being common. In this work; there is no need to embed strain gauges or other sensors in the concrete, since the concrete itself is the sensor. The new sensor technology made use of new phenomena of the stress-induced electrical effect. This new phenomena is the change in nanomaterials/ composite contact electrical resistivity upon applying an external load on the cement composite. Concrete is somewhat electrically conducting; therefore it satisfies the basic requirement for the matrix of the composite material that senses using a new concept. The addition of conducting nanomaterials to concrete not only decreased the volume resistivity, but decreased also the contact resistivity between concrete and metal. A good electrical contact can be achieved simply by touching the concrete with the metal probe.

Keywords

Sensors, CNTs, Multiferroic nanoparticles, concrete, Resistivity.

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References

The effect of dopant concentration on the thermal and opto-dielectric properties of GdCl$_3$-doped polyvinylpyrrrolidone nanocomposite system

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ABSTRACT

Newly prepared and well-characterized nanocomposite thin films of polyvinylpyrrrolidone (PVP), containing GdCl$_3$ with percentages of 2, 5, 10, 15 and 20% by weight, are studied to investigate the effect of dopant concentration on the thermal properties, stability and degradation up to higher temperatures (500 °C) utilizing differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). A thermal transition of decomposition nature has been recorded for all samples in the range from room temperature to 150 °C. The heat consumed during this transition has showed a monotonic decrease with increasing dopant concentrations. Thermogravimetry has showed two degradation phases; at lower and higher temperature. Increasing the dopant concentration remarkably minimized the rates of degradation for the higher temperature phase. The effect of dopant concentration on the opto-dielectric properties was also investigated and the optical parameters, such as refractive index, extinction coefficient, real and imaginary parts of the dielectric constant and optical conductivity, were studied on the basis of optical data.
Preparation and optical properties of PVA/TiO$_2$

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Abstract:

The composite films of PVA/TiO$_2$ were prepared successfully by using the solvent-casting technique with different composition ratios of the two materials (1.25, 2.5, 5, 7.5, 10 and 12.5 wt%TiO$_2$). Ultrasonic were used in order to get better dispersion. Optical properties measurements explain the effect of adding TiO$_2$ on absorption coefficient, refractive index, extinction coefficient and electronic transition. The absorbance spectrum was recorded in the wavelength range 200-1000nm. It was found that absorbance increase by increasing the amount of TiO$_2$ in the film.
Fabrication and characterization of silica @ silver core-shell nanoparticles using modified method

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Abstract

The nanocomposite particles of SiO$_2$ @ Ag core shell were successfully prepared. Silica core has been synthesized by means of modified Stober process which was coated by silver to fabricate silica@ silver core-shell in 5 nm size. Silver nanoparticles were prepared by the reduction of Ag ions and PVP as a caping agent. Such core-shell nanoparticles opened new vision to be used in a wide range of applications such as: antibacterial, optics, electronics, catalystics, solar cells according to desired shape and size.

Keywords: Silica nanoparticles; Ag nanoparticles; coreshell; XRD; HRTEM; UV-vis.
Structural and physical properties of nanostructured barium doped BiFeO$_3$

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Abstract

Nanometric multiferroic samples Bi$_{1-x}$Ba$_x$FeO$_3$; (BBFO, $x = 0.10, 0.15, 0.20, 0.25$) were prepared using conventional solid-state method. The structural, particle size, dielectric and magnetic properties of the prepared samples were investigated. XRD patterns show the formation of (BBFO) with single-phase rhombohedral-hexagonal structure. At room temperature, antiferromagnetic BiFeO$_3$ is converted to ferromagnetic on Ba doping. A change in the magnetization is observed around (742-833) K. Spin canting or impurity phase could be a probable reason for the origin of ferromagnetism. The dielectric properties of the nanoparticles were affected by the properties of the substitutional ions as well as the crystalline structure of the samples.

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Synthesis and characterization of Tin oxide thin film, effect of annealing on multilayer film for sensing applications

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Abstract:

Nanocrystalline Tin oxide thin films of multiple layers were successfully prepared by the sol-gel method. Spin coater have been used to deposit the films. The starting material is SnCl\textsubscript{2}.\textsuperscript{1} The SnO\textsubscript{2} material was characterized by X-ray Diffraction (XRD), Scanning Electron Microscope (SEM) and EDS analysis. The optical properties (A, T, R) of the SnO\textsubscript{2} thin film of various annealing temperatures (400,500,600°C) and the electrical properties have been studied. Characterization results indicated that the products are composed of crystalline SnO\textsubscript{2} nanoparticles which exhibit the cassiterite-type tetragonal crystal structure\textsuperscript{3}. SEM revealed that with increase annealing temperature, the uniformity of the film increased. The variations of the refractive index (n), extinction coefficient (K) and Optical Conductivity with the wavelength have been studied. Nevertheless, the variation of the optical band gap with film thicknesses shows a significantly decrease in the values of the band gap with increase the film thicknesses. SnO\textsubscript{2} was tested as a gas sensor to detect carbon dioxide (CO\textsubscript{2}) gas. It shows high sensitivity for various concentrations of CO\textsubscript{2} gas\textsuperscript{2}.

References:


The influence of pH value on sol–gel preparation of PLZT polycrystalline powders

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Abstract

The piezoelectric Lanthanum Lead zirconate titanate (PLZT) based ceramics with a composition of La₀.₆Pb₀.₉₄(Zr₀.₅₂Ti₀.₄₈)O₃ were studied using sol-gel auto-compulsion method. The specimens were fabricated and studied to understand the effect of pH adjustment on the microstructure, dielectric and the ultrasonic mechanical properties. The material was characterized for DSC/TGA and TEM studies. A polycrystalline single phase of PLZT with tetragonal structure was obtained, for the powder calcined at 600 for 3 h and 850 °C for 3 h. The electrical properties of the prepared ceramics were investigated as a function of the frequency using impedance analyzer. The remnant polarization (Pᵣ) and coercive electric field (Eᵥ) were calculated from the ferroelectric loop by Sawyer-Tower circuit.
EFFECT OF TEMPERATURE AND ADDITIVES ON THE ELECTRICAL PROPERTIES OF ZnO VARISTOR

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Abstract:
Mixtures of ZnO and Ce$_2$O$_3$ as additive were prepared by solid state reaction from the calcined oxides with the following proportions 0.15, 0.25, 0.4 mol%. SEM revealed the presence of intergranular phase. Phases developed were detected by XRD. XRD showed that no binary compound was formed. EDAX showed that cerium was detected in the ZnO grains confirming the XRD results. The conductivity is highly dependent on the microstructure of conducting grains surrounded by this insulating oxide barrier. The electrical conductivity was found to increase with the proportion of cerium oxide up to 0.25 mole then decreased.

Keywords: electro-ceramics, varistor, ZnO, cerium oxide
Nano-Molar concentration of Cu(II), Zn(II) and Co(II) in Wastewater by a Novel Carbon paste ion-selective electrode

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ABSTRACT

A novel highly selective sensitive for decreasing the detection limit for a Cu(II), Zn(II) and Co(II) have been fabricated from ion-selective electrode (ISE). The ISE is designed using acetaldehydethiosemicarbazone complex as ion-exchanger in carbon pastedissolved in tricresyl phosphate (TCP) as pasting liquid were prepared. This work describes the attempts to develop the electrodes, measurements of their characteristics and determination in real samples. The developed sensors exhibit good linear response of Nernstian slopes of 29.5±1, 28.5±1 and 29.0±1 mV per decade over the concentration range of 5.0×10⁻⁸-2.0×10⁻³, 6.3×10⁻⁸-7.9×10⁻³ and 3.3×10⁻⁸-8.0×10⁻³ M and a detection limit of 0.26, 0.5 and 0.3 nM for Cu(II), Zn(II) and Co(II) respectively. The sensors have a relatively fast response time of less than 10 s and the selectivity coefficients of the proposed electrodes revealed very good selectivity with respect to alkali, alkaline earth and some transition metal ions and could be used in pH range of 3.5–8.0. As a result the proposed electrodes were successfully applied to Cu(II), Zn(II) and Co(II) ions determination in mixture solutions and wastewater samples and as an indicator electrodes for potentiometric titration of ions with EDTA. The isolated complexes, HATS were synthesized by the anodic dissolution of metal in an anhydrous acetone solution of the ligands where HATS is acetaldehydethiosemicarbazone ligand and ac = acetone. Elemental analysis, magnetic susceptibility measurements, molar conductance, thermal analysis and spectroscopic techniques has been used for characterization and elucidation of the isolated complexes.

Keywords: Ion-selective electrode, Sensor, Potentiometry, Carbon Paste, Electrochemical, Acetaldehydethiosemicarbazone, wastewater.
The first-principles electronic structure calculations of chromia (Cr2O3)

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Abstract

Chromia (Cr2O3) has been extensively explored for the purpose of developing widespread industrial applications, owing to the convergence of a variety of mechanical, physical and chemical properties in one single oxide material. It is one of the antiferromagnetic transition-metal oxides which present a challenge for electronic band theory. So we used the first principles calculations to study the magnetism of Cr2O3. The electronic structure calculations of chromia are studied by using full-potential linearized augmented plane wave (FP-LAPW) method implemented within Wien2k package. The strong electronic correlations between the d electrons on Cr atoms are taken into account using GGA+U method. Here, we present the calculations of density of state (DOS) and magnetic properties of chromia. Our calculations are in a good agreement with experimental values.

Keywords:

Density functional theory (DFT) - Full Potential Linearized Augmented Plane Waves (FPLAPW) - spin polarized calculations - Generalized Gradient Approximation (GGA).
Factors affecting physical and physicochemical properties of NR/SBR rubber blends:

I) Effect of blend ratio on the stress-strain characteristics for pure and carbon blacks filled composites

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Abstract

Blends of Natural Rubber/Styrene Butadiene Rubber (NR/SBR) loaded with different ratios of N220:N774 carbon black fillers were prepared. The mechanical properties of pure blends and those loaded with different ratios of carbon black were investigated. The (50NR/50SBR), 40N220/(50NR/50SBR) and 60N774/(50NR/50SBR) blends were found to exhibit the highest values of tensile strength and elongation at break. The theoretical Mooney-Rivlin model applied to NR/SBR and supports the result of stress-strain. (50NR/50SBR) blends loaded with mixed ratios of N220 and N774 were also prepared. The stress-strain study of them did not show any significant change due to the order of addition of carbon black. The values of shore hardness (A) for all samples were measured and showed a marked increase by increasing the black content.

Keywords: Carbon black, NR rubber, SBR rubber, stress, strain, order of addition.

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TOPIC III: Lasers and Applications & High Power Lasers
How Particle Accelerators Are Helping Us Treat Cancer?

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Abstract

Cancer is currently one of the major causes of death. So far we have limited success in treating this deadly disease. In the recent past, use of hadrons is growing becoming popular in treating cancer using conventional as well as laser driven accelerators. Our recent works encompasses that. In our current talk we will throw light on accelerators including LHC and their use through hadron therapy. We will particularly focus on the progress made so far.
Study of the optical aspects of suitable new glass for Radiation Shielding Applications

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Abstract

Lead oxide doped borosilicate glasses, in chemical composition $20\text{SiO}_2-x\text{PbO}-(15+x)\text{B}_2\text{O}_3-5\text{WO}_2-10\text{ZnO}-(50-2x)\text{Na}_2\text{O}$ have been prepared using melt-quenching technique. The samples were examined by using Philips Analytical X-ray diffraction system in order to check the amorphous nature of the investigated glass samples. The effect of boron and lead oxides on glass transition temperature was carried out using Differential Thermal Analysis measurements (DTA). The results of DTA showed that both melting and glass transition temperatures decrease with the increase of lead and boron oxides. Density and its related parameters have been determined as a function of lead content. The optical properties of the glass samples have been obtained using UV-VIS measurements. The optical parameters, such as optical band gap, Urbach energy, refractive index, and electronic polarizability were estimated to study the effect of lead on the optical properties of prepped glasses.
Transmyocardial Revascularization for Treating End Stage Coronary Artery Diseases

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ABSTRACT

Coronary artery disease remains one of the leading causes of morbidity and mortality in developed countries. It is projected to be the leading cause of death in the developing world. Despite the success of current medical and surgical management of ischemic heart disease, a growing number of patients have diffuse obstructive coronary artery disease that is not amenable to coronary-artery bypass grafting or catheter-based interventions it is estimated that patients with ungraftable coronary artery disease account for approximately 5% of patients who undergo coronary angiography. This problem has stimulated interest in developing alternative therapeutic approaches. On a concept was based on the model of the reptilian heart, in which the left ventricle is directly perfused from endothelium-lined channels that radiate out from the left ventricular cavity. Mirhoseini and associates, advanced the concept by using laser energy to create the transmural channels. Subsequent clinical trials demonstrated that transmyocardial revascularization significantly improved angina in patients who were not candidates for conventional therapies such as bypass surgery, balloon angioplasty, or medical management.
Entanglement and Geometric Phase of Nonomechanical Resonators

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ABSTRACT

We discuss different aspects of the relation between entanglement and geometric phase of different systems. Information dynamics of charge qubits coupled to a nanomechanical resonator under influence of both a phonon bath in contact with the resonator and irreversible decay of the qubits is considered. The focus of our analysis is devoted to two qubits and the effects arising from the coupling to the reservoir. Even in the presence of the reservoirs, the inherent entanglement is found to be rather robust. Due to this fact, together with control of system parameters, the system may therefore be especially suited for quantum information processing.
Laser Induced Plasma Spectroscopy of Nano vs. Bulk Materials

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Abstract.
In this work, we present recent results on behavior of nanoparticles when irradiated with Nd: YAG laser pulses. The light emitted from plasma generated with a set of nanomaterial and bulk targets (ZnO, Fe$_3$O$_4$, Ag$_2$O, TiO$_2$, SiO$_2$ and Al$_2$O$_3$) is compared for the same experimental conditions. The laser fluence was detuned in the range from 86 J/cm$^2$ down to 2.5 J/cm$^2$ with special emphasis on the Ag$_2$O nanomaterial. The targets are irradiated with nanosecond, pulsed Nd: YAG laser radiation, at 1064 nm in laboratory air. The spectra were recorded at the gate and time delay of 1 μs and for a constant spot size of 0.9 mm. The results show an exponential increase in the enhanced emissions with decrease of the laser fluence. The reversed behavior is discussed here. On the other hand, the laser fluence was kept at a constant level while the delay was changed in equal steps of 1 μs. The measurement of plasma parameters when utilizing optical emission spectroscopy technique reveals no significant variation of the relative electron density and temperature with laser fluence or delay time. The variation of the relative concentration with laser fluence, after correcting the measured spectral lines for self-absorption, attests that the enhanced emission can be attributed only to the relative concentrations. Possible explanations are based on changes in the physical properties of the nanomaterial upon subjected to high power laser pulses.

References
New Trends For waste water by Electro-spraying Corona Discharge

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ABSTRACT
New technologies are required always to find new methods for water treatments and solve waste water problems. Among the new techniques for waste water treatment there are: 1-the treatment of water by ozone (Garamoon et al., 2002), 2-AOP: advanced oxidation processes e.g. 1-photocatalysis on TiO2 surface (Feryal & Nur, 2003), 2-Fenton and photofenton process (Fares et al., 2008), 3-electrical discharge (Junwen et al., 2009),…..etc. Corona discharge is considered as one of the most efficient techniques in AOP processes (Sun et al., 1999). Generation of highly reactive oxidants, such as hydroxyl radical OH, atomic oxygen O, ozone O3 and hydrogen peroxide H2O2, has been obtained using corona discharge (Anpilov et al. 2001, Šunka et al., 1999, Malik et al., 2002 and Zhengguang et al., 2005). Unlike the methods which used under water corona discharge, the objective of the present work is to introduce a new design for waste water treatment using electro-spraying corona discharge system. The Advantage of Electro-spraying Corona Discharge system is that the surface area of the water is sprayed by the electro-spraying corona where the sprayed water passed through the entire regions of the corona discharge itself.
Methane Reforming Through spark discharge

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Abstract
Spark discharge has been used as a source of atmospheric non thermal plasma for methane reforming. Hollow electrode and gliding arc discharge have been used for the reforming process. Optimization and characterization of the two discharge systems have been investigated for maximum methane reforming. The two discharge systems work in two different range of methane flow rate, the first one is efficient for small flow rate (50-300 sccm), while the second one is efficient at high flow rate (100-5000 sccm). Maximum volume percentage of Hydrogen of about 83 % has been reached for the first system and maximum efficiency of the second system of about 75 gm/kWh has been reach for the second system.
Abstract
In this work, an enhanced technique for pulsed pumping was proposed denoted by Automated Pulsed Pumping (APP) technique. In this technique, a controlled system was suggested to detect the generation of the output pulse and control the pumping level. The technique is applied to a diode-pumped Yb:YAG laser passively Q-switched by Cr^4+:YAG as saturable absorber by numerically solving the coupled rate equations describing the system. The thermal distribution, within the laser active medium of Q-switched solid-state lasers when subjected to APP, has been studied by solving the coupled laser rate equations simultaneously with the thermal conductivity equation. The thermal transient time and focal length in the cylindrical coordinates were also calculated.
Full wave solution and simulations of laser pulse amplification

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Abstract:

The need for low cost, compact, high-power laser systems with their applications in medicine and high energy physics is growing rapidly. Counter propagating laser pulses amplification promise a breakthrough by the use of much smaller amplifying media, that is, millimeter plasma scale. The full-wave solution for the two laser pulses interact in almost homogenous or plasma channel is conducted along with particle-in-cell simulation for the same pulses parameters. Motivated by the promise of reduced cost and complexity of the intense lasers, the amplitudes of laser pulses are taken to be small ($a_0 < 1$). The growth rate of the seed pulse and the dephasing limitations are calculated. The results show that the energy is transferred from the pump pulse to the seed pulse effectively depending on the length of amplification and the isolation of the limiting conditions. A wide variety of system parameters such as frequency of laser pulses, plasma density matched to three waves interaction, and intensity of the pump wave and seed wave are studied. The influence of plasma and pulses parameters on simulation results are thoroughly investigated using a moving window technique and are compared with theoretical and numerical predictions. The comparison shows that the numerical full wave solution is very sensitive to any plasma density changes near the entrance of the pump pulse into the plasma.
Liquid Phase Pulsed Laser Ablated TiO$_2$ Nanoparticles Applied to Self-Cleaning Surfaces

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ABSTRACT

In this study, TiO$_2$ nano-crystalline structures are fabricated using the LP-PLA technique. Nano-structural investigation was carried out by Electron Microscopy Measurements TEM, HRTEM, SEM, EDX and Electron Diffraction measurements. Optical properties were also determined by measuring absorption, emission and luminescence spectra of the Nano-crystalline TiO$_2$. We then prepared a simple self-cleaning paint loaded with the TiO$_2$ nanocrystals of different structural and/or optical properties. Coatings of the paint were made on aluminum, stainless steel and plastic surfaces representing materials applied in preserving food and medical systems. Self-cleaning of outdoor surfaces such as ceramics and cementious materials used in buildings were prepared by immediate loading with TiO$_2$ nanoparticles and tested. In order to verify self-cleaning performances of photocatalytic cements/concretes, tests mainly based upon the degradation of methylen blue color and measuring the water contact angle for providing self-cleaning performances were carried out for materials. The experimental results introduce new information on visible light photocatalytic technologies of nano- TiO$_2$ in providing self cleaning and antimicrobial surfaces often used in the open environment such as every day use of home utensils, buildings, and medical needed hygienic tools.
Atmospheric Pressure cold plasma jet for Biomedical Applications

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\textbf{ABSTRACT}

In recent years, cold non-thermal atmospheric plasmas play an important role in various applications such as material processing, and biomedical applications. Atmospheric Plasma jet (APJ) is one of the most widely used methods for generating non-thermal atmospheric plasma. The jet plume consists of various groups of highly reactive chemical agents such as reactive oxygen species (ROS) including oxygen atoms O, hydroxyl group OH, hydrogen peroxide H\textsubscript{2}O\textsubscript{2} and ozone O\textsubscript{3}. The new field of plasma medicine is rapidly advancing toward the development of new medical therapies such as skin diseases, disinfection of dental cavities, dermatology, cancer treatment, and many others. The ROS generated by plasma jet can penetrate the cells and might induce high levels of DNA damage, resulting in apoptosis. The main goal of the paper is design and characterize atmospheric plasma jet APJ with high electron density and high reactive oxygen species (ROS) that targeting different types of cancer cell line (in-vitro) and other biomedical applications, through ROS-reaction mechanisms which can enhance the role of cold plasma cancer and medical therapy in Egypt. A schematic diagram and real photo of a dielectric barrier discharge plasma APJ is shown in figure 1a,b that is designed in our Lab.

![Schematic diagram of APJ and real photo](image)

\textbf{Fig.1 a:} schematic diagram of APJ, \textbf{b:} real photo of the jet

\textbf{References}

Aluminum tris-quinolate complex thin film producing novel blue laser

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ABSTRACT
High-quality Aluminum-tris-quinolate complex (Alq₃) with oxasene Nile Blue (NB) layers were grown on glass substrates by thermal evaporation under vacuum. The photo-luminescence spectra show three distinctive peaks and their relative intensities change with mixture relative concentrations. The major emission peak at 4100 ± 20 Å has been identified. The $I–V$ characteristics show a Schottky diode behavior for thin film double layers of NB–(Alq₃–NB) mixture. Planer Blue Laser emission took place parallel to the substrate surface and perpendicular to the electric field direction starting at $V = 0.28 ± 0.05$ V. Threshold current of 0.088±0.012 mA and optical power densities up to 0.5 mW/cm² were determined.

Keywords: Aluminum-tris-quinolate, Nile blue laser
Liquid Crystal Photonic crystal Devices
Salah Obbaya

ABSTRACT

Photonic crystal fibers (PCFs) have attracted the interest of many researchers in recent years due to their unusual optical properties. PCFs can be endlessly single mode over a wide wavelength range, and can be tailored to achieve nearly zero and flat dispersion over a wide range of wavelengths. Recently, some attention has been devoted to the possibility of infiltration of the air holes with different materials such as polymer, oil, or liquid crystal (LC). However, PCF structure infiltrated with a LC has unique and uncommon propagation and polarization properties. In this talk, novel designs of high birefringence LC PCF infiltrated with a nematic liquid crystal (NLC-PCF) are presented and analyzed. In addition, due to their different uses in communication systems, the performance of novel designs of high tunable polarization rotator, directional coupler, polarization splitter, and multiplexer-demultiplexer based on the NLC-PCF will be introduced. Moreover, LC Photonic crystal based optical router and image encryption will be presented. The simulation results are obtained using full vectorial finite difference method, and full vectorial finite difference beam propagation method, finite difference time domain method (FDTD) with nonuniform meshing capabilities and perfect matched layer boundary conditions.
How to Optimally Collect Hyperentangled photons.


Abstract:

The creation of hyperentangled photons entails the two-photon emission over relatively wide extent in frequency and transverse space; generated photons are thus simultaneously entangled in energy, momentum and polarization. Because the creation process runs in nonlinear domain(s) which is always dispersive and birefringent, the output two-photon state undergoes loss of relative-phase coherence over frequency and space. This offers the vital role of spatial-spectral phase compensation so as to restore partially the state coherence in the two degrees of freedom. Behind compensation, the two-photon state emerges with much better phase flatness allowing collection over wider spatial and spectral ranges. However, as the spatial or spectral modes become further from the central compensated modes, stronger phase variations appears to dominate the scene. This excites two important experimental questions; what is the optimal combination of spatial and spectral filters a) that minimizes the overall phase variations at a given two-photon flux counts? b) that maximizes the two-photon counts at some accepted phase range? Here we address an experimentally convenient approach to determine the best answers of these two questions. The optimization process of the throughput-purity trade-off draws the main guidelines to design hyperentanglement sources whose intrinsic role in several protocols of quantum information and quantum computation.
Absorption Spectroscopy with Frequency Comb Lasers for Breath Analysis

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Absorption laser spectroscopy ALS is a powerful technique for qualitative and quantitative studies of atoms and molecules in trace concentrations. As such ALS has applications not only in physics and chemistry but also in biology, environmental monitoring, and medicine. In the later field the analysis of the human breath is very useful for health monitoring and a rapidly expanding field for medical instrumentation, In this connection we developed an optical multi-pass cell based on highly reflecting confocal mirrors, achieving both long optical paths and dense atom space (volume) coverage to obtain high-sensitivity and high-selectivity. The system uses six mirrors, and we demonstrate a path-length of 300 m in a cell of only of 0.5 m in lenght. Different volume fillings and path lengths were achieved by tilting the mirrors with angles ≤ 0.05 radians. Spectrally resolved absorption measurements in the near IR of the greenhouse gases CO₂, CO, and CH₄ were carried out using a broadband frequency comb Er+ fiber laser beam including Raman shifting in a highly nonlinear fiber to an optical range spanning from 1.5 μm to 1.7 μm. Initially we recorded the absorption spectra of the first overtone rovibrational band for CO₂, CO, and CH₄, and in the future we plan to quantify minute concentrations of additional biomarker gases and measure isotope ratios. In the case of methane a signal to noise ratio S/N=120 was obtained, yielding the estimated theoretical sensitivity of 6 ppmv, which can be further improved by optimizing the number of passes. Our optical apparatus is portable and can be used for a wide range of applications, including environmental monitoring, combustion processes, other medical diagnostics, and fundamental atomic and molecular physics studies.

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Study of refractive index for glass laser medium by using Clausius–Mossotti method

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Abstract:
The present work study the refractive index by using Clausius–Mossotti method, which deals with the ion refraction of the atoms for glass system with chemical composition as \((x-42)\) \(\text{B}_2\text{O}_3\) \((100-x)\) \(\text{Na}_2\text{CO}_3\cdot40\text{ZnO}.2\text{Nd}_2\text{O}_3\) (where \(x=100, 95, 90, 85, 80\text{ and }75\)), density was measured, and the molar mass, refractive index, molar refraction, reflectance, phase velocity, Brewster angle, polarizability, electric susceptibility and elasto optic coefficient were estimated.
ELI-ALPS Gas High Harmonic Generation Beamlines

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Gas high-order harmonics generated (GHHG) by the nonlinear interaction of an intense ultrashort laser pulse with atoms or molecules are now used in many fields including atomic, molecular, plasma, and solid state physics. The interest in the generated radiation results from unique features like tunability over the extreme ultraviolet (XUV) and soft x-ray (SXR) spectral regions (reaching several keV), good beam quality, and ultrashort pulse duration down to the attosecond range. Currently many efforts are devoted to increase both the conversion efficiency of the GHHG process and thus the photon flux of the emitted XUV radiation.

For this purpose ELI-ALPS are developing several GHHG beamlines. The main target of these beamlines is to provide the users of the ELI-ALPS facility with state-of-the-art attosecond pulses to perform pump-probe experiments with attosecond time synchronization between IR and XUV or XUV and XUV pulses. The under development attosecond sources will operate at a repetition rate of 100 kHz and 1 kHz, using high-order harmonic generation in noble gases confined in either isolated attosecond pulses or short trains of attosecond pulses. The XUV radiation will be available in different spectral ranges (from 17 eV up to 90 eV) selected using different noble gases and metallic filters. The produced pulses and pulse-trains offered to the users will be properly characterized with respect to pulse duration, spectrum, photon number, spatial coherence and brightness.

Further details about ELI-ALPS facility and the overview of the GHHG beamlines will be discussed at the conference.
High Density Laser Induced Thermal Energy for Water Desalination

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Abstract.

Only 2.5% of all water in the world is fresh; even less than 0.1% is readily available for direct human use. Water desalination proves to be a compelling necessity now and in the near future. Desalination techniques like multi-stage flash (MSF) or multi-effect distillation (MED) require heat for creating the steam which provides the fresh water. A handful of energy intensive techniques are currently used, mostly at industrial scale; however, Laser material heating energy can be used as an alternative to conventional sources of energy for water desalination purposes. Ultra intense laser sources are explored and a Terawatt laser system is found to be a potential candidate as a tremendous thermal energy source.
Preparation of silver nanoparticles to improve the physical properties for textile material

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Abstract

Silver nanoparticles have attracted much attention in antibacterial coatings, biological sensors, textiles, and biomedical devices because of their size-dependent properties. Pulsed laser ablation in liquids confine the movement of the resultant plasma plume which can greatly influence the kinetic properties. This causes distinctly different environments of the condensing phase formation from that of laser ablation of solids in vacuum or diluted gas. In this study, silver nanoparticles were prepared by two different techniques namely liquid phase pulsed laser ablation (LP-PLA) and chemical reduction. In the LP-PLA, IR and UV lasers types were used to ablate silver rods in distilled water. The IR laser was Nd:YAG with $\lambda = 1064 \text{ nm}$, pulse duration = 6 ns, and 110 mJ laser energy. The UV type was nitrogen laser with $\lambda = 337 \text{ nm}$, pulse duration = 15 ns, and 375 mJ laser energy. In the chemical reduction, silver sulphate, sodium borohydride, and tri-sodium citrate were used to prepare the silver nanoparticles. The fabricated nanoparticles were characterized by transmission electron microscopy (TEM), X-ray diffraction (XRD) and energy dispersive X-ray (EDX) microanalysis in order to analyze the final size and composition of nanoparticles. For sample prepared by Nd:YAG laser, the measured average size was found to be $\sim 9.9 \text{ nm}$ and sample prepared by chemical reduction showed average size of $\sim 13.9 \text{ nm}$. The results show about spherical shape for samples prepared by Nd:YAG laser and chemical reduction while needle shape produced by the nitrogen laser. These silver nanoparticles will be applied to cotton fabrics for studying the dyeing behavior of the treated fabrics, such as color strength measurement and color fastness measurement.
Synthesis of Nano CdS by pulsed laser ablation in liquid environment (PLAL)


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Abstract
A new method was developed to synthesize materials in nanoscale by using pulsed laser ablation in a liquid solution. Compared to the other synthetic methods, the advantages of this method are simplicity of the procedure and absence of chemical reagents in solution, which offers novel opportunities to solve the toxicity problems. This method can be carried by two ways; the first one is Top-Down technique appeared in publications in the last few decades while the other one is Bottom-Up technique appeared to be the first time in this paper. The both synthesized methods can be applied in all materials because of its ability to ablate almost all kinds of materials due to the ultra-high energy density and control over the growth process by manipulating the process parameters like Intensity, wavelength, etc.

Keywords: ablation, pulsed laser, nanomaterials.
High Density Laser Induced Thermal Energy for Water Desalination

(B)

Simulation of Fusion Evaporation of Compound Nuclei Created in Ultra Intense Laser Interaction with Carbon Targets


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Abstract

Compound nucleus creation in Ultra Intense Laser UIL interaction with materials could be possible through Fusion of the target nuclei with the accelerated target charged ion in the laser field. The residual radioactive nuclei in the remaining target material could well be due to evaporation of protons, neutrons, deuterons etc. from the created compound nucleus.

We here with report simulation of compound nucleus formation followed by particle evaporation applying Monte Carlo code PACE-4 to estimate the possible Fusion cross-section for carbon nuclei forming excited Mg$^{24}$ compound nucleus. The results shown in Figure 1 indicates the highest cross section of such possibility peaking at carbon ions projectile energy $\approx 30$ MeV (2.5 MeV/ A ).

The cross sections for production of neutron deficient nuclei resulting from the Fusion-Evaporation process of C$^{12}$ + C$^{12}$ are also estimated.

The simulation results help greatly in choosing the power of the UIL as well as the design of the experimental set up to be applied in verifying the Fusion-Evaporation Phenomena.

FIGURE 1.1: Simple schematic of the four stages of inertial confinement fusion via “hot spot” ignition.
Stage 1: Energy is delivered to the surface of a tiny hollow sphere (a few millimeters in diameter) of fusion fuel (the target). The blue arrows represent the driver energy delivered to the target—this is the laser light, x-ray radiation or particle beams that heat the outer yellow shell. Stage 2: Orange arrows indicate the ablation of the outer shell that pushes the inner shell towards the center. The compression of the fusion fuel to very high density increases the potential fusion reaction rate. Stage 3: The central low-density region, comprising a small percentage of the fuel, is heated to fusion temperatures. The light blue arrows represent the energy transported to the center to heat the hot spot. This initiates the fusion burn. Stage 4: An outwardly propagating fusion burn wave triggers the fusion of a significant fraction of the remaining fuel during the brief period before the pellet explodes/disassembles. Steady power production is achieved through rapid, repetitive fusion micro-explosions of this kind. This image obtained from [1]

Reference

[1] Committee on the Prospects for Inertial Confinement Fusion Energy Systems; Board on Physics and Astronomy; Board on Energy and Environmental Systems; Division on Engineering and Physical Sciences; National Research Council "An Assessment of the Prospects 2 for Inertial Fusion Energy".
Spectroscopic and thermal properties of PVK/AgNPs nanocomposites prepared by laser ablation

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Abstract

Nanocomposites of Poly (n-vinylcarbazole) PVK/Ag nanoparticles were prepared by laser ablation of a silver plate in aqueous solution of chlorobenzene. The influences of laser parameters such as; time of irradiation, source power and wavelength (photon energy) on Spectroscopic, morphological and thermal properties have been investigated using Fourier Transform Infrared Analysis (FT-IR), Scanning Electron Microscopy (SEM) and Thermogravimetric Analysis (TGA), respectively. From IR data there is a complexation between AgNPs and PVK matrix. SEM reveals that the presence of AgNPs leads to changes in the surface morphology. Kinetic thermodynamic parameters such as activation energy, enthalpy, entropy and Gibb’s free energy are evaluated from TG data using Coat’s – Redfern model.

Keywords: PVK; AgNPs; Laser ablation; FT-IR; SEM; TGA.

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References

High Density Laser Induced Thermal Energy for Water Desalination

(C)

Nonlinear Process in Plasma Induced by High Density Laser Interaction with Solid

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Abstract

Interaction processes of heavy projectile-ions with solid and gaseous targets with a target thickness exceeding the ion stopping length were under theoretical and experimental investigation. Inertial Fusion Energy requires intense laser or particle beams to heat matter to high temperatures in the order of 300 eV. Interaction processes providing plasma should be suppressed in order to enhance inertial fusion process. In this respect we have to understand fully the nonlinearity process occurring at the high energy reaction provide the magnetic and electric field see Figure 1.

![Figure 1: schematic diagram show interaction laser with target in LIEF chamber.](image-url)
Abstract

One of the key component for a Laser Inertial Fusion Energy (LIFE) engine is the fusion chamber subsystem. There are different structure of chambers such as dry-wall, wetted-wall, thick-liquid wall, or solid/voids. The chamber contain material absorb the thermal fusion energy, produce fusion fuel to replace that burned in previous targets, and enable both target and laser beam transport to the ignition point. The chamber system also must mitigate target emissions, including ions, X-rays and neutrons and reset itself to enable operation at 10–15 Hz. Finally, the chamber must offer a high level of availability, which implies both a reasonable lifetime and the ability to rapidly replace damaged components.
TOPIC IV: Nuclear, High Energy & Particle Physics
Results on the scaling of multiplicity distributions of fast target fragments in high energy nucleus-nucleus collisions

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ABSTRACT

In this work the fast target fragments from high multiplicity interactions of \textsuperscript{16}O (at 60 A GeV and 200 A GeV) and \textsuperscript{32}S (at 3.7 A and 200 A GeV) ions with Ag (Br) targets have been measured. The characteristics of these interactions have been compared to those from simulations using the Modified FRITIOF Code. The comparison indicates that there is a need to modify the code and incorporate a greater amount of rescattering for a better fit to the experimental data. The multiplicity distributions for all interactions have been fitted well with the Gaussian distribution function. The measurements of the scaled variance ($\omega$ >1) show that the production of target fragment at high energies cannot be considered as a statistically independent process. The energy dependence of entropy is examined. The entropy values normalized to average multiplicity ($S / \langle N_g \rangle$) are found to be energy independent. The possibility of scaling, i.e., similarity in the multiplicity distributions of grey tracks produced in nucleus-nucleus interactions has been examined. A simplified universal function has been used to display the experimental data. The relationship between the entropy, the average multiplicity and the KNO function is examined as well.
Missing energy within helium fragments emitted in N-N collisions at high Energies

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ABSTRACT

The projectile helium fragments emitted in peripheral heavy ion collisions at high energies (relativistic and ultra-relativistic) were found to have a less value of the average shower particle multiplicities $n_s$ than that the corresponding primary $^4\text{He}$ beam at similar energy. These is balanced by missing energy of helium fragments energy and momentum of the parent beam. The differences in $n_s$ between $^4\text{He}$ beam and helium fragments is found to increase with energy or momentum of the incident beam, the observed decrease in average $n_s$ for secondary helium interactions is $\sim 20\%$ corresponding to a decrease in energy of about $30\%$. 
Analysis of Reactivity Induced Accidents in Power Reactors

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Abstract: The studying of the point kinetics equations, which are solved numerically using the stiffness confinement method (SCM). The difficulty in the numerical solution of these equations is due to the stiffness of the system arising from the difference order of magnitude between the prompt and delayed neutron lifetimes. Numerical examples of applying this method to a variety of problems confirm that the step size of time increment can be greatly increased and the computing time much saved as compared to other conventional methods. The solution is applied to the kinetics equations in the presence of different types of reactivity’s, and is compared with different methods. The present work is a consistent comparison of the performances of the numerical method applied to the point reactor equations for different transient's methods. In the present work, the SCM is used for large time steps with the greatest accuracy for developing. This method is, also used to analyze reactivity induced accidents in two different types of reactors. The first is a thermal reactor (HTR-M) fueled by uranium-235 and the second is a fast reactor (PRISM) fueled by plutonium-239. This analysis presents the effect of negative temperature feedback, and the positive reactivity of the control rods ejection. The results are compared with previous works and satisfactory agreement is found.

KEYWORDS: Reactivity induced accident, stiffness confinement method, point kinetics equations, control rod ejection, reactivity coefficient, and safety analysis.
The Energy Dependence on the Density Depression Parameter

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Abstract:

A semi-microscopic approach based on Skyrme energy density functional is used to study the effect of the depression parameter ($\beta$) of the density distribution of protons and neutrons on the total energy of nuclei with proton number $Z = 18, 114, 116$ and $120$. For each element, two isotopes are considered. The variation of the contribution of the total energy parts (Coulomb, kinetic and potential) with the depression parameter is studied. For super heavy nuclei, the variation of the lowest total energy curve with $\beta$ has a shallow minimum, which occurs at negative value of $\beta$, suggesting that, these nuclei prefer large values of density at of their centers, these nuclei gain about 15 MeV in their binding energies within the $\beta$ range considered. For the lightest Ar nucleus, the minimum is clear and occurs at positive value of $\beta$.

Key Words
Binding energy, Energy density function, Density depression
Projectile Fragmentation of $^6,^7$Li nuclei in Photoemulsion at Dubna energy

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Stripping and diffraction dissociation processes of $^6$Li at incident momentum of 4.5 AGeV/c and $^7$Li at incident momentum of 3 AGeV/c provided by the JINR Synchrophantron, were studied using the photoemulsion technique. The two stable isotopes of $^6$Li and $^7$Li were treated as two weakly-bound systems composed of ($^4$He+d) and ($^4$He+t) cluster configurations, respectively. Along the track double scanning method was carried out in order to search for $^6,^7$Li interactions in emulsion (Em). For $^6$Li-Em about 1050 inclusive events were recorded with mean free path $\lambda_{^6Li} = 14.5 \pm 0.5 \text{ cm}$ while about 1015 events were detected for $^7$Li-Em with mean free path $\lambda_{^7Li} = 15.1 \pm 0.6 \text{ cm}$

The mechanisms, the type of momentum distribution inside the projectile according to which the features of each mechanism can be correctly explained and the difference between the angular distributions of these processes are theoretically discussed. The total cross sections of both stripping and dissociation are estimated theoretically as well as experimentally. The measured angular distributions of the outgoing fragments were compared with that calculated theoretically. A good agreement between the experimental and theoretical values was obtained. This agreement supported the presence of $^6,^7$Li nuclei in a cluster mode at high energy reactions.
SYSTEM SIZE AND ENERGY DEPENDENCE IN $^4$He–NUCLEUS INTERACTIONS

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ABSTRACT

The behavior of the relativistic hadron multiplicity for $^4$He–nucleus interactions is investigated. The experiment is carried out at 2.1A and 3.7A GeV (Dubna energy) to search for the incident energy effect on the interactions inside the different emulsion target nuclei. Data are presented in terms of the number of emitted relativistic hadrons in both forward and backward angular zones. The dependence on the target size is presented. For this purpose the statistical events are discriminated into groups according to the interactions with H, CNO, Em, and AgBr target nuclei. The separation of events, into the mentioned groups, is executed basing on Glauber's multiple scattering theory approaches. Features suggestive of a decay mechanism seem to be a characteristic of the backward emission of relativistic hadrons. The results strongly support the assumption that the relativistic hadrons may already be emitted during the de–excitation of the excited target nucleus, in a behavior like that of compound–nucleus disintegration. Regarding the limiting fragmentation hypothesis beyond 1A GeV, the target size is the main parameter affecting the backward production of the relativistic hadron. The incident energy is a principle factor responsible for the forward relativistic hadron production, implying that this system of particle production is a creation system. However, the target size is an effective parameter as well as the projectile size considering the geometrical concept regarded in the nuclear fireball model. The data are analyzed in the framework of the FRITIOF model.
High Density Laser Induced Thermal Energy for Water Desalination Project