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EuroSciCon Joint Event on

Laser Optics & Photonics and Atomic & Plasma Science

July 16-17, 2018 Prague, Czech Republic

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Katel Herve-Aubert et al., Am J Compt Sci Inform Technol 2018, Volume 6
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OPTIMIZED SYNTHESIS AND ASSESSMENT OF FLUORESCENT DYE-LABELLED NANOSYSTEMS

Katel Herve-Aubert[1], Emilie Allard-Vannier[1], Anastasia Ignatova[2], Alexey Feofanov[2, 3] and Igor Chourpa[1]
[1]University of Tours, France
[2]Shemyakin-Ovchinnikov IBCh-RAS, Russia
[3]Lomonosov Moscow State University, Russia

Research in nanomedicine is receiving increasing attention since the beginning of the twenty-first century. There is a hope that unique properties of nanosystems (NS) may help to improve diagnosis and therapy of diseases. Nanosystems of different design (quantum dots, liposomes, dendrimers, carbon nanotubes, microbubbles, metallic nanoparticles…) were proposed for their use as imaging, therapy or theranostic (therapeutic plus diagnostic) agents. The development of these nanosystems in medicine requires investigating their biodistribution in cells and tissues. For this purpose, a common strategy consists of labelling the nanosystems with a fluorescent dye. However, such a labelling does not always allow a reliable tracking of nanosystems, namely due to: i) the degradation and/or the quenching of fluorophores by interaction with the biological environment; ii) the release of fluorophores from the NS, which prevents to know if the observed fluorescence does correspond to the nanosystem. To circumvent these limitations, we developed a rational NS design and used spectral analysis of the NS fluorescence in solution and in cells. Rationally designed NS were composed of an inorganic core (superparamagnetic iron oxide nanoparticles – SPIONs or gold nanoparticles) coated with an organic shell made of molecules covalently attached to the core (fluorophores and polyethylene glycol, PEG_{5000}). Thus, the fluorescent labels were hidden under the PEG_{5000} layer. This was intended to (i) protect the fluorophores from quenching and degradation, (ii) reduce the risk of their release from the nanoparticles, and (iii) avoid the possible effect of these labels on the nanoparticles surface properties, which are critical for their stability and biological interactions. Labelling was optimized by varying the dye concentration and due to the purification steps. For the more relevant optical assessment of these optimized nanosystems within cancer cells, their fluorescence has been analyzed both by spectroscopy and confocal spectral imaging.

Biography

Katel Herve-Aubert has completed her PhD from University of Rennes 1, France in 2005. She is an Associate Professor in Nanomedicine and Nanoprobes laboratory (EA6295) at the University of Tours since 2006. This interdisciplinary team develops bio-analytical methods and nanomedicine technology for drug delivery and disease diagnostics. Her speciality is the Synthesis and Characterization of Nanomedicines.

katel.herve@univ-tours.fr

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Jiang Yu, Am J Compt Sci Inform Technol 2018, Volume 6
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AN ANALYSIS ON ABSOLUTE VELOCITY

Jiang Yu
Guangzeng Group Co Ltd, China

Light travels through a vacuum at speed c regardless of the motion of the light source or that of an observer's frame of reference. Consequently, some time is required for light to travel from a light source to an observer in space, such that the emission of light and the observance of the emitted light are not simultaneous. Based on these considerations, a method for measuring the absolute velocity of an observer is proposed, which could be used for determining a spacecraft's state of motion from inside a closed cabin. In this study, a new explanation of the Lorentz transformation is also introduced.

Biography

Jiang Yu has graduated from China Pharmaceutical University. He is a Pharmaceutical Engineer. He has been working on Philosophy for 20 years and established his own ideological system. Every natural phenomenon is described by principle of physics and backed by mathematics. Everyone is startled that he is not a physics professional as after all its natural for the physics professional to have their own natural ideology and perception based on which they strive to unlock the true potential of nature. Benefiting from a solid philosophical foundation, he solved the problem of absolute speed.

jiangyugs@163.com

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Shien-Kuei Liaw et al., Am J Compt Sci Inform Technol 2018, Volume 6
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PERFORMANCE IMPROVEMENT OF STIMULATED BRILLOUIN SCATTERING DISTRIBUTED FOR FIBRE SENSING SYSTEM

Shien-Kuei Liaw[1], Yu-Cheng Chou[1], Chow-Shing Shin[1], Yu-Lin Shen[2] and Chi-Wen Liao[3]

[1]National Taiwan University, Taiwan
[2]Institute of Labor, Occupational Safety and Health, Ministry of Labor, Taiwan
[3]Green Energy and Environment Research Laboratories, ITRI, Taiwan

The aim of this paper is to improve a distributed fiber sensing system based on Stimulated Brillouin Scattering (SBS) effect. In the experiment, we introduced the measuring principle of distributed fiber sensing system and defined the importance of parameters. While the spatial resolution was affected by the reference frequency and the sideband component suppressed in the probe. Among choosing the reference frequency from 0.125 MHz to 5 MHz, we found that the accurate data could be obtained when the reference frequency was set at 0.125 MHz. In the original experimental setup, the Fiber Fabry-Perot (FFP) tunable filter was used before the lock-in amplifier (LIA) in order to prevent the power from getting too high. We also adjusted the sensitivity of the lock-in amplifier so we could read the data correctly without FFP-tunable filter and optimize the input signal quality. Afterward, we replace the new DFB-LD with better output power and narrower line width because it was useful for single side band modulation. Moreover, by replacing the signal generator, the operation time on the frequency sweep would be faster; while the speed increased more than two times from 11.66 points/min to 24.07 points/min. As for the modulation amplitude, it was selected from the original 100 mV unit as small as 1 mV so the modulation depth of the selection could be more accurate. Finally, we successfully achieved the measurement range to 313 m with 3 m spatial resolution.

Biography

Shien-Kuei Liaw received double Doctorate degrees from National Chiao-Tung University in photonics engineering and from National Taiwan University in mechanical engineering, respectively. He joined the National Taiwan University of Science and Technology (NTUST) in 2000. He has been the Director of both the optoelectronics research center and the technology transfer center there. He was a visiting researcher at Bellcore (now Telcordia), USA in 1996 for six months and a visiting professor at University of Oxford, UK for three months in 2011. He has forty U S/Taiwan patents and more than 250 journal articles and international conference presentations. He has been actively contributing for many conferences as technical program chair, international advisory committee and/or keynote speaker. Currently, he is a distinguished Professor at National Taiwan University of Science and Technology, President of the Optical Society (OSA) in Taiwan chapter and the Secretary-General of the Taiwan Photonic Society.

peterskliaw@gmail.com

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STUDY ON SOLAR PUMPED FIBER OPTICAL DEVICES FOR MAINTAINING ESSENTIAL OPTICAL COMMUNICATIONS DURING DISASTERS

S K Liaw[1], P H Tsai[1], B Srinivasan[2], A Sivasubramanian[2] and K Chitra[3]

[1]National Taiwan University, Taiwan
[2]Indian Institute of Technology, India
[3]VIT University, India

The aim of this paper is to enable solar energy (green energy) for designing the fiber-optic laser and amplifier. Collection of sunlight as the pump lasers are lunched into fiber laser and fiber amplifier, respectively. Fiber lasers and fiber amplifiers are designed based on solar pumping and various gained fibers. The operation wavelength of fiber devices is decided by the pumped wavelengths which we selected. For example, the 980 nm solar pumped is for 1550 nm Erbium doped fiber devices as well as for 1064 nm Ytterbium doped fiber devices. To facilitate free space communication using solar pumped fiber amplifier and fiber lasers in the absence of electric power, especially during natural disasters, solar energy can be stored using a battery and which can be used to maintain an uninterruptible communication setup. To improve the pump slope efficiency, we designed a multi-input pumped power from different ports/positions to collect much more solar power. Parameters such as the pump slope efficiency, gain and noise figure for fiber amplifier or fiber laser are analyzed. The performance is tested in cloudy days, rainy days and sunny days for comparison. The fiber devices may be used for applications in uninterruptible fiber optic communication systems during disasters.

Biography

Shien-Kuei Liaw received double Doctorate degrees from National Chiao-Tung University in photonics engineering and from National Taiwan University in mechanical engineering, respectively. He joined the National Taiwan University of Science and Technology (NTUST) in 2000. He has been the Director of both the Optoelectronics Research Center and the Technology Transfer Center there. He was a Visiting researcher at Bellcore (now Telcordia), USA in 1996 for six months and a visiting Professor at University of Oxford, UK for three months in 2011. He has forty U S/Taiwan patents and more than 250 journal articles and international conference presentations. He has been actively contributing for many conferences as technical program chair, international advisory committee and/or keynote speaker. Currently, he is a distinguished Professor at National Taiwan University of Science and Technology, President of the Optical Society (OSA) in Taiwan chapter and the Secretary-General of the Taiwan Photonic Society.

peterskliaw@gmail.com

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Khamchukov Y D, Am J Compt Sci Inform Technol 2018, Volume 6
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VIBRATIONAL SPECTRA OF TRIGLYCINE SULFATE

Khamchukov Y D
Vitebsk State Academy of Veterinary Medicine, Belarus

The polydomain structure of ferroelectric materials, the mobility of their orientation, the possibility of fixing it, ensures the existence of ways to control their macro polarization. Polydomain materials of this type predetermine the defectiveness of their crystal structure. These are, perhaps, orientation defects, whose existence for molecular crystals is very likely at room temperature. The stability of the properties of the ferroelectric phase of these materials also depends on the properties of elementary excitations: phonons and internal vibrations of molecular ions. Since the interpretation of the Raman spectra of triglycine sulfate (TGS) in the literature does not reflect the defectiveness of the crystal structure, and it has a significant effect on its properties, to determine the relationship between the macro and micro properties of such materials, it is necessary to determine the effect of defectiveness on their vibrational spectra. Therefore, the Raman spectra are recorded from the splitting of plates of triglycine sulfate monocrystals obtained by splitting. The registration of the Raman spectra was carried out with the Confotec NR500 microscope. For the excitation of Raman scattering, laser radiation with generation wavelengths of 532 and 632.8 nm was used. The power of the radiation focused on the sample was 3 mW. The optical signal was recorded from a site approximately 0.5 μm in diameter from the depth of the sample at a distance of 4 μm from the surface of the single crystal. All recorded spectra for the separation of overlapping bands were processed using the software package Origin 8.1. From the clarification of the existing interpretation of the Raman spectra, the presence of position-group splitting of the bands of degenerate sulphate-ion oscillations is determined, the absence of dynamic resonant interaction of the vibrations of ions of a primitive crystalline cell. The existing idea of the location of chromium ions implanted in the TGS was confirmed. Changes in the phonon bands of TGS as a result of doping: an increase in the area of higher-frequency bands, an increase in their half-width, and shifts to the low-frequency region are explained by a change in the distribution and properties of the electron density of the TGS structure bonds. The simulation of the bands of non-degenerate vibrations by the sum of two Lorentz contours is explained by the presence of orientational structural defectiveness, and the change in the area of model contours in the spectra of doped samples is due to an increase in the unipolar properties of the samples: the dominance of one orientation of the domains. The appearance of oscillation bands in the region of overtones and composite oscillations for doped TGS samples is explained by the presence of other types of defects that fix the unipolar structure of macro samples. The increase in the relative intensity, half-width, and the decrease in the frequencies of the maxima of the phonon bands in doped samples probably determine the change in the conditions for the transformation of the ferroelectric phase into the paraphase of TGS.

Biography

Khamchukov Y D has been graduated in Optics and Spectroscopy in Physical faculty from the Belarusian State University. He is degree of the candidate of Physical and Mathematical Sciences (PhD) in a Chemical Physics (N N Semenov Institute of Chemical Physics, Moscow, 1990). He was the Head of Laboratory Physical methods of research, Senior researcher of laboratory informational technologies and non-linear materials. He has published more than 56 papers in reputed journals, Co-author of three books monographs.

Khamch@tut.by

Badri Lal Manmya, J Food Nutr Popul Health 2018, Volume: 2
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VBM FUSION REACTOR H – H CYCLE

Badri Lal Manmya
[1]VBM Fusion Reactor, India

If the bunches of charged particles of same species (protons) are injected to a point „F", where two magnetic fields (perpendicular to each other) are applied ,the charged particles (the protons) of the first bunch will undergo to a confined circular path and will pass through this point "F" (point of injection) by time and again and thus the confined protons will be available for the protons of the later injected bunch (reaching at point "F") to be fused with at point "F". As the proton of later injected nth bunch reaches at point "F", it fuses with the proton of the first injected bunch (that has already confined) passing through the point "F". At point "F", the two protons fuse and form a compound nucleus. The compound nucleus splits and the deuteron (and the positron) is produced. The produced deuteron, due to applied magnetic fields, undergo to a circular orbit. The produced deuteron starts its circular motion from point "F" (the point of production of deuteron) and pass through this common tangential magnetic field point "F" (or the point of production of nucleus) by time and again during its circular motion .Thus the produced deuteron is confined and so the produced deuteron will be available at point "F" (the point of injection) for the proton of later injected bunch (that is reaching at point "F") to be fused with. Exhausting the produced non – useful charged nuclei: The produced positron annihilates with free electron and produces two gamma ray photons that in turn heat the tokamak. As the proton of later injected bunch reaches at point "F", it fuses with the confined deuteron (passing through the point "F") and form the helium -3 nucleus. The produced helium -3 nucleus starts its circular motion from point "F" (0,0,0) or the point p1(x1 , y1, z1) and reaches at point p2 (x2 , y2 , z2) located on the circumference of the circle to be followed by the helium -3 nucleus. As the helium -3 nucleus reaches at point p2 (x2, y2 , z2), it enters into the mouth of the horse pipe that is located at the point p2 (x2 y2 z2) and thus the helium -3 nucleus is extracted out of the tokamak with the help of vacuum pump attached to the another end of horse pipe. Thus we can establish a steady state controlled nuclear fusion reactor based on H-H cycle.

Biography

Badri Lal Manmya completed his education in JNV Hurda (Rajasthan) and completed his Diploma also got Teacher's training certificate and now working as a Teacher in state government of Rajasthan. His Research interest- plasma physics,to establish a steady state controlled nuclear fusion reactor based on hydrogen cycle and also based on D - D cycle. Books written by him are VBM fusion reactor H - H cycle and VBM fusion reactor D - D cycle.

badrilalmanmya@gmail.com

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SPECTRAL STUDIES OF COMBINED UV-VIS AND INFRARED EMISSION FROM LASER-INDUCED CARBON AND OTHER PLASMAS

Clayton S C Yang[1], Sudhir Trivedi[1], Jin Feng[1], Laszlo Nemes[2] and Uwe Hommerich[3]
[1]Brimrose Corporation of America, Maryland
[2]Research Centre for Natural Sciences, Institute of Materials and Environmental Chemistry, Hungarian Academy of Sciences, Hungary
[3]Hampton University, Virginia

Time-resolved infrared emission spectra were obtained at Hampton from YAG-laser induced graphite plasmas in various gaseous environments at atmospheric pressure in the wavelength range of 1-10μm using a single element LN_2 cooled InSb or HgCdTe detector and a scanning grating spectrometer. Spectra were averaged by a boxcar detector applying 10μs delays relative to the laser pulse and a 16μs gate width. These spectra were compared to laser-induced breakdown (LIB) carbon spectra in the UV-visible range obtained simultaneously as well as published earlier at the Central Research Institute for Chemistry, Budapest. The differences illustrate the specifics of infrared emission that are general for infrared LIBS (IR-LIBS) spectra. IR-LIBS spectra obtained for carbon are too complex and are of too low resolution to yield definite molecular assignments, but comparisons to low temperature solid phase IR absorption spectra, high temperature gas-phase IR emission spectra and a theoretical IR spectral database suggest assignments to certain class of carbon molecules. These results may be of interest for carbon nanostructure research. Some aspects of vibrational excitation in IRLIB spectra using plasma from a small PAH molecule will also be discussed.

Biography

Laszlo Nemes obtained a diploma in chemical engineering in 1959. I started doing research at the Pharmaceutical Research Institute, Budapest, then I joined the research network of the Hungarian Academy of Sciences and I have been associated ever since with that organization I am emeritus science adviser; possess a Ph.D. degree from the Technical University of Budapest a D.Sc. Degree from the Hungarian Academy of Sciences and Dr.Hab. as habilitated professor at the Technical University of Budapest. I was appointed Visiting Research Scientist at the Chemistry Department, University of Michigan, Ann Arbor, USA. of Pure and Applied Science at the St. Francis Xavier University in Nova Scotia, Canada. Since 1980 I was active in the field of laser induced chemistry and the emission spectroscopic studies of laser generated plasmas (mainly carbon plasmas). This activity brought me into close cooperation with the Space Institute of the University of Tennessee With colleagues there we have published a number of common papers in this field, mostly on diatomic molecules. Another of my special field has been the theory and spectroscopy of carbon clusters, especially fullerenes. In 2006 I retired but remained active at my former Institute, the Central Research Institute of Chemistry as science advisor emeritus. In the last 3 years I am associated with the Research Centre of Natural Sciences of the Hungarian Academy of Sciences, Budapest, as emeritus science advisor. A selected compilation of my scientific papers are available at Research Gate.

nemes.laszlo@ttk.mta.hu

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THE EFFECT OF TB3^{+} IONS CONCENTRATION ON THE MORPHOLOGY, STRUCTURE AND PHOTOLUMINESCENCE OF $GD_2O_2SO_4$: TB3^{+} PHOSPHOR OBTAINED BY THERMAL DECOMPOSITION OF SULFATE HYDRATED

R V Rodrigues[1,4], L Marciniak[2], L U Khan[3], A A L Marins[4], R Tomala[2], J R Matos[1], W Strek[2] and E J B Muri[4]

[1]Institute of Chemistry, University of Sao Paulo, Brazil
[2]Institute of Low Temperature and Structure Research, University of Wrocław, Poland
[3]Brazilian Nanotechnology NationalLaboratory (LNNano), Brazil
[4]Federal University of Espirito Santo, Brazil

Rare earths (RE) are widely explored to develop luminescent materials which may find use in such applications as lasers, optical markers, phosphors, semiconductor materials and X-ray detectors. Rare earth sulfonates have attracted attention because they can be obtained with simple and cost-effective methods for potential technological applications as luminescent thin films. The characteristic features of the electronic spectroscopy of the RE3+ ions include the narrow emission lines and long lifetimes due to the intra configurational 4f–4f transitions. The oxysulfides and oxysulfate ($RE_2O_2S/RE_2O_2SO_4$) of rare earth has been widely exploited as optical materials due to their applicability and easy production. Recently, the oxysulfates and oxysulfides has being largely used as Tb3^{+} (green), Eu3^{+} (red) and Dy3^{+} (yellow/blue) colors ions. In this work, the $Gd_2O_2SO_4$:Tb3^{+} optical material was obtained by thermal decomposition of sulfate hydrated under air atmosphere The photo luminescent investigation of $Gd_2O_2SO_4$:Tb3^{+} material showed that the brightness of terbium-activated gadolinium oxysulfate phosphors was enhanced with increase of the concentration of Tb3^{+} and the distributions of size particles were decreased with controlling by doping the phosphor. The structure and purity was confirmed with XPD powder diffractions according JCPDS # 41-0684. The $Gd_2O_2SO_4$: is a good host to Tb3^{+} and ions exhibit better intensity of transitions in the $^5D_4$-->$^7F_2$ narrow lines monitored at 545,5 nm.

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Biography

Rodrigo V Rodrigues has completed his PhD at the São Paulo University (USP), São Paulo, Brazil. He is the collaborator of Thermal Analysis Laboratory (USP) and the Institute of Low Temperature Structure and Research INTIBS-PAN, Wroclaw, Poland. His research work includes developing materials using the TG/DTG/DSC Thermal Analysis Techniques and TG/MS in the part of obtaining and characterizing the application of thermogravimetry to obtain nanomaterial and luminescent materials, studying kinetic methods (Ozawa) in determining the time of life of compounds and in the study of photoluminescence applications of the excitation and emission spectra of the luminescence of rare earth elements RE. He has published some papers in reputed journals and has been serving as an Editorial Board Member of repute. He has collaborations with São Paulo University USP, Brazil; Turku University, Finland and Institute of Low Temperature of Wroclaw – INTIBS – Poland.

rodv16429@hotmail.com
rodv16429@usp.br

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SCATTERING PHOTONS FOR QUANTUM TECHNOLOGY

Almut Beige
University of Leeds, UK

In this talk, we have a closer look at different types of dynamics of photons with potential applications in quantum technology. The polarization states of photons are ideal carriers for quantum information, since photons travel fast and are relatively robust against decoherence. At the same time, when travelling in free space, it remains difficult to create interactions and to generate entanglement between them. Nevertheless, photons can exhibit a wide range of dynamics. For example, photons in optical cavities with instantaneous quantum feedback can exhibit non-linear and non-ergodic dynamics with potential applications in quantum metrology. Moreover, we study the scattering of photons through semi-transparent mirrors, like beam splitters and mirrors, with applications in quantum information processing. For example, we show that photons can induce long-range interactions between atoms on either side of a semi-transparent mirror for applications in quantum sensing.

a.beige@leeds.ac.uk

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APPLICATION OF SNELL'S LAW IN THE MEASUREMENT OF ECONOMIC INEQUALITY

Amlan Majumder
Dinhata College, India

In this paper, I present a pair of new measures of economic inequality with the application of Snell's law. The idea originates when I envisage, with fantasy, that a society without economic inequality is nothing but a state or condition where light touches everyone without refraction. The egalitarian line of the Lorenz curve framework, for measuring economic inequality, represents such an ideal condition. In reality, however, it deviates or refracts from the ideal condition, as we live in a stratified society with varying living conditions. Refractive index has origin in geometrical optics, where it measures bending of a ray of light passing from one homogeneous transparent medium into another. As light refracts according to characteristics of different media, so also Lorenz curve does according to concentration of wealth or income in different strata. Thanks to this analogy, first, I compute refractive (inequality) index for each income group in a distribution to study inequality condition in each, and then simply add all and standardise to propose an overall measure for the whole framework. I utilise data on quintile group shares of income or consumption from the UNU-WIDER World Income Inequality Database - WIID 3.4, 2017 with 180 countries and 5604 cases. Results are noteworthy. While a refractive index value of less than 1.00, in case of light, refers an 'anomalous refraction', such a condition of economic inequality is found to be too common for many of us in reality. In contrast to that, in more than 31% of the cases, the index value of the richest group lies above 2.00, where the same of 1.00 depicts an ideal condition that is enviable. With many attractive properties, the summative overall measure appears to be pro transfer-sensitive and ornamental going far beyond the most popular Gini coefficient, which is simply transfer-neutral.

amlan@amlan.co.in

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SPIRAL SCANNING DEFLECTOR FOR KEV ENERGY ELECTRONS

Amur Margaryan[1], Robert Ajvazyan[1], John Annand[2], Hayk Elbakyan[1], Lekdar Gevorgian[1], Ken Livingston[2], Rachel Montgomery[2] and S Zhamkochyan[1]

[1]A I Alikhanyan National Science Laboratory, Republic of Armenia
[2]University of Glasgow, UK

A timing processor for keV energy electrons, which is capable to achieve 1 Tbit/s sampling rate and 1 ps resolution in a few 10 ns time interval, will be described. The method employs the GHz radiofrequency spiral scanning deflector, where sequence of keV energy electrons is directly encoded onto the spatial-time content, producing a two dimensional spatial image of the temporal shaped electrons. Results of current theoretical and experimental studies will be presented.

mat@mail.yerphi.am

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RESONANCE TUNNELLING IN 3D/1D NANOSCALE INAS/GAAS COMPLEX

B Vlahovic[1], V Mitic[2] and I Filikhin[1]
[1]North Carolina Central University, USA
[2]University of Nis, Serbia

Weakly coupled binary semiconductor nanoscale systems demonstrate perspectives for laser and nano-sensor applications, due to high sensitivity of the resonance tunnelling between the objects of the system on the symmetry violation. The single electron tunnelling properties of 1D, 2D and 3D structures as well as double quantum wells (DQWs) (1D), double quantum dots (DQDs), and quantum rings (3D) are well known. The electron spectra of such quantum objects in 2D and 3D were studied in our previous works with relation to the electron localizations and tunnelling between the objects. The wave function of electron may be localized in one of the QDs or be delocalized when it is spread over the whole system, tunnelling occurs in the last case. Under the condition of weak coupling objects, electron wave function can be localized in the both objects but with different probabilities. In this work we focus on the resonance tunnelling in 3D/1D nanoscale InAs/GaAs complex. Modelling carrier transfer from the barrier in InAs/GaAs dot-well, tunnel-injection structure is performed by using the band gap model based on the effective potential. This complex has a hybrid spectral structure: discrete spectrum for QD and continue spectrum for QW when QW is considered in three-dimensional space. We describe the tunnelling in the terms of localized/delocalized states and their spectral distribution. It was shown that the resonance tunnelling is going through the lowest spectral levels of 1D object. The QD-QW distance and geometry of the complex are varied. The relation to the PL experiments will be presented. This work is supported by the NSF (HRD-0833184) and DMR-1523617 awards, and ARO grant W911NF-13-0165.

vlahovic@nccu.edu

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EFFECT OF GEOMETRICAL PARAMETERS ON THE LIGHT PROPAGATION CHARACTERISTICS OF HEXAGONAL PHOTONIC CRYSTAL FIBERS

Dhanu Krishna G[1], Prasannan G[2], V P Mahadevan Pillai[3] and K G Gopchandran[4]
University of Kerala, India

Photonic crystal fibers (PCFs) have a structure of wavelength-scale morphological microstructures running along its length. In recent years, photonic crystal fiber (PCF) has attracted significant interest because of its unusual properties and extended applications in telecommunications as well as in novel photonic devices such as sensors, medical instrumentation, and many kinds of optical components. All these applications depend on the structure and geometrical parameters like lattice pitch, air hole shape and diameter and type of lattice. By manipulating these parameters, we can design fibers for different desired applications. In this paper, we analyses the effect of doubling the air hole diameter and pitch of hexagonal PCF (H-PCF) structures. Here, we have performed numerical analysis using finite element method to calculate the dependence of the PCF parameters towards the propagation characteristics like effective mode area, confinement loss, nonlinear coefficient, numerical aperture, spot size and zero dispersion shifting over 800–2000 nm wavelength range. We found that by doubling the value of air hole diameter of an H-PCF, we can increase the nonlinearity by an amount of 80-90% and reduce the confinement loss by 100%. These structures can be used for highly nonlinear applications like super continuum generation in their zero dispersion wavelengths. By doubling the value of pitch of a given symmetric H-PCF structure, large mode area H-PCF of effective area around 600 times more than its original value with an increase in confinement loss by a factor of 800 can be designed. But, doubling both the air hole diameter and pitch of the given symmetric H-PCF structure keeping the AFF constant, results in an increase in the effective mode area of the structure with the decrease of the confinement loss. This consideration can be used for the construction of low loss LMA PCF.

dhanukrishnag@gmail.com

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LOW COST U-BENT OPTICAL FIBER VOLATILE LIQUID SENSOR BASED ON LOCALIZED SURFACE PLASMON RESONANCE (LSPR) TECHNIQUE

D Paul A, S Dutta B, D Saha C and R Biswas D

Tezpur University, India

A fiber-optic volatile liquid sensor has been introduced utilizing localized surface plasmon resonance (LSPR) technique. The unclad portion of a U-bent multimode fiber has been modified through deposition of colloidal nanoparticle layer on to the exposed portion which has been used as the sensing probe. Interaction of noble metal nanoparticles (Ag and Au) and evanescent wave field at the sensing region lead to excite the localized surface plasmons (LSPs) that affect the resonance condition and thereby helps to detect the changes. The vapours of the proposed VLs (viz. acetone, methanol, ethanol and propanol) interacts with the electric field of the plasmons at different concentration of VLs causing a progressive change in resonance conditions of the localized plasmons which eventually modulate the output light signal of the fiber. The modulated light signal falls on a photo-detector at the output end of the fiber and consequently registers the change in voltage response. Using both Ag and Au nanoparticle coating on the unclad portion of the fiber, the consistency of the designed optical sensor has been investigated. The response sensitivity for silver NPs coated probe is found to be more uniform than that of gold NPs coated probe. In addition to that, as a proof of concept, the sensitivity, working domain, limit of detection (LOD) as well as repeatability test has been evaluated for each set of VLs. The novelty of the proposed sensor lies in its inexpensive and simple optics design, miniaturized optical set-up and quick response towards the analyte concentration

dmppaul22@gmail.com

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FIBRE-TO-THE-HUT; BROADBAND CONNECTION TO THE REMOTE USER IN AN AFRICAN SETTING

E K Rotich Kipnoo[1, 2], D Kiboi Boiyo[2], D W Waswa[3], R R G Gamatham[4], A W R Leitch[2] and T B Gibbon[2]

[1]University of Kabianga, Kenya
[2]Nelson Mandela University, South Africa
[3]University of Eldoret, Kenya
[4]SKA-MeerKAT, South Africa

We propose an optical network suited for fibre-to-the-hut application. This study experimentally investigates the performance of Raman-aided, vertical cavity surface emitting laser (VCSEL)-based networks optimized for the sparsely populated areas in Africa. Raman amplification is preferred due to its high gain, low noise figure over a wide wavelength range suited for long reach optical network systems. VCSELs on the other hand are attractive due to their low cost and low power consumption hence affordability by the low-income earning users in the remote villages of Africa. In this study, a 1550 nm VCSEL is modulated with a 4.25 Gbps pseudo-random bit sequence (PRBS) and transmitted over an ITU-T G 655 fibre. The performance of Raman amplification at different pumping configurations is demonstrated. The transmission quality is then analysed through BER measurements. Our findings showed that error-free transmissions extending to over 100 km are achieved. This is a relatively cheap all-optical network ideal for long reach supporting a broadband connection to a number of users.

ekinoo@kabianga.ac.ke

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TWISTED OPTICAL AND MICROWAVE NEAR FIELDS FOR PROBING CHIRALITY OF BIOLOGICAL STRUCTURES

E O Kamenetskii
Ben Gurion University of the Negev, Israel

A large fraction of biological molecules are chiral, the chemistry of life is built almost exclusively on left-handed amino acids and right-handed sugars, a phenomenon that is known as the homo chirality of life. Despite the importance of chiral molecules, the experimental determination of enantiometric excess, the fraction of left- versus right-handed molecules within a mixture of chiral molecules remains a tremendous challenge. Nowadays, localized measuring of chirality of biological and artificial-material structures is mainly a prerogative of optics. In optics, chiral discrimination for biosensing and chiral-material characterization is represented in a larger variety of effective tools. For biomedical diagnostics and pathogen detection, special plasmonic structures with left- and right-handed optical superchiral fields have been recently proposed. These structures effectively interact with large biomolecules, in particular, and chiral materials in general. Microwave techniques are attractive for biological applications because of their sensitivity to water and dielectric contrast. Due to the growing interaction between biological sciences and electrical engineering disciplines, effective microwave sensing and monitoring of biological samples is an important subject. It becomes sufficiently apparent that in microwaves, the problem of effective chirality characterization of chemical and biological objects can be solved when one develops sensing devices with microwave chiral probing fields. Can one use the main ideas and results of the optical subwavelength chiral-field photonics to create microwave structures with subwavelength chiral-field confinement? Since resonance frequencies of electrostatic (plasmon) oscillations in small particles are very far from microwave frequencies, an answer to this question should be negative. Nevertheless, there exists another type of microwave structures, which show strong subwavelength localization of electromagnetic energy and unique field topology. There are small ferrite particles with magnetostatic-magnon oscillations. Recent studies in Microwave Magnetic Laboratory, BGU show that near fields originated from small ferrite-disk particles with such oscillations are microwave twisted fields. The obtained microwave chiral-field structures can provide unique insights for biomedical diagnostics and pathogen detection.

kmntsk@bgu.ac.al

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DESIGN OF A NOVEL POLARIZATION DEPENDENT 1X2 OPTICAL SWITCH AND A 2X1 MUX/DEMUX BASED ON POLARIZATION CONTROLLERS, POLARIZATION BEAM SPLITTERS AND COMBINERS

F Karim
Aboubekr Belkaid University of Tlemcen, Algeria

In this paper, we present a 1x2 electro-optical switch based on a 1x2 polarization beam splitter (PBS), a 2x2 polarization beam combiner (PBC) and two TE/TM polarization converters. By applying a voltage of 0/+5 V simultaneously on the two converters, an optical signal is routed to the cross port or to the bar port. We have used the light polarization principle to eliminate the polarization dependent loss. The total insertion loss obtained through simulation is 0.6 dB, while the switching time is estimated to 20 μs. The estimated extinction ratio of this switch is 30 dB. We present also on this paper, an all-optical 2x1 multiplexer based also on PBSs, PBCs and a polarization controller. The insertion loss found by simulation is 0.5 dB. The demultiplexing function is done by placing only a 1x2 polarization beam splitter after this multiplexer. The two proposed devices operate on the 1550 nm wavelength with a 40 nm pass band.

karim.fethallah@gmail.com

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SECURITY CONVENTIONS IN WSN

Himanshu Monga
JCDM College of Engineering, India

Remote sensor organization (WSN) is a developing innovation for different advanced applications both for mass open and military. This sleuthing innovation consolidated with handling force and remote correspondence makes remote detector organize called sensor networks (WSN) as money making for being victimized in copiousness in future. The presentation of remote correspondence innovation in addition acquires differing types of security dangers. The expectation of this proposal is to look at the safety connected problems and difficulties in remote detector systems. The following proposal has a tendency to acknowledge the safety dangers, various attacks and the attackers, audit projected security elements for remote detector systems to avoid detection of data or loss of data over the insecure network. We have a tendency to likewise examine the excellent perspective of security for guaranteeing superimposed and robust security in remote detector systems. This theory gives information about significance of organization of cryptography methods for secure information transmission in remote sensor systems. As cryptographical primitives square measure central building obstructs for designing security conventions for accomplishing privacy, validation, honesty and non-denial and allowing little to state that the determination and incorporation of correct cryptographical primitives for the protection conventions decides the most important piece of the effectiveness and vitality utilization of the remote detector prepare (WSN). There are range of reviews on security problems on WSNs, which, be that because it might, didn't focus on open key cryptographical primitives in WSNs. This study provides an additional profound comprehension of open key crypto graphical primitives in WSNs which contains temperament based mostly cryptography and talk concerning the first bearings and a few open analysis problems that may be is asked for more. Our work would research best in class programming usage consequences of open key cryptographic primitives as far as execution time, vitality utilization and asset occupation on compelled remote gadgets picking famous IEEE 802.15.4-agreeable WSN equipment stages, utilized as a part of genuine arrangements. By this review we might give up necessary bits of information on open key cryptanalytic primitives on WSN stages, and answers for locating tradeoffs between price, execution and security for coming up with security conventions in WSNs.

Himanshumonga@gmail.com

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LASER WRITING OF CRYSTALLINE TRACKS IN BARIUM TIANOSILICATE GLASS BY FEMTOSECOND LASER BEAM WAIST WITH ELLIPTICAL CROSS SECTION

Ivan A Moiseev, Alexey S Lipatiev, Sergey V Lotarev, Tatiana O Lipateva and Vladimir N Sigaev
Mendeleev University of Chemical Technology of Russia, Russia

Barium titanosilicate glass system is of particular interest for of space-selective laser-induced precipitation of Ba_2TiSi_2O8 fresnoite crystals possessing high piezoelectric and pyroelectric properties. Recently, we have investigated the process of femtosecond laser writing of crystalline tracks in the bulk of $40BaO \cdot 20TiO_2 \cdot 40SiO_2$ (mol %) glass and established the dependence of crystalline tracks morphology on the laser beam scanning speed and pulse energy. In the present study, we report direct laser writing of Ba_2TiSi_2O8 crystalline tracks by the femtosecond laser beam with an elliptical cross-section of the waist formed by anamorphic prism pairs as compared to the conventional Gaussian beam. It is found that applying the anamorphic prism pair allows to increase the maximum laser writing speed enabling homogeneous crystalline track growth. The longitudinal and transverse cuts of the laser-written crystalline tracks have been investigated by polarized optical microscopy, Raman spectroscopy and transmission electron microscopy. It is for the first time revealed that the fine annealing of the laser-written crystalline tracks erases a lot of defects in their structure. These results pave the way to the formation of high-quality crystalline waveguides in glass and their application in novel photonic and optoelectronic devices.

mois.chem@yandex.ru

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A FAST AND ACCURATE APPROACH TO THE COMPUTATION OF OSCILLATION MODES OF WIDEBAND OPTOELECTRONIC OSCILLATORS

S Jahanbakht and S F Mousavi
University of Kashan, Iran

Optoelectronic oscillators (OEOs) with wide band radio frequency (RF) filters can be used to tune the oscillation frequency in a wide range by using a RF phase shifter. Because of the low quality factor of the RF filter in such OEOs, some of the non-fundamental harmonics are not negligible and should be taken into account in the steady state analysis. As in other OEOs, generally there are a number of stable periodic solutions that each of them can be the observed solution depending on the initial conditions. These solutions are called the oscillation modes. A frequency domain approach for computing all the oscillation modes of wideband OEOs is presented. A stability analysis approach is presented for detecting the stability of the computed modes. It is shown that considering an adequate number of harmonics is necessary for an accurate computation of the modes and a valid stability analysis. The advantages of the new approach over time domain approaches to the OEO analysis are the ability to compute all the oscillation modes, instead of only the dominant mode, as well as much less runtime and memory requirements. The validity of the new approach is verified by comparing its results against the time-consuming time domain integrations.

Jahanbakht@kashanu.ac.ir

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LOW FREQUENCY INTERNAL-GRAVITY WAVY STRUCTURES IN THE SHEAR FLOW DRIVEN IONOSPHERE

K Z Chargazia, O Kharshiladze, G Zimbardo, D Kvaratskhelia, N Javakhishvili and K Gomiashvili
I Javakhishvili Tbilisi State Univerity, Georgia

The linear generation, intensification and further dynamics of internal gravity waves (IGW) in the ionosphere with non-uniform zonal wind (shear flow) is studied. In case of the shear flows the operators of linear problem are non-selfadjoint, and the corresponding Eigen functions are nonorthogonal. Thus, canonical - modal approach is of less use studying such motions. Non-modal mathematical analysis becomes more adequate for such problems. On the basis of non-modal approach, the equations of dynamics and the energy transfer of IGW disturbances in the ionosphere with a shear flow is obtained. It is revealed that the transient amplification of IGW disturbances due time does not flow exponentially, but in algebraic - power law manner. The frequency and wave-number of the generated IGW modes are functions of time. Thus in the ionosphere with the shear flow, a wide range of wave disturbances are produced by the linear effects, when the nonlinear and turbulent ones are absent. The effectiveness of the linear amplification mechanism of IGW at interaction with non-uniform zonal wind is analyzed. It is shown that at initial linear stage of evolution IGW effectively temporarily draws energy from the shear flow significantly increasing (by order of magnitude) own amplitude and energy.

Khatuna.chargazia@gmail.com

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HIGH-TEMPERATURE ANNEALING FOR IMPROVED CRYSTALLINE QUALITY OF SEMIPOLAR ALN ON M-PLANE SAPPHIRE

Masafumi Jo, Hideki Hirayama
RIKEN, Japan

AlGaN light-emitting diodes (LEDs) have been studied for highly efficient light sources in deep ultraviolet (DUV) range. In widely used c-plane AlGaN, the spontaneous and piezoelectric polarization produces a strong electric field along the growth direction, which degrades the performance of the LEDs. To overcome the polarization problem, growth on semipolar/nonpolar substrates has been carried out extensively. However, expected properties have not been clearly observed for AlGaN alloy in DUV range because of the low crystalline quality. Here, we report the improved crystalline quality of semipolar AlN grown on m-plane sapphire by using a high-temperature annealing process.

masafumi.jo@riken.jp

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OPTICAL CHOAS: DYNAMICAL COMPLEXITY OF DELAY-COUPLED SEMICONDUCTOR LASERS SYSTEM

Pramod Kumar
University of Exeter, UK

Mutually delay-coupled semiconductor lasers system show a plethora of dynamical complexity in the emitted radiation due to phase-amplitude coupling factor alpha, α that make them ideal candidate for fundamental studies of coupled oscillators as well as for practical applications ranging from optical communications to computing. On the one hand these dynamical instabilities are undesired features and disturb the many applications where one needs the constant stable high power but on the other hand they may allow for new methods for secure communications using chaos synchronization. The variety of optical complexity in these systems which we have investigated theoretically as well as experimentally is well behaving, well understandable, well classifiable in terms of complex nonlinear dynamics. So the systematic study and control of these nonlinear dynamics provides fundamental insight into the underlying physics of the system, on the basis of which one can redesign the device in order to stabilize the working point against environmental fluctuations or improve the processing, or simply exploit the dynamical performance of a system to one's advantages.

P.Kumar2@exeter.ac.uk

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GLOBAL POSITIONING SYSTEM CONFIRMATION OF A CONTRADICTION BETWEEN EINSTEIN'S PREDICTIONS OF TIME DILATION AND REMOTE NON-SIMULTANEITY

Robert J Buenker
University of Wuppertal, Germany

Time dilation and remote non-simultaneity are two of the most famous predictions derived from the Lorentz transformation. As a simple example, consider two lightning strikes which occur at different positions in space. According to Einstein's special theory, the time differences Δt and $\Delta t'$ measured by two observers between the two strikes must satisfy a strict proportionality relation (time dilation): $\Delta t'=X\Delta t$. In addition, it is claimed by virtue of the corresponding prediction of remote non-simultaneity that the two events can occur simultaneously for one of them ($\Delta t=0$) without doing so for the other ($\Delta t'\neq 0$). It is pointed out that it is impossible to satisfy both of the above conditions because that would mean having to violate the algebraic axiom which states that multiplication of any finite number, in this case X, by zero, i.e. Δt in the above equation, must have a product of zero as well, i.e. $\Delta t'=0$, in direct contradiction to the prediction of remote non-simultaneity. As a result, the Lorentz transformation itself is shown to be invalid since it is responsible for both predictions. A different space-time transformation is presented which also satisfies both of Einstein's postulates of relativity but without requiring that space and time be mixed. The Hafele-Keating experiments with atomic clocks carried onboard circumnavigating airplanes confirm that time dilation is a real effect, but they also show that the prediction of Einstein's theory that observer can disagree in principle which of two clocks runs slower is not correct. The Global Positioning System makes use of the observed proportionality relationship between elapsed times in the Hafele-Keating experiment to adjust the rates of atomic clocks carried onboard its satellites so that they run at the same rate as identical clocks located on the earth's surface. This practice also serves as verification that remote non-simultaneity has no basis in fact. Otherwise it would make no sense to have the two clocks running at the same rate in order to measure elapsed times for laser beams to travel between the satellite and the ground position.

bobwtal@yahoo.de

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PHYSICAL PROPERTIES OF BESSEL, AIRY AND NON-DIFFRACTING BEAMS

S Chavez-Cerda

Insituto Nacional de Astrofísica, Optica y Electronica, Mexico

Since their introduction 30 years ago, Bessel beams have been the subject of polemic arguments due to their apparent non-diffracting property and others features that are physically and mathematically inconsistent. Nevertheless, they have been the subject of thousands of publications around the world investigating their properties and potential applications. Another family of beams with similar odd features are Airy beams that have been the trend in optical investigations during the last decade. In this talk, based on mathematical physics principles I will discuss the properties of these beams and other families of non-diffracting beams unveiling their real physics clarifying their apparent strange behaviour.

sabino@inoaep.mx

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DESIGN OF CUIN1–YGAYSE2/SI1-XGEX TANDEM SOLAR CELLS

Samaneh. Sharbati, Iman Gharibshahian and Ali A Orouji
Semnan University, Iran

In this work, an experimental $Si_{0.73}Ge_{0.27}$ solar cell has been modelled. The photovoltaic characteristics of the $Si_{0.73}Ge_{0.27}$ solar cell are in good agreement to its experimental counterpart. Afterwards, a double junction CGS/$Si_{0.73}Ge_{0.27}$ tandem solar cell with 24.1% efficiency has been designed. The effects of Ge concentration on the CGS/$Si_{1-x}Ge_x$ solar cell performance have been analysed. Additionally, the band gap combination of CuIn1-yGa_ySe/$Si_{1-x}Ge_x$ structure has been studied. Our findings indicate that CuIn1-$_y$$Ga_y$Se/$Si_{1-x}Ge_x$ tandem cell with 0.7<y<1 and 0<x<0.7 can achieve acceptable efficiency, and the optimized CGS/Si device with 26.1% efficiency is proposed. In CGS/$Si_{0.73}Ge_{0.27}$ tandem cell, the current matching is obtained when the CGS absorber thickness of the top cell is 1 μm and the $Si_{0.73}Ge_{0.27}$ absorber thickness of the bottom cell is 1.9 μm. The current matching condition for this device degrades the fill factor, although increases the current, so the device does not achieve maximum output power. An optimal thickness of 1.8-2 μm for CGS layer can adjust the Jsc and FF for the maximum efficiency of 24.3%, it has improved 2% compared to the current matching CGS thickness (1 μm).

Samaneh.Sharbati@semnan.ac.irir

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SIMULTANEOUS ELECTRON-PHOTON EXCITATION OF ATOMIC TARGETS

Saxena Sanjeev
Bareilly College, India

Electron-atom scattering in the presence of a laser field is a rapid and fast growing subject. This study is very useful from the point of view of plasma heating, population of metastable states and gas break down phenomenon. The electron atom scattering in the presence of a resonant laser field was investigated by so many theoreticians. Some of them have derived a time dependent close coupling approach for particle scattering by a two state atom, generated by the strong near resonant field. In present paper, I would propose two phases. The first phase is devoted to the study of electron Hydrogen atom scattering in presence of electromagnetic field. The variation of the cross section with laser intensity and with incident electron energy is too investigated for the optically forbidden s-s and s-d type transitions. The effect of laser on the individual magnetic sub-state excitation when the final state is a'd' state, is also observed. The variation of differential cross sections with the scattering angle at incident electron energy is also presented at different laser intensities. In the second phase of proposed paper, the above study would be extended to Helium atom. The use of pseudo-states as intermediate states is also being taken into account. Here, I would assume that laser is non-resonant with any atomic level. I predicted major changes in the joint excitation cross section of Helium atom due to a multi-pole interference effect, near the resonant frequencies corresponding to the quadrupole allowed intermediate states. As for as my knowledge, such effects have not studied so far. The present calculation is done by taking the asymptotic wave functions hence extracted the phase shift accordingly. The detailed results shall be presented as well discussed at the venue of conference.

sanjiv.sxn@gmail.com

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FEMTOSECOND LASER DIRECT WRITING OF CRYSTAL-IN-GLASS LABGEO5 WAVEGUIDES

Sergey V Lotarev, Alexey S Lipatiev, Tatiana O Lipateva, Vladimir N Sigaev
Mendeleev University of Chemical Technology of Russia, Russia

Femtosecond lasers have become a powerful tool for three-dimensional precision micromachining of dielectrics. One of its promising applications is space-selective laser-induced crystallization of glasses providing growth of continuous crystalline architectures with functional properties such as second-order optical nonlinearity. Though laser-induced precipitation of different crystalline phases was demonstrated in a wide set of glasses, writing single-crystal tracks which could operate as channel waveguides was a challenge which required optimization of laser treatment parameters and beam profiling. Such crystalline channel waveguides consisting of ferroelectric stillwellite $LaBGeO_5$ phase have been recently obtained in lanthanum borogermanate glass. In particular, we reported laser writing of oriented $LaBGeO_5$ tracks with improved homogeneity providing waveguide effect by applying the femtosecond beam with elliptical waist cross-section and demonstrated second harmonic generation in this waveguide. In the present study, we revealed the possibility and investigated conditions of laser direct writing of oriented LaBGeO5 crystal tracks at various pulse duration from 300 fs - 5 ps and various pulse repetition rates from 25 kHz to 500 kHz. It is shown that there is a constant minimal value of peak pulse intensity about 1,6 10^{12} W/cm^2 in the pulse repetition rate range of 100-500 kHz, while at lower repetition rates this value rapidly grows with repetition rate decrease. We also suggest a method of fast laser-induced growth of a seed microcrystal which is necessary as a starting point for writing a crystalline track and is formed in glass by the stationary beam. Exposure of glass to the beam with gradually increasing pulse energy is shown to greatly reduce and stabilize time required to grow a seed crystal as compared to the beam with constant pulse energy. The obtained data will be useful for further improvement and feasibility of crystal-in-glass waveguides writing method.

sergey_lot@mail.ru
slotarev@muctr.ru

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SPECTRUM-POLARIZATION ENCODING FOR BROADBAND LASER PULSES BASED ON ROTATORY DISPERSION AND ITS POSSIBLE APPLICATIONS

S Xu, S Zheng, X Zeng and Y Cai
[1]Institute of Photonic Engineering, SZU, China
[2]Shenzhen Key Laboratory of Micro-Nano Photonic Information Technology, SZU, China

As we know, chirped pulse amplification, a kind of time-spectrum encoding, has scaled the femto-second pulse to several petawatts. Here we report a novel technology, we call it spectrum-polarization encoding (SPE) for broadband pulse, which is realized by inducing some optical rotatory dispersion (ORD), and decoded by compensating ORD. By the aid of optical polarizers, SPE can induce spectral polarization-dependent loss and gain. Accordingly, SPE can not only work as optical filters by controlling polarization-dependent transmission to tune central wavelength or bandwidth, as a tunning component inside laser oscillator to tune output wavelength, but also be used in ultrafast light pulse shaping. Our results show SPE can help a Ti: S regenerative or multi-pass amplifier to boost an 800 nm pulse up to mJ level with a bandwidth to support few-cycle pulse duration. SPE is entirely passive thus very simple to be designed and aligned.

shxxu@szu.edu.cn

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FORWARD BRILLOUIN SCATTERING IN PHOTONIC CRYSTAL FIBER STIMULATED BY 1 μM BAND LIGHT SOURCE

Sigang Yang, Yi Yang, Yan Xie, Minghua Chen, Shizhong Xie
Tsinghua National Laboratory for Information Science and Technology (TNList), Department of Electronic Engineering, Tsinghua University, China

Nonlinear optical generation in photonic crystal fiber (PCF) can afford tunable radiation in non-conventional wavelength band that conventional laser source can not emit. During the nonlinear optical generation process, the situation always occurs that high power is confined in very small core region which leads to large gradient distribution of mode field. Hence tightly trapped acoustic wave in the cross-section direction is ready to be generated due to electrostriction. And it is named as guided acoustic wave Brillouin scattering (GAWBS) or forward Brillouin scattering. Recently, GAWBS in PCF pumped at 1.5 μm band or 1.8 μm band has been investigated in depth. However GAWBS pumped at 1060 nm band has not been reported yet. Parametric optical sources based on PCF pumped at 1060 nm band have shown its potential in the biological imaging application due to much larger tunability bandwidth compared with traditional laser source in this band. The GAWBS generation in PCF in this band need to be investigated in details since it is an unavoidable problem in the study of parametric light source operating in 1060 nm band. Here we investigate the GAWBS generation in PCF pumped at 1060 nm band for the first time to the best of our knowledge. A homemade PCF with small core diameter of about 2.4 μm and large air filling fraction in the cladding is used as optical-acoustic interaction medium. A Sagnac loop including a section of PCF in a asymmetric configuration is used to convert the phase modulation of light wave by the generated acoustic wave to intensity modulation. A homemade mode-locked Ytterbium doped fiber laser is used as the pump source. The output from the Sagnac loop is measured by a high speed real time oscilloscope. The measurement shows generation of GAWBS with the frequency of 1.23 GHz and lifetime of 120 ns.

ysg@tsinghua.edu.cn

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NON-LINEAR OPTICAL PROPERTIES OF NANO PARTICLE C60 FULLERENE USING LASERS

T K Subramaniam
Sri Sairam Engineering College, India

The third order non-linear optical properties of Buckminster fullerene (C_{60}) molecule has been studied using a Nd:YAG laser, in the visible and in the infrared region .The solvent using toluene was specifically used because of low threshold intensity for an optical limiter application. Closed aperture Z-scan technique was adopted to characterize the material due to its simplicity and high sensitivity in measuring the third-order optical nonlinearity. This allows computing the contributions of nonlinear absorption and nonlinear refraction towards nonlinearity. Saturable absorption (SA) for C_{60} nano particles is also established. RSA is not established. FT-IR studies is also carried out to characterize the sample and to correlate the NLO studies.

subramaniam.phy@sairam.edu.i

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SYSTEM DESIGN FOR FSO BASED TRANSCEIVER

Vijay Janyani and Saurabh Sarkar
Malaviya National Institute of Technology, India

The demand for high speed data access is growing day by day; every digital infrastructure of our modern day society requires a very high speed data access. We have achieved very high data rates over fibre in our backbone networks and also within our local area network, the only bottleneck for high speed data access that remains is the interconnecting network that connects the local area network to the backbone network. The Free Space Optical (FSO) Communication {a.k.a. Terahertz Communication} provides us with the economical solution to this bottle neck problem. The beauty of this type of communication scheme is that it utilizes licence free spectrum band, does not require any installation or laying of fibre, and future expansion is limitless and fast. Along with the advantages that include very high data rate, no RF licensing requirement, high security, smaller form factor, smaller transceiver architecture and immunity from electromagnetic interference or jamming the FSO communication provides the most effective high speed data communication technology for the next generation of wireless communication. We in our work here at Electronics department of MNIT, Jaipur, plan to build a Full Duplex FSO transceiver system that can support data rates upto 5 Gbps (Gigabit per Second). This would be helpful as an alternative to current BTS-BSC structure as it would remove the data speed bottleneck problem. We would like to deploy various modulation schemes over our transceiver model to best tackle various atmospheric perturbations. Thus, our work focusses on designing transceiver system providing high speed point-to-point data link using 1550 nm spectrum.

vjanyani.ece@mnit.ac.in

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SURFACE ELECTROMAGNRTIC WAVES: PAST, PRESENT, FUTURE

Vladimir Datsko
Institute of Applied Geophisics, Russia

Surface electromagnetic waves (SEV) have been known for 117 years. Currently, they are widely used in optical and investigated at THz frequencies in the area which form the basis of the current status and future development of nanotechnologies (plasmonics). The history of the research of electromagnetic waves that are different in nature from spatial Maxwell-Hertz electromagnetic waves and emerging on the boundary of two media with different dielectric properties, developed from universal acceptance in the early 20th century, the concept of SEV Sommerfeld- Zenneck, until her categorical denial by middle-century, the revival of interest in 60 years and experimental confirmation by the beginning of the 21st century. In Russia, the theory of SEV developed intensively, and experimental proof of the existence of SEV was given: waves of ultrahigh frequencies detected and investigated in the laboratory in the magnetized semiconductors, on salt (w h Ocean) water, gas plasma and metals; were observed *in vivo*. SEV exist at frequencies up to optical. To date, they are best explored in the ultra high frequency range and optics (plasmon- polaritons) .Extended field studies in the field of high, low and ultralow frequencies holds exciting prospects: (OTH) radar, new channels of global telecommunications, monitoring the surface of oceans, weather management, wireless transfer of energy flows on the surface of Earth and the bottom edge of the ionosphere from continent to continent. SEV have dramatic past, pragmatic present and a great future.

contyr@yandex.ru

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STRUCTURE AND STABILITY ON MULTIDIMENSIONAL NONLINEAR WAVES IN SPACE PLASMA

Vasily Yu Belashov[1], Elena S Belashova[2] and Oleg A Kharshiladze[3]

[1]Institute of Physics, Kazan Federal University, Russia
[2]Institute for Computer Technologies and Information Protection, Kazan National Research Technical University named after A.N. Tupolev - KAI, Russia
[3]Ivane Javakhishvili Tbilisi State University, M Nodia Institute of Geophysics, Georgia

The structure and stability of the multidimensional nonlinear waves and solitons forming on the low-frequency branch of oscillations in complex continuous medium with dispersion, such as plasmas, are studied analytically on the basis of the Belashov-Karpman (BK) system which includes the Kadomtsev-Petviashvili and derivative nonlinear Schrodinger classes of equa-tions and takes into account the generalizations relevant to various complex physical media, associated with the effects of high-order dispersion corrections, influence of dissipation and instabilities. This is consistent representation of the both early known and new original results obtained by author and also some generalizations in theory of the nonlinear waves and solitons in complex dispersive media. The analysis of stability of solutions is based on study of transformational properties of the Hamiltonian of the system. The structure of possible multidimensional solutions is investigated using the methods of qualitative analysis of proper dynamical systems and analysis of the solutions' asymptotics. As a result, we have constructed a classification of possible solutions for the BK system and have obtained the conditions of existence of the 2D and 3D soliton solutions in this system. Some applications of obtained results in plasmas (for the fast magnetosonic (FMS) and Alfvén waves, and for the internal gravity waves at heights of the F-layer of the ionosphere) are considered.

vybelashov@yahoo.com

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MODULATION OF KINETIC ALFVEN WAVES IN AN INTERMEDIATE MAGNETOPLASMA

A P Misra and D Chatterjee
Visva-Bharati University, India

We study the modulational instability (MI) of kinetic Alfven waves (KAWs) in an intermediate magnetoplasma. A set of fluid equations, coupled to the Maxwell's equations are considered to derive a coupled set of nonlinear partial differential equations (PDEs) which govern the evolution of KAWs in the plasma. We show that the KAWs can evolve into bright envelope solitons, rogons or can undergo damping depending on whether the characteristic ratio of the Alfven to ion-acoustic speeds remains above or below a critical value. The growth rate of MI, as well as the frequency shift and the energy transfer rate, are obtained and analysed. The results can be useful for understanding the existence and formation of bright envelope solitons, rogons or damping of KAW envelopes in space plasmas, e.g., interplanetary space, solar winds, etc.

apmisra@visva-bharati.ac.in
apmisra@gmail.com

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GLOBAL RELATIVISTIC PLASMA JETS WITH HELICAL MAGNETIC FIELDS - PIC SIMULATIONS

Athina Meli
University of Gent & University of Liege, Belgium

One of the key open questions in the study of relativistic jets is the jet's plasma interaction with its ambient environment, on the microscopic level. In this presentation studies of the initial evolution of both electron–proton and electron–positron relativistic jets containing helical magnetic fields, focusing on their interaction with ambient plasma will be shown. Simulations of global jets containing helical magnetic fields are presented in order to examine how helical magnetic fields affect kinetic instabilities such as the Weibel instability and the kinetic Kelvin-Helmholtz instability (kKHI). In an initial stage, these kinetic instabilities are suppressed and new types of plasma instabilities can grow and importantly in the electron-proton jet case simulation, one can see a recollimation-like instability occuring near the center of jet. On the other hand, in the electron-positron jet simulation, mixed kinetic instabilities grow and the jet electrons are accelerated. Finally I will discuss the evolution of electron-ion jets with different mass ratios and point different mechanisms of flares, possibly due to reconnection.

ameli@uliege.be

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STABILITY OF THE COLLINEAR POINTS WITH PERTURBING FORCES IN THE RELATIVISTIC RESTRICTED THREE BODY PROBLEM (R3BP)

Aminu Abubakar Hussain[1] and Nakone Bello[2]
[1]Ahmadu Bello University, Nigeria
[2]Usmanu Danfodiyo University, Nigeria

The objective of this paper is to investigate the locations and stability of the collinear points within the framework of the post-Newtonian approximation by taking into consideration the oblateness of the bigger primary. The numerical results of this study related to Jupiter-Satellite systems and Saturn-Satellite systems show that the points L_1 and L_2 move towards the smaller primary due to oblateness and relativistic factors while L_3 moves away from the bigger primary due to oblateness. Also the locations of these points are drawn versus the mass ratio μ and it is observed that the point L_1 moves away from the smaller primary for an increasing mass ratio while L_2 moves towards the bigger primary when the mass ratio increases. The point L_3 moves away from the bigger primary when the mass ratio increases. It is also noticed that only point L_2 is significantly affected by the relativistic effect when varying the mass ratio. The collinear points are found to be unstable due to the presence of positive real roots.

dadinduniya@gmail.com

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PREFORMATION OF ALPHA-PARTICLE FOR FAVOURED TRANSITIONS USING PROXIMITY POTENTIAL

C K Phookan
Haflong Government College, India

Preformation for alpha-particle for favoured transitions is calculated using proximity potential. Calculations are done using an indirect semi-empirical method in which experimental values of half-lives are taken into consideration. Values of assault frequency are determined using a modified formula, and penetrability is calculated using proximity potential. Calculations are carried out for favoured transitions of all alpha emitters, i. e., 179 e-e, 80 e-o, 98 o-e and 55 o-o alpha emitters. As expected from the shell model, preformation values obtained are highest for e-e alpha emitters, followed by e-o and o-e alpha emitters. The lowest values are obtained for o-o alpha emitters. It is also found that preformation values are highest for transitions originating in the ground state than for transitions originating in the isomeric state. This suggests that there is greater preformation of alpha-particle in the ground state than in the isomeric state. The preformation values also show a distinct minima at the neutron magic number, N=126. Comparison of these semi-empirical values is also done with values obtained by microscopic methods. Comparison indicates that the trend of values obtained by the two methods is quite similar. As there is no universal formula for calculating the assault frequency, hence, the preformation values of the above semi-empirical method can be brought very close to the microscopic values by adjusting the assault frequency.

chinmoy.phookan@gmail.com

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NEUTRAL ARGON PLASMA FOR THE LAPAROSCOPIC TREATMENT OF ENDOMETRIOSIS

Ceana H Nezhat
Nezhat Medical Center, USA
Northside Hospital, USA
Emory University, USA

Endometriosis affects 15% of reproductive aged women. It is the 3rd leading cause of gynaecologic hospitalizations and is associated with chronic pain, diminished quality of life, sub-fertility, psychological morbidity and work absenteeism. Diagnosis has proved difficult in the past because lesions are usually undetectable by exam, labs or imaging modalities. Surgical assessment by laparoscopy for simultaneous diagnosis and treatment has been the gold standard for endometriosis. Neutral argon plasma, like the Plasma Jet® System, gained FDA approval as a coagulation device in 2004. It can be utilized as a multi-functional device for vaporization, coagulation, and superficial cutting with acceptable outcomes such as minimal thermal spread (0.5-2mm). The use of neutral argon plasma in the treatment of all stage endometriosis in various locations within the body (i.e. ovaries, pelvic sidewall, fallopian tubes, etc.) appears to be efficacious and safe.

Ceana@Nezhat.com

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PROCESS AND COATING DEVELOPMENT FOR PECVD COATED PLASTICS PRODUCTS

Rainer Dahlmann, Montgomery Jaritz, Dennis Kirchheim, Stefan Wilski and Christian Hopmann
Institute for Plastics Processing (IKV), RWTH Aachen University, Germany

The largest field of application for plastics is currently in packaging, as they offer good mechanical properties combined with low density. A drawback of plastic packaging for food, pharmaceuticals and electronics applications over metals or glass is often their permeability to oxygen, carbon dioxide, water vapour and aroma. In order to improve this property, nano-scaled plasma deposited barrier coatings are researched. These are able to form virtually impermeable layer on the substrate and reduce permeation. Thanks to developments in low-pressure technology, surface functionalization by means of plasma is economically viable for mass-produced products nowadays, which is demonstrated by numerous examples such as the inner coating of polyethylene pipes, polypropylene syringes or polyethylene terephthalate bottles, polypropylene jam cups or coffee capsules. For example, polyethylene terephthalate bottles are coated with a barrier layer immediately after stretch blow molding before they are filled. Right after injection moulding, polypropylene cups are barrier-coated in batch processes. Functionalization processes for mass production start with a laboratory reactor in which functionalities are developed on small, mostly two-dimensional substrates. Subsequent to that, the process must be transferred to complex geometries and finally scaled up to viable sizes for mass production. Therefore a knowledge-based, systematic process and coating development is required which can be separated into product, plasma process and system properties, which are linked to each other via surface and coating analysis. Surface and coating analysis is mandatory for the definition of substrate-based challenges to the plasma process, tailoring the plasma process to the substrates particularities and testing the product properties. In addition, surface analytical methods are used to determine the influence of process parameters on coating properties and to achieve the defined target values of surface functionality. Systematic upscaling of the plasma process represents a decisive step towards mass-produced applications for the process integration of the developed functionalities.

rainer.dahlmann@ikv.rwth-aachen.de

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APOKAMP DISCHARGE PHENOMENON: LABORATORY STUDIES AND UNEXPECTED APPLICATION FOR ATMOSPHERIC PHYSICS

Eduard A Sosnin[1,2] and Victor F Tarasenko[1,2]
[1]Institute of High Current Electronics (IHCE SB RAS), Russia
[2]National Research Tomsk State University, Russia

Apokamp discharge is the potential pulsed-periodic discharge, forming a plasma jet propagating transversely to discharge channel. This report provides an overview of laboratory measurements of apokamp characteristics. It is established experimentally that this regime of pulse-periodic discharge is formed stage by stage. At the first stage, in a microsecond discharge of a voltage pulse of positive polarity, a potential spark channel formed during the first pulses between two needle electrodes is transformed into a diffuse channel. At the second stage, a weakly glowing halo is formed near the discharge channel, and a bright offshoot arises near channel. Finally, the offshoot becomes a source of plasma bullets (streamers) moving with a velocity of up to 200 km/s. The measured values are in good agreement with the results of numerical simulation of streamer in air at atmospheric pressure. It is shown that the formation of a jet significantly depends on the air temperature. It is established that apokamp discharge in air at pressures that corresponds to the middle and upper atmosphere of the earth is miniature analogous to a large-scale transient luminous events-blue jets and sprites, namely, the velocities of propagation of apokamps are about the velocities of propagation of starters and blue jets in the atmosphere of the Earth. It was shown that jets (apokamps) with the maximum length are observed in the pressure range corresponding to the altitudes of appearance and propagation of starters and blue jets. In addition, by means of scaling law for gas discharge we estimate experimentally the electrical field strength at altitudes, which corresponds to the formation of blue jets in the middle earth atmosphere. Estimated value lies in a range of $6 \cdot 10^5$-$1.9 \cdot 10^6$ V/m which confirms the correct use of streamer model to describe the physical nature of apokamp and blue jets.

badik@loi.hcei.tsc.ru

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ELECTRON INJECTION AT NONRELATIVISTIC SHOCKS OF YOUNG SUPERNOVA REMNANTS

Jacek Niemiec[1], Artem Bohdan[2], Martin Pohl[2, 3] and Oleh Kobzar[1]
[1]Institute of Nuclear Physics Polish Academy of Sciences (IFJ PAN), Poland
[2]Deutsches Elektronen-Synchrotron (DESY), Germany
[3]University of Potsdam, Germany

Particle pre-acceleration constitutes a central unresolved problem for diffusive shock acceleration process assumed to provide high-energy cosmic rays in astrophysical plasma environments. Here, we report on recent studies of electron injection at high Mach-number nonrelativistic perpendicular shocks with application to forward shocks of young supernova remnants. We use high-resolution large-scale two-dimensional fully kinetic particle-in-cell simulations that sample a representative portion of the turbulent shock front and account for time-dependent effects of the cyclic shock reformation. We discuss a nonlinear shock structure and analyse conditions leading to efficient electron heating and pre-acceleration. We confirm electron injection through shock-surfing acceleration in the foot of high Mach-number shocks and analyse additional electron energization processes due to spontaneous magnetic reconnection in the filamentary region of the turbulent shock ramp. We demonstrate a non-stationarity of the injection processes and their dependence on plasma temperature upstream of the shock and also on numerical parameters assumed in computer simulations. The relevance of our results to the physics of fully three-dimensional systems will also be discussed.

Jacek.Niemiec@ifj.edu.pl

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NUMERICAL INVESTIGATION ON THE EFFECT OF PARAMETERS ABOUT GAS ON OZONE GENERATION AS WELL AS SENSITIVITY AND RATE OF PRODUCTION OF IMPORTANT SPECIES

L S Wei, X Liang and Y F Zhang
Nanchang University, China

Ozone is widely used because of its environmental friendly and strong oxidant. The demand for ozone and high-efficiency ozone generator increases rapidly. Much attention has been paid to ozone generation technology, and the effects of various parameters have also been investigated experimentally. Due to the limitation for highly sophisticated instruments and equipment, it is difficult to analyse experimentally the mechanism of influence of various parameters on ozone generation. Numerical simulation has been proved to be an effective method for power supply's parameters. In this work, the influence of gas parameter including inlet gas temperature, gas pressure and gas flow rate on ozone generation are investigated numerically in detail, as well as their mechanism. Meanwhile, the sensitivity and rate of production of important species O_3, O, O (1D) and O_2 ($b^1\Sigma$) based on specific energy are investigated numerically, too.

weilinsheng@ncu.edu.cn

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PHYSICS BEYOND THE STANDARD MODEL IN COSMOLOGICAL PLASMA

Maxim Yu Khlopov
Astroparticle and Cosmology (APC) Laboratory Paris, France
National Research Nuclear University MEPhI (Moscow State Engineering Physics Institute) Russia

Modern inflational cosmology with baryosynthesis, dark matter and dark energy is based on physics beyond the standard model of elementary particles. It implies new types of particles and their interactions and their effects, add new features to the behaviour of cosmological plasma and its possible forms. New types of stable charged particles and the reasons why they are elusive for experimental searches are discussed. New types of Coulomb-like interactions possessed by new particles lead to new forms of cosmological plasma and we consider examples of alternating current (AC) particles of almost commutative geometry, 4th generation in heterotic string phenomenology and mirror or shadow matter and possible methods to test the ideas on the corresponding dark photons in experiments and observations.

khlopov@apc.in2p3.fr

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COUPLED LOW-FREQUENCY ELECTROSTATIC DRIFT AND ION-ACOUSTIC WAVES PROPAGATED THROUGH (E-P-I) PLASMA WITH SHEARED ION FLOW

M Abedi-Varaki and S Jafari
University of Guilan, Iran

In this paper, the linear and non-linear effects of a coupled low-frequency electrostatic drift and ion-acoustic waves propagated through electron-positron-ion (e-p-i) plasma with sheared ion flow and in the attendance an oblique magnetic field is investigated. The obtained results from linear analysis electrostatic drift and ion-acoustic waves published in (e-p-i) plasma show that these waves owing to the ion sheared flow and oblique magnetic field can be unstable. Besides, it is analysed that we can obtain the non-linear equations governing on the behaviour of electrostatic drift and ion-acoustic waves in weakly interacting regime with vortex solutions consisting of a vortex chain and a double vortex. Moreover, it is shown that when accelerated mode is unstable and for, it leads to maximum value of the growth rate. Furthermore, it is found that oblique magnetic field has a curial role in the dispersion of low-frequency electrostatic drift and ion-acoustic waves published in (e-p-i) plasma. The obtained theoretical results in this article can be applied in coherent non-linear structures in a magnetized (e-p-i) plasma, solar wind plasma and etc.

M_abedi-varaki@phd.guilan.ac.ir

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PLASMA SURFACE INTERACTION: PASSIVATION OF SOLID SURFACES

J Raud, I Jogi, R Talviste and J Aarik
Institute of Physics, University of Tartu, Estonia

Plasmas are used in numerous applications as the sources of different reactive species like N, O, H, OH, and H_2O_2. Reactions between these reactive species with atoms and molecules of solids could be used for functionalization of solid surfaces. Specifically to low temperature plasmas, also the functionalization of temperature sensitive materials is possible as plasma temperature does not rise remarkably over room temperature. Reasonable gas composition and choice of plasma source allow production of set of reactive species needed for specific application. Usually the main gas in these gas mixtures is an inert gas, most frequently Ar or He, as molecular additive often small percentage of gases like N_2, O_2 or H_2 is added. In respect of industrial application, Ar is preferable buffer gas as it is remarkably cheaper than He and excited states of Ar can actively participate in the production of reactive species while quenching of these species by Ar is usually negligible. In this work RF capacitively coupled middle-pressure discharge in Ar/ N_2/ H_2 mixtures was used for functionalization of a semi-conductor GaAs surface. Fast surface oxidation of GaAs surface introduces high defect density and deteriorates device performance. One possibility to passivate GaAs surface is to form thin layer of GaN on the GaAs surface by using N_2 containing plasmas as a source of active nitrogen species. Addition of H_2 to the mixture should decrease target surface oxidation and thus enhances nitridation efficiency. Present work focused on the characterization of mid-pressure Ar/N_2/H_2 plasma used for the remote nitridation of GaAs. Input power, electron concentration, electric field strength and mean electron energy were determined on the basis of electrical measurements. Gas temperature and concentration of Ar atoms in 1s states were determined from spectral measurements. The treated GaAs samples were analysed by using XPS technique.

jyri.raud@ut.eeir

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INFLUENCE OF FREE CARRIER PLASMA EFFECT ON THIRD ORDER NONLINEARITIES IN POROUS SILICON THIN FILMS

Rihan Wu and Andrey Kaplan
University of Birmingham, UK

Porous silicon has attracted great interests in recent years due to its unique opto-electronic properties. The nanoscale sponge-like structure of porous silicon enhances the quantum confinement effect and resulting in faster carrier transport, enhanced photo-luminescence efficiency and optical nonlinearities in comparison with conventional crystalline silicon. These improvements lead to a wide range of potential applications in the field of optical sensing, energy conservation and photonic devices. Among all the applications, the enhanced nonlinearities of porous silicon can be either an issue or an advantage. For a better understanding of the nonlinear properties, our work explores the self-focusing and two photon absorption process in free-standing porous silicon thin films by employing z-scan technique in short-infrared wavelength region. In addition, pump-probe technique has also been used to investigate the influence of free carrier plasma effect on the third order nonlinearities.

rxw593@bham.ac.uk

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QUANTUM DYNAMICS OF A HYDROGEN-LIKE ATOM IN A TIME-DEPENDENT BOX: NON-ADIABATIC REGIME

S Rakhmanov[1], D Matrasulov[2], V I Matveev[3, 4, 5]
[1]National University of Uzbekistan, Uzbekistan
[2]Turin Polytechnic University in Tashkent, Uzbekistan
[3]Federal Center for Integrated Arctic Research, Ural Branch, Russia
[4]Russian Academy of Sciences, Russia
[5]Northern (Arctic) Federal University, Russia

Atoms and molecules confined to nanoscale domains have physical properties which are completely different than those of free atoms. Such difference is caused by modification of the boundary conditions imposed for quantum mechanical wave equations, as well as by high pressure induced by the domain boundaries. For free atoms, the boundary conditions are imposed in whole space, while for confined atoms one should solve the wave equations with the boundary conditions imposed on a finite domain. Due to such modification, properties of the atoms, molecules and matter depend on the shape and size of a confining domain. Experimentally, atom-in-box system can be realized in co-called atom optic billiards which represents a rapidly scanning and tightly focused laser beam creating time averaged quasi-static potential for atoms. Recent technological developments make possible trapping and manipulating of atoms and molecules in time-dependent potentials. Manipulation of the atomic Hamiltonians with both discrete and continuum spectra is of practical importance in such field as metrology and quantum information processing. In this work we study quantum dynamics of hydrogen-like atom confined in spherical box with time dependent radius by focusing on the response of atomic electron to the effect of moving walls of the box. The time-dependence of the wall's position is considered as non-adiabatic, i.e. we consider the cases of rapidly shrinking, expanding and harmonically breathing boxes. The expectation values of the total and kinetic energy, average force, pressure, coordinate are analyzed as a function of time. It is shown that linearly extending box leads to de-excitation of the atom, while the rapidly contracting box causes the creation of very high pressure on the atom and transition of the atomic electron into the unbound state. In harmonically breathing box diffusive excitation of atomic electron may occur in analogy with that for atom in a microwave field.

saparboy92@gmail.com

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PLASMA TREATMENT OF BLACK PHOSPHORUS FLAKES

Xue-Feng Yu[1] and Wan Li[1, 2]
[1]Center of Biomedical Materials and Interfaces, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China
[2]City University of Hong Kong, China

Black phosphorus (BP) is a new two-dimensional semiconductor consisting of a weak van der Waals interlayer interaction and strong in-plane bonds. BP has high carrier mobility and tunable band gap from 0.3 to 2.0 eV, offering excellent performances for electric and optoelectronic devices. However, thin BP flakes are difficult to be fabricated. Here we report a controllable thinning method by using hydrogen plasma etching to thin down mechanically exfoliated BP flakes. Atomic force microscope, optical microscopy and Raman techniques was used to identify process conditions. Not only the thickness of the BP flakes can be controlled, but also the defects of the exposed BP surface are removed after plasma treatment. It is expected to improve the electrical performance of BP based field-effect transistor. This method provides a new way to fabricate BP-based electronic and optoelectronic devices in the future.

xf.yu@siat.ac.cn