Preface

The present volume of Journal of Physics: Conference Series represents contributions from participants of the International Physics Conference at the Anatolian Peak (IPCAP2016) Erzurum, Turkey, 25-27 February 2016, organized by Atatürk University Physics Department that were peer-reviewed by 40 expert referees to the best professional and scientific standards.

The conference aims; to share the experiences and research results of academicians, researchers, and students (scientists) studying physics and related fields, to exchange information about the latest developments in physical science, to discuss the collaboration facilities and finally to provide scientific communication between scientists from different countries.

The Conference venue was the Atatürk University Nenehatun Cultural Center in Erzurum. IPCAP 2016 conference covers a wide spectrum of important topics on physics with 12 different issues:

1. Atomic, Molecular and Plasma Physics;
2. Solid State and Nanophysics;
3. Nuclear Physics and Nuclear Energy;
4. Particle Physics;
5. Optic and Lasers;
6. Statistic Physics;
7. Mathematical Physics,
8. Applied Physics;
9. Biophysics and Medical Physics;
10. Physics Education;
11. Astronomy and Astrophysics and
12. Other topics.

Even though we have organized the first IPCAP 2016 conference this year, about 300 papers will be presented in 4 separated halls and in 8 oral and 2 poster sessions during 3 days.

I would like to thank the Invited Speakers for their significant contributions to the conference. I would also like to thank the members of the International Advisory and Scientific Committee, the members of the Organizing, conference secretary and sponsors.

I hope the reader will enjoy this special issue and will find ideas for new bright achievements.

Rıdvan Durak, Atatürk University, Erzurum-Turkey, March 23, 2016.

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Title and abstract of invited talks in order of presentation

Mohd Nizar Bin Hamidon, University Putra, Malaysia

Title: Future Trend in Sensor Technology

Abstract: Smart' sensors are increasingly being employed, not only in industrial settings, but in every aspect of human life, where they are telling something about their environment by bridging them with the electronic world. Sensors are used to gather a wealth of information from the process that can improve operational efficiency and product quality which involving a mass of data that need to be analysis especially with the merging of the Internet of Things (IoT). They also included with new features such as communication capability and on-board diagnostics. Leading edge research in sensors has been propelled by the advancements made in fabrication, signal processing and material technology in the last decade. With these the scientific world is now on the verge of delivering sensors with radically new capabilities for the human societies. This talk deals with the future trend in sensor technology and several research work in Universiti Putra Malaysia related with them.
Sait Eren San, Gebze Technical University, Turkey
Title: Liquid Crystals and Conducting Polymers with Nanoparticles for Several Organic Electronics Applications

Abstract. Liquid Crystals (LC) are highly nonlinear optical materials and they are sensitive against optical, electrical and magnetic fields. This sensitivity could be exploited for various device designs. In the scope of this presentation, I will firstly discuss the diffraction grating experiments, which are indeed base experiments for Holographic data storage and principally information could be stored at the order of Terabyte per cubic centimeter via this approach. Actually it was experimentally observed and shown that dye and Carbon nanoparticles doped LCs are promising candidates as storage mediums via Holography. Second case study is devoted to another critical experimental demonstration that proves the reorientation and conservation of Carbon Nanotubes (CNT) in the structure of nematic LC. Experimental concepts propose this CNT reorientation, which is of critical importance for potential CNT applications, via electrical, optical and magnetic fields. Third case study is a Hybrid Solar Cell, which is designed and proposed as a feasible and reasonable alternative, according to acquired efficiency with the employment of zinc oxide (ZnO) nanorods and ZnO thin films at the same time. Both of these ZnO structures were grown electrochemically and poly(3-hexylthiophene) : phenyl-C61-butyric acid methyl ester; (P3HT: PCBM) was used as an active polymer blend, which was found to be compatible to prepared Indium-Tin-Oxide (ITO) substrate base. This ITO base was introduced with mentioned ZnO structure in such a way that, the most efficient configuration was optimized to be ITO/ZnO film/ ZnO nanorod/ P3HT: PCBM/Ag. All ZnO works were carried out electrochemically, that is indeed for the first time and at relatively lower temperatures. Forth one is an Organic Field Effect Transistor (OFET) device, which was prepared by a side chain thiophene based-dielectric gel copolymer and it shows a higher field-effect mobility and lower threshold voltage. The device is a sandwich type and promising results could be attributed to the compatibility that comes from the similarity between the chemical structures of semiconductor and dielectric layers due to \(\pi\text{-}\pi\) interactions caused by intermolecular overlapping of p orbitals in aromatic thiophene groups existing in both layers. Actually this kind of devices could also be a good inspiration for artificial skin concepts, if pressure sensitivity reveals at the same time. 19 One of the proposed device without pressure deal is the one, prepared with poly (MMA-coMTM) has a field-effect mobility of 0.57 cm2/Vs, a threshold voltage of -0.20 V, on/off current ratio of 103 while the device prepared with just PMMA has a field-effect mobility of 0.38 cm 2 /Vs, a threshold voltage of -0.26 V and on/off current ratio of 102. There are some positive qualitative results for pressure sensitivity of OFET concepts as well.

A. Bek, M. E. Taşgün, H. E. Ünal
Title: Molecular Activation by Plasmon Enhanced Nonlinear Conversion

Abstract. In this study we propose a method for deterministic activation of few molecules. We demonstrate effective background-free continuous wave nonlinear optical excitation of enhanced yellow fluorescent protein molecules that are sandwiched between asymmetrically constructed plasmonic gold nanoparticle clusters [1]. We observe that infrared photons are converted to visible photons through efficient plasmonic second harmonic generation. Our theoretical model and simulations demonstrate that nonlinear conversion of continuous wave light becomes possible by Fano resonance in the nonlinear response. We show that nonlinearity enhancement of plasmonic nanostructures via coupled quantum mechanical oscillators such as molecules can be several orders larger as compared to their classical counterparts [2-3]. Our numerical simulations demonstrate that observation of second harmonic generation with continuous wave laser becomes possible owing to the cooperative action of conversion enhancement through Fano resonance, hybridization in the plasmon absorption spectrum and the size asymmetry of nanoparticle dimers. We further investigate the Fano effects on the molecular response.
resonances in intrinsic nonlinear optical response of single or coupled metal nanoparticles. We show that Fano resonance conditions can be tuned to enhance nonlinear optical conversion. When a bare metal nanoparticle is coupled with a plasmonic nonlinear converter, second harmonic generation can be enhanced by several orders of magnitude. This phenomenon emerges due to path interference effects. It is shown that second harmonic generation enhancement in hybrid structures can be obtained even in the absence of coupled quantum emitters [4]. This is an important finding with the potential of facilitating use of purely metallic nanoparticles with appropriate plasmonic properties for efficient nonlinear conversion.

İlhami Gülçin, Atatürk University, Turkey
Title: Polyphenolic Antioxidant Compounds-Potent Carbonic Anhydrase Enzymes Inhibitors

Abstract. Polyphenols compounds are a structural class of mainly natural, but also synthetic or semisynthetic, organic chemicals characterized by the presence of large multiples of phenol structural units. On the other hand, an antioxidant molecule has been defined as any substance when found in low concentrations compared to that of an oxidizable substrate significantly delays or inhibits the oxidation. Antioxidant compounds can scavenge free radicals and increase shelf life by retarding the process of lipid peroxidation, which is one of the major reasons for deterioration of food, medicine and pharmaceutical products during processing and storage. The major antioxidant compounds are especially phenolics and flavonoids, which are responsible for their health benefits. Carbonic anhydrase (CA, EC 4.2.1.1) is a pH regulatory enzyme in all life kingdoms, being found in organisms all over the phylogenetic tree. It catalyzes the hydration of carbon dioxide (CO$_2$) and water (H$_2$O) to bicarbonate ion (HCO$_3^-$) and the corresponding dehydration of HCO$_3^-$ in acidic medium with regeneration of CO$_2$. CA isoforms are found in a variety of tissues. They participate in several crucial biological processes such as acid-base balance, respiration, CO$_2$ and ion transportation, bone resorption, ureogenesis, gluconeogenesis, lipogenesis and electrolyte secretion. On the other hand, the phenyl moiety of phenol was found to lay in the hydrophobic part of the CA active site, where CO$_2$, the physiologic substrate of the CAs, binds in the precatalytic complex, explaining thus the behavior of phenol as a unique CO$_2$ competitive inhibitor. This presentation consists of two main sections. The first section is devoted to main phenolic antioxidant compounds in the foodstuffs and beverages. The second general section is about some definitions of CA inhibitory effects of the main phenolic compounds used for antioxidant activity. The phenolic compounds and acids had marked especially CA I, and II inhibition effects and might be used as leads for generating CA isoenzyme inhibitors. This class of compounds may lead to isof orm-selective inhibitors targeting just one or few of the medicinally relevant CAs. In addition, there are given some chemical and kinetic basis and technical details related to phenolic antioxidant compounds and CA isoenzymes.

B. Aktaş, R. Topkaya, Gebze Technical University, Turkey
Title: Spin Waves in Ultra-Thin Magnetic Multilayers

Abstract. Spin wave resonance (SWR) has been widely used by researchers to study magnetic materials since the basic theory was introduced first by Kittel, Herring, Amend and Rado [1-3]. The SWR modes can be excited even by a uniform rf field if certain boundary conditions are met. In this study, the fundamental aspects of the collective spin behaviour in magnetic thin films were investigated. A basic dynamic equation of motion was used together with suitable boundary conditions at the surface or interfaces of magnetic thin films or multilayers. Gilberttype damping parameter was assumed in order to simulate the SWR spectra. It has been realized that the theory developed for magnetic multilayered thin films is suitable to apply to also thick (bulk) plate-like samples in limiting case for a large number of layer. The spectra strictly depend on equilibrium direction of dc magnetization. Since the equilibrium direction continuously varies as the external field is swept, it has to be calculated for each value of the external field during the record of the SWR spectra. However, it
is quite a lot of time consuming, that is, the computer speed may not be enough especially for multilayered structures. Therefore, we have developed a new technique and algorithm to speed up this process. It has been shown that the SWR technique is very suitable to study the spin dynamics and extract various relevant magnetic parameters.

Bruno DAUDIN, University Grenoble Alpes, France
Title: GaN Nanowires Grown by Molecular Beam Epitaxy: From Spontaneous Nucleation to Light Emitting Heterostructures

Abstract. Nitride-based light emitting diodes (LEDs) are now widely used for a wide range of applications, including domestic lighting. Present applications are based on the combination of blue LEDs with phosphors in order to produce white light. This is due to the limited efficiency of LEDs in the long wavelength range (green and red). After discussing the limitations of conventional InGaN/GaN LEDs, I will show how nanowire (NW) based LEDs could allow one to extend the present limitations and overcome the present limitations of conventional LEDs. In particular, I will report on the growth, structural and optical characterization of InGaN nanowire (NW) heterostructures grown by molecular beam epitaxy, in view of realizing green and red light emitting diodes (LEDs). As evidenced by a combination of Energy Dispersive X-rays Spectroscopy (EDS) and photoluminescence (PL) data, it will be shown that Indium content can be as large as 60%. The dominant role of carrier localization in InGaN NWs will be discussed in details as well as the potential of NW heterostructures for a new generation of LEDs.

Coşkun Kocabaş, Bilkent University, Turkey
Title: Graphene based optoelectronics from visible to microwave

Abstract. Graphene emerges as a viable material for optoelectronics because of its broad optical response and gate-tunable properties. Atomic thickness together with tunable high mobility charge carriers yields a unique platform for electrical control of light-matter interactions. For practical applications, however, single layer graphene has performance limits due to its small optical absorption defined by fundamental constants. In the first part of the talk will review the recent research on graphene based optoelectronic devices covering a broad spectrum from visible to microwave. In the second part I will summarize our work on application of graphene in adaptive camouflage systems.

Hüseyin Kurt, İstanbul Medeniyet University, Turkey
Title: Heusler Alloys: A Rich Class of Materials

Abstract. Materials with varying electronic and magnetic structures enable new functionalities. For example, a semiconductor can be used to turn on and off electric current, a superconductor enable dissipation-less electric current to flow, and a spin valve device can act as a valve for electric current controlled by external magnetic fields. Heusler alloys are usually ternary alloys that can be engineered to exhibit electronic and magnetic properties spanning a very wide class of materials. By engineering a well ordered face centered cubic structure novel band structures and magnetic properties can be achieved. During this talk I will give a recent overview of novel materials with novel functionalities obtained through judicious selection of elements and crystallizing them in the L21 or C1b Heusler crystal structures.

Sebahattin Tüzemen, Atatürk University, Turkey
Title: Approaching to Gravity?

Abstract. Following the discovery of Higgs Bosons (H) with a mass of around 126 GeV/c2, it is hypothesized in this study that the gauge bosons (theoretically predicted to be gravitons) in the mass
interaction may be produced by H, just as photons are produced in the case of electromagnetic (EM) interaction. Although the hypothesis is extremely difficult to prove experimentally in gravitation mechanism, from the parallel estimation of —quantum efficienciesl of virtual gravitons produced by virtual H annihilation in gravitation and virtual photons produced by virtual electron-positron annihilation in EM interaction, due to Heisenberg’s Uncertainty Principle (HUP), we evaluate that the relative ratio of photon to graviton intensities is in the order of 1036 which is in agreement with the relative strength between EM and gravitational interactions predicted in Quantum Field Theory (QFT).

Niyazi Meriç, Director Ankara University Institute of Nuclear Sciences, Turkey

Title: Education and Training in the Nuclear Field

Abstract. Bearing in mind the long lead times generally required for nuclear education and training, the establishment and preservation of an adequate nuclear workforce supply calls for systematic planning decades ahead. In this respect, contradictory energy policies can have grave effects. A deteriorated global context caused by the persistent financial crisis and the negative sentiments in the wake of the Fukushima accident heighten uncertainties and may exacerbate existing shortcomings. Indeed, shifting or deferred government decisions act as deterrent mechanisms in investment and employment, and have deleterious repercussions on the interest and engagement of younger people in the industry.