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Poster Presentation

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Majority carrier modulation using contact area ratio between graphene and liquids for harvesting blue energy

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Harvesting energy from ambient water is highly desirable, especially for realizing self-powered electronic devices. Graphene is a functional material which can be utilized to harvest the energy. To improve the factors of generating voltage by the graphene, we designed an experimental device which can be used to generate electricity through ambient water motions. We discussed various contact ratio (w/L) of graphene exposed to the liquids influencing the induced voltage. The photoresist is used to define the contact ratio (w/L) of the liquids flowing through the graphene. It was found that the contact ratio of 40% (w/L=0.4/1) and 60% (w/L=0.6/1) would generate the maximum value of the induced voltage. However, the induced voltage of the contact ratio 50% (w/L=0.5/1) is lower than the contact ratio of 40% (w/L=0.4/1) and 60% (w/L=0.6/1). The diagram for the induced voltage with different contact ratios showed an M-type symmetrical structure. The type of majority carrier can be modulated by changing the contact ratio (w/L) between the graphene and the liquid solution. This work provides the feasibility of energy conversion using graphene chips and a method for majority carrier modulation, allowing the feasibility of the graphene to be more flexible for harvesting blue energies from nature.

Biography

Ruey-Jen Yang is a Chair Professor of Engineering Science at National Cheng Kung University (NCKU) in Taiwan. He received his PhD degree in Mechanical Engineering from University of California at Berkeley in 1982. He has been with the NCKU since 1993 after 11-year service in USA. His past academic services include Department Chair, Director General of Research and Services Headquarters and University Librarian at NCKU. His research interests include Microfluidics, Nanofluidics, Fluid and Thermal Sciences, Computational Physics, Energy and Nanotechnology. He has published more than 140 papers in high ranking Journals.

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e-Poster Presentations

Valentyn Alekseevitch Nastasenko, Res. Rev. J Mat. Sci. 2018, Volume 6
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Strict justification of the force of the gravitational field

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Currently, the force of the gravitational field is assumed to be estimated by the value F_G of the gravitational interaction of two-point bodies of mass m_1, m_2 (kg) located at a distance r (m) between them, which follows from the Law of Universal gravitation discovered by Newton:

$$F_G = G\frac{m_1 m_2}{r^2}(H). \quad (1)$$

where G – gravitational constant.

However, the force F_G, found for the interaction of point objects, cannot strictly characterize the gravitational field having a spatial structure that encompasses the entire sphere of the observable Universe. Therefore, the application of Newton's law to determine this force is incorrect. In the work performed, this drawback is eliminated on the basis of the found parameters of the waves of the gravitational field: the frequency v_G, the wavelength λ_G, the energy of this wave $E_G=hv_G$ (where h is Planck's constant), and the mass equivalent m_G of this wave, which are related to the speed of light in vacuum c by the following dependence:

$$m_G = \frac{E_G}{c^2} = \frac{hv_G}{c^2}(kg). \quad (2)$$

Herewith, the total mass m_2 of waves of the gravitational field in the law (1) is replaced by its equivalent Nm_G, where N is the number of wavelengths in the distance r to any object of mass m_1, which makes up the value $N=r/\lambda_G$, which allows us to find a new strict physical dependence for the force F_G:

$$F_G = G\frac{m_1 N h v_G}{r^2 c^2} = G\frac{m_1 r h v_G}{\lambda_G r^2 c^2} = G\frac{m_1 h v_G}{\lambda_G r c^2} = \frac{G h v_G}{\lambda_G c^2}\times\frac{m_1}{r}(N). \quad (3)$$

Since the constants G, h, c, v_G, and λ_G, under their dimensionality, can be expressed in terms of Planck's values length lp, time tp and mass mp, we obtain the following:

$$\frac{G h v_G}{\lambda_G c^2} = \frac{\left(\frac{l_p^3}{m_p t_p^2}\right)\times\left(\frac{m_p l_p^2}{t_p}\right)\times\left(\frac{1}{t_p}\right)}{(l_p)\times\left(\frac{l_p}{t_p}\right)^2}. \quad (4)$$

Taking into account the value of (4), we finally obtain a strict physical dependence for calculating the force F_G:

$$F_G = c^2\frac{m_1}{r} = \frac{m_1 c^2}{r}(N). \quad (5)$$

It follows from the dependence (5) that the force F_G of the action of the gravitational field on the object of mass m1 is energetic, it is directly proportional to the total energy of the mass of selected body and is inversely proportional to the distance r between it and any chosen point of the gravitational field. This dependences (3)...(5) can be qualified as scientific discoveries.

Biography

Valentyn Alekseevitch Nastasenko, the Kherson State Maritime Academy Ukraine, faculties Electrical engineering and electrics, the department of transport technologies. Professor of the department of transport technologies candidate of Dr. technical sciences. A sphere of scientific interests include quantum physics, the theory of gravitation, fundamentals of the material world and the birth of the Universe. Author of more than 50 scientific works in these spheres.

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Effects of strain and structure defects on the spectrum of electromagnetic excitations in microcavities lattice

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Recent experiments and theoretical investigations reveal an intense interest for photonic structures and systems of coupled microresonators, whose applications include fabrication of clockworks of unprecedented accuracy as well as the sources of coherent irradiation. A number of our recent works have been devoted to photonics of imperfect structures and to the dispersion of exciton-like electromagnetic excitations in non-ideal lattices of coupled microresonators. Designing and utilization of novel materials for manufacturing of the sources of coherent irradiation is currently a vast interdisciplinary area, which spans various theoretical and fundamental aspects of laser physics, condensed matter physics, nanotechnology, chemistry as well information science. The physical realization of corresponding devices requires the ability to manipulate the group velocity of propagation of electromagnetic pulses, which is accomplished by the use of the so-called polaritonic crystals. The latter represents a particular type of photonic crystals featured by a strong coupling between quantum excitations in a medium (excitons) and optical fields. We considered 1D polaritonic crystal as a topologically ordered system-chain of coupled microcavities containing quantum dots. This chain of identical cavities contains randomly embedded quantum dots of two types. Moreover, these microcavity-resonators are also randomly removed at distances between the nearest neighbors. The peculiarities of the polariton spectrum in the 1D lattice of microcavities caused by uniform elastic deformation of the structure are considered. It is shown that as a result of elastic deformation and structure defects in the system it is possible to achieve the necessary changes of its energy structure and optical properties caused by the restructuring of the polariton spectrum.

Biography

Vladimir V Rumyantsev is Professor in Nanophysics Department at Donetsk National University (DonNU) and Head of Physics Technology Subdivision at AA Galkin Donetsk Institute for Physics and Engineering (DonPhTI). He received PhD in Physics (1988) from DonNU and Dr. Sci. in Solid State Physics (2007) from DonPhTI. He has published more than 250 scientific publications. He is a member of the American Physical Society as well as Mediterranean Institute of Fundamental Physics (MIFP, Italy) and Editor-in-Chiff of Journal of Photonic Materials and Technology (Science PG, USA).

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$Zn_{1-x}MgxO$ nanostructures in advanced electronics and photonics

Mehdi Anwar
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Zinc oxide (ZnO) and its associated nanostructures are pursued applications in advanced electronics, UV detectors, chemical sensors and source for white light, to name a few. The research group at the University of Connecticut has made great strides in the growth of both $Zn_{1-x}MgxO$ nanowires and nanorods to demonstrate highly efficient UV solar blind detectors, chemical sensors and recently material implication logic, physically unclonable functions using ZnO based memristors. In this talk, we will present a comparison of the different growth techniques for the growth of $Zn_{1-x}MgxO$ nanorods and nanowires. ZnO-based memristors along with DC and RF measurements will be presented. The system-level application will be demonstrated with the experimental realization of one-bit PUF.

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Quenching of photoluminescence in graphene hybrids

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Recently there is a considerable interest to study the plasmonic properties of graphene hybrids. Graphene was invented theoretically by Wallace in 1947. He predicted that graphene is a gapless NS and has an indirect band gap. Later, Wallace and I found more gapless materials such as Cd3AS2, HgTe which have direct band gaps. We showed that the optical energy absorption/emission is stronger in the direct bandgap materials than indirect band materials. Recently graphene-like nanostructures such as germanene and silicanes have been invented. Here, we investigate the quenching of photoluminescence in a quantum dot (QD)-metallic nanoparticles and metallic graphene film (QD-MN-G) hybrid system deposited on a dielectric material such as Si. The surface plasmon polaritons (SPPs) are calculated solving the Maxwell equations for the graphene and the dielectric heterostructure in the quasi-static approximation. QDs have excitons which interact with SPPs of the graphene-dielectric heterostructure. Photoluminescence (PL) of QD is found by using the quantum density matrix method in the presence of exciton-SPP coupling. Numerical simulations for the PL spectrum in the QD is performed for (QD-MN-G) hybrid system. It is found that when the exciton energy of the QD is in resonant with the SPP energy the intensity of the photoluminescence is quenched. The PL quenching occurs is due to the transfer of photon energy from the QD to the graphene film and MNP due to the exciton-SPP coupling. Furthermore, when the exciton energy is non-resonant with the SPP energy the PL quenching disappears. The energy transfer from the QDs to the graphene film can be switched ON and OFF by mismatching the resonant energies of excitons and polaritons. The mismatching of energies can be achieved by applying external pump lasers or stress and strain fields. Recently Dong et al. and Zeng et al. have measured the PL spectrum of QDs in QD-G hybrid and QD-MN-G hybrid, respectively. In both experiments, they have observed the PL quenching. We have compared our theory with these experiments and found a good agreement between theory and experiments. These are interesting findings and they can be used to fabricate switches and sensors by using graphene nanocomposites.

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Resolving the VO_2 controversy: Mott mechanism dominates the insulator-to-metal transition

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We consider a minimal model to investigate the metal-insulator transition in VO_2. We adopt a Hubbard model with two orbital per unit cell, which captures the competition between Mott and singlet-dimer localization. We solve the model within Dynamical Mean Field Theory, characterizing in detail the metal-insulator transition and finding new features in the electronic states. We compare our results with available experimental data obtaining good agreement in the relevant model parameter range. Crucially, we can account for puzzling optical conductivity data obtained within the hysteresis region, which we associate to a novel metallic state characterized by a split heavy quasiparticle band. Our results show that the thermal-driven insulator-to-metal transition in VO_2 is compatible with a Mott electronic mechanism, providing fresh insight to a long-standing "chicken-and-egg" debate and calling for further research of "Mottronics" applications of this system. Notably, we find Hubbard bands of a mixed character with coherent and incoherent excitations. We argue that this state is relevant for VO_2 and its signatures may be observed in spectroscopic studies, and possibly through pump-probe experiments.

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Materials for giant spin hall effect

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Spin-orbit coupling in metastable β-W generates spin-orbit torques (SOT) strong enough to flip the magnetic moment of an adjacent magnetic layer. In a magnetic tunnel junction (MTJ) stack these torques can be used to switch between high and low resistive states. Deposition conditions selective to β-W need to be understood for the large-scale fabrication of SOT-MTJ devices or charge coupled spin-logic devices. We demonstrate two different techniques to grow 5-20nm thick β-W films by introducing either O2 gas or N2 gas during the deposition on SiO2/Si or SiN/Si substrates. The flow rate of these gases had a significant impact upon the crystallinity and formation of β-phase W. X-ray diffraction patterns, resistivities, X-ray photoelectron spectroscopy, and X-ray reflectivity were utilized to determine phase, bonding information, and thickness, respectively. These results demonstrate a reliable technique to fabricate β-W films up to 20nm thick on bare Si and silicon dioxide while providing insights that enable deposition of these films anywhere in the device stack. Recent spin Hall effect studies in the beta phase Ta and W show that transverse spin currents are strong enough to switch an adjacent magnetic layer. Films with perpendicular magnetic anisotropy (PMA) can exhibit uniform magnetizations and higher thermal stability. Inserting a 1nm thick Ta insert-layer between the CoFeB and W induces PMA which is confirmed by vibrating sample magnetometer and anomalous Hall voltage measurements. β-W(5nm)/Ta(1nm) channel and the adjacent CoFeB/MgO/Ta layers are patterned into a 100nm wide Hall bar structures. Effect of in-plane current induced change in coercivity was studied during a sweep of the in-plane magnetic field. An empirical model to quantitatively understand the switching mechanism will be presented.

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Protection against the pseudoscientific swindlers usurping the power of world scientific community is necessary to a science. About mechanical essence of physical interactions, a philosophical and natural-science inconsistency quantum - relativistic subconsciousness

Vladislav Cherepennikov
Newton society, Russian

All faster also is fast untwisted a flywheel of a pseudo science under the influence of forces self-rotation (look the note) by armies well paid and armed with lie and ignorance pseudo scientists. The pseudo science flywheel is untwisted in a direction of degradation of public consciousness and stratification of people on poor and over the rich. Thirst of enrichment has no borders and dims reason over rich - conducts to a criminal slaughter-house for repartition of the property and world supremacy. The only thing of that has reached, so-called, scientifically technical progress is not well-being of the population of the Earth, not social justice and peaceful co-existence of the people, and the invention and manufacture of more and more destructive means of mass self-destruction of the population. In infinite bloody wars perish, guilty people turn to cripples and refugees-derelicts in what not. And all these crimes are made to please enrichments "strong" this world. Madness "strong", indifference and carelessness of the weak conducts the world to global accident. We should not admit that the pseudo science flywheel was untwisted to a stage of self-rotation or the destruction of a mad civilization is inevitable. In present conditions when all accessible means, including through curricula of schools and high schools, mass media, to the public impose antiscientific idealistic and religious outlook, profound studying, development and propagation of works of classics of natural sciences and dialectic materialism is the major direction of struggle for a science, culture, against barbarity, absurdity and destructions of a civilization. Only joint efforts of scientists, progressive state and public figures, not indifferent to the own destiny and to destiny of a terrestrial civilization of various strata of society, it is possible to suspend process of degradation and global accident.

The note: The self-rotation phenomenon was openly outstanding researchers.

In the monograph of the author «Protection is necessary to the Science. » (you can see it on the site http://newtonsociety.ru/science-needs-protection-2017en.doc) resolution of problems about about the mysterious rotating disks in the experiments of Paul Baumann ("Testatika"), G.V. Nikolaev from Tomsk (Electric Motor "Siberian Kolya") levitating drives John Searle, the rotating rotor Muscovites Vladimir Roshchin and Sergey Godin. All of them have the uniform nature of the physical interactions which mechanical essence the dialectic materialism has allowed to establish. Under certain conditions, bodies compulsorily resulted in rotation, reaching certain speed, further can be self-accelerated in itself - up to self-damage under the influence of centrifugal forces. Thus in a direction of axes of rotations there are forces, superior forces of gravitation which, due to a misunderstanding, accept now for supernatural forces.

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On certain structures in dispersion relations for electrons and HOMO-LUMO-gap-effect

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We review some structures in dispersion relations for electrons leading via the Adler Bell Jakiw anomaly able to in magnetic and electric fields bringing electrons from one singularity simulating Weyl equation to another one. This may be of great interest. Further, we consider what we call the HOMO-LUMO-gap-effect, which we seek to define as a very general effect resulting from the back reaction of the fermions/the electrons on "bosonic" variables (what really means e.g. the positions of the ions or some smeared out properties or may be the electrons themselves). Such effects might be speculated to be used in some pre-standard model fundamental physics to lead to the appearance of Weyl particles.

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The rate of entropy model for irreversible reactions in living systems

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An analytical model to compute the rate of entropy in living systems is developed basing on the equations of heat and mass diffusion. The model is applied to the most interesting case of the metabolic network, the glucose catabolism in normal and cancer cells. This is done treating the cell as an open thermodynamic system. It is shown that the rate of internal entropy is mainly due to irreversible chemical reactions and that the rate of external entropy is mostly correlated to the heat flow towards the intercellular environment. It is found that the ratio between the rates of entropy associated with respiration and fermentation processes has a space and time dependence for diffusion of chemical species and is invariant for heat and irreversible reactions. Analytical and numerical results show that in a cell Prigogine's minimum dissipation principle is fulfilled in agreement with the local formulation of the second principle of thermodynamics. The applications of these results could be important for cancer detection and therapy.

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Carbon nanotubes/metal-sulfide composite flexible electrode for quantum dot-sensitized solar cells and super-capacitor

Hee-Je Kim and Chandu VVM Gopi
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Carbon nanotubes (CNT) and metal sulfides have attracted considerable attention owing to their outstanding properties and multiple application areas, such as electrochemical energy conversion and energy storage. Here we describes a cost-effective and facile solution approach to the preparation of metal sulfides (PbS, CuS, CoS, and NiS) grown directly on CNTs, such as CNT/PbS, CNT/CuS, CNT/CoS, and CNT/NiS flexible electrodes for quantum dot-sensitized solar cells (QDSSCs) and supercapacitors (SCs). X-ray photoelectron spectroscopy, X-ray diffraction, and transmission electron microscopy confirmed that the CNT network was covered with high-purity metal sulfide compounds. QDSSCs equipped with the CNT/NiS counter electrode (CE) showed an impressive energy conversion efficiency (η) of 6.41% and remarkable stability. Interestingly, the assembled symmetric CNT/NiS based polysulfide SC device exhibited a maximal energy density of 35.39 $W.h.kg^{-1}$ and superior cycling durability with 98.39% retention after 1,000 cycles compared to the other CNT/metal-sulfides. The elevated performance of the composites was attributed mainly to the good conductivity, a high surface area with mesoporous structures and stability of the CNTs and the high electrocatalytic activity of the metal sulfides. Overall, the designed composite CNT/metal-sulfide electrodes offer an important guideline for the development of next level energy conversion and energy storage devices.

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Majorana qubits

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Qubit is the building blocks for quantum computers. The qubit hardware needs to be as robust as possible in order to allow scaling towards circuits with many qubits. We investigate Majorana qubits where information is stored non-locally and therefore protected against basic decoherence mechanisms. We use semiconductor nanowires proximitized by superconductors as the material for realizing Majorana zero modes. Nanowire networks are needed in order to manipulate the Majoranas as qubits and perform qubit operations. We will report on the Majorana qubit progress at Microsoft.

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Modeling and simulation of CZTS-perovskite sandwiched tandem solar cell

Awodele Mojoyinola Kofoworola
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The solar cell capacitance simulator (SCAPS-1D) was used in the modeling and simulation of sandwiched Perovsk-ite solar cells (PSCs) with planar hetero-junction structure in the arrangement of the sandwiched model (FTO/ZnO/CZTS/PSCS/CZTS/HTM). Two different configurations "121 and 111" of sandwiching absorber layer of the devi-ce were simulated and compared with the Perovskite without a sandwich, using absorber layer of step length thickn-ess of 25nm, and varied from 100nm to 500nm. The band gap diagram, I-V characteristics curve, and other param-eters were constructed. The best configuration for better performance was then determined, from which further sim-ulations were carried out. The efficiency of 22.57% was achieved, which shows that having a combination of two different absorbers was achievable with considerable photon conversion efficiency.

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