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# Part I Conference Schedule

Time: January 13-15, 2018

Location: International Asia-Pacific Convention Center Sanya  
(三亚亚太国际会议中心暨三亚海航度假酒店), China

Date	Time	Lobby		
Jan. 13	14:00-17:00	Registration		
Date	Time	Beijing Room[北京厅]	Macao Room[澳门厅]	Tokyo Room[东京厅]
Jan. 14	08:30-12:00	<b>Material Series: Invited Session I</b>  Chair: TBD  Group photo & Coffee Break: 10:00-10:15	<b>Mathematics Series: Invited Session 1</b>  Chair: TBD  Group photo & Coffee Break: 10:00-10:15	<b>Physics Series: Invited &amp; Oral Session I</b>  Chair: TBD  Group photo & Coffee Break: 10:00-10:15
	12:00-13:30	Lunch <small>[Pacific Cafe (太平洋咖啡厅)]</small>		
Date	Time	Beijing Room[北京厅]	Macao Room[澳门厅]	Tokyo Room[东京厅]
Jan. 14	14:00-18:00	<b>Material Series: Invited Session II</b>  Chair: TBD  Group photo & Coffee Break: 16:00-16:15	<b>Mathematics Series: Invited Session II &amp; Oral Session I</b>  Chair: TBD  Group photo & Coffee Break: 16:00-16:15	<b>Physics Series: Invited &amp; Oral Session II</b>  Chair: TBD  Group photo & Coffee Break: 16:00-16:15
	18:00-19:30	Dinner <small>[Pacific Cafe (太平洋咖啡厅)]</small>		
Date	Time	Beijing Room[北京厅]	Macao Room[澳门厅]	Tokyo Room[东京厅]
Jan. 15	08:30-12:00	<b>Material Series: Oral Session I</b>  Chair: TBD  Group photo & Coffee Break: 10:00-10:15		<b>Material Series: Oral Session II &amp; Poster Session I</b>  Chair: TBD  Group photo & Coffee Break: 10:15-10:30
	12:00-13:30	Lunch <small>[Pacific Cafe (太平洋咖啡厅)]</small>		

## Part II Invited Speeches

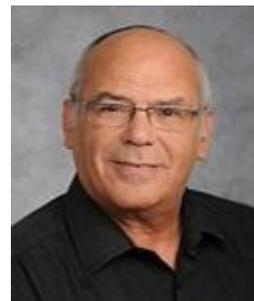
### Material Series: Invited Session I

#### Invited Speech 1: TBD

**Speaker:** Prof. Aharon Gedanken, Bar-Ilan University, Israel

**Time:** 08:30-09:00, Sunday Morning, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building,  
International Asia-Pacific Convention Center Sanya



#### Abstract

#### Invited Speech 2: Fabrication and modification of different nanoparticles by laser irradiation process

**Speaker:** Prof. Alexander Pyatenko, Technion – Israel Institute of Technology, Israel

**Time:** 09:00-09:30, Sunday Morning, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building,  
International Asia-Pacific Convention Center Sanya



#### Abstract

Nanoparticles were the first and remain one of the most important subjects in Nanoscience and Nanotechnology. A variety of different nanoparticles can be produced by different chemical or physical methods and are available now on the market. Each of these methods has their own advantages and disadvantages. During the last decade, laser processing has been used very successfully for production of nanoparticles. In this lecture I will show how, by using the laser technique, we produce nanoparticles of different materials (metals, oxides, semiconductors, carbon and others), different sizes (from several nm to submicron), different shapes and structures. I will briefly explain the main idea used in our original method. I will also observe briefly the modern methods and apparatuses used for nanoparticle characterization.

## Invited Speech 3: Bulk inversion asymmetry effect on band structure and optical properties of cubic CsSnBr<sub>3</sub> perovskite

**Speaker:** Dr. Weijun FAN, Nanyang Technological University, Singapore

**Time:** 09:30-10:00, Sunday Morning, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

Since Miyasaka and co-workers open the door of the hybrid organic-inorganic halide perovskite AMX<sub>3</sub> (where A is an organic cation, M = Pb, Sn, or Ge, and X = I, Br, or Cl), it has attracted increasing attention from the photovoltaic community. More information about this kind of new material has been revealed through the calculation of the complicated densities functional theory (DFT). Here, we report a new simple 8-band k.p method to calculate the band structure and optical properties of cubic CsSnBr<sub>3</sub> perovskite. The bulk inversion asymmetry  $\delta z = \delta x y = 500$  meV is taken into consideration in our model. The band splitting caused by the bulk inversion asymmetry is observed at non-R point.

## Invited Speech 4: Interface Engineering and Force Tuning Electrical Transport Behavior of Nano-devices Based on Atomic Layered MoS<sub>2</sub>

**Speaker:** Prof. Junjie Qi, University of Science & Technology Beijing, China

**Time:** 10:15-10:45, Sunday Morning, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

High-performance piezoelectricity in monolayer semiconducting transition metal dichalcogenides is highly desirable for the development of nanosensors, piezotronics and photopiezotransistors. Here we report the experimental study of the theoretically predicted piezoelectric effect in triangle monolayer MoS<sub>2</sub> devices under isotropic mechanical deformation. The experimental observation indicates that the conductivity of MoS<sub>2</sub> devices can be actively modulated by the piezoelectric charge polarization-induced built-in electric field under strain variation. These polarization charges alter the Schottky barrier height on both contacts, resulting in a barrier height increase with increasing compressive strain and decrease with increasing tensile strain. The underlying mechanism of strain-induced in-plane charge polarization is proposed and discussed using energy band diagrams. In addition, a new type of MoS<sub>2</sub> strain/force sensor built using a monolayer MoS<sub>2</sub> triangle is also demonstrated. Our results provide evidence for strain-gating monolayer MoS<sub>2</sub> piezotronics, a promising avenue for achieving augmented functionalities in next-generation electronic and mechanical– electronic nanodevices.

Developing nanoelectronics that utilize the vertical sub-nanometer thickness of two-dimensional materials is desirable for achieving miniaturization of circuit elements. However, only a few researches have been studied in the vertical transport of atomic layered materials so far. Here, the vertical electrical transport behavior of bilayer MoS<sub>2</sub> under coupling of photons and force is explored by the use of conductive atomic force microscopy. We found that the current-voltage behavior across the tip-MoS<sub>2</sub>-Pt junction is a tunneling current which can be well fitted by a Simmons approximation. Among which, direct tunneling is dominated at low bias voltages whereas Fowler-Nordheim tunneling is happened at high bias voltages. The bias voltages in transition point between direct and Fowler-Nordheim tunneling are matched with the tunneling barrier height of energy band shape difference. Furthermore, the source-drain current dropping surprisingly appears when we continually increase force in which the dropping point is altered by light provided. The potential mechanism is responsible for the tuning in tunneling barrier height and width by force and photons. These results provide a new way to design devices that takes advantage of ultrathin two-dimensional materials. Such ultrashort channel length electronic components that possess tunneling current are important for establishing high-efficiency electronic and optoelectronic systems.

## Invited Speech 5: First-Principles Theoretical Design and Analysis of Graphene Layers for Sensing Application

**Speaker:** Prof. Ting-kai ZHAO, Northwestern Polytechnical University, China

**Time:** 10:45-11:15, Sunday Morning, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

The pursuing aim of high reflection loss and broad frequency bandwidth for electromagnetic wave (EMW) absorbing materials is a long-term task and under a close scrutiny. To construct rational microstructures for the absorber have significant impacts on increasing reflection loss and broadening frequency bandwidth. Herein, we presented a sandwich microstructured expand graphite(EG)/BaFe<sub>12</sub>O<sub>19</sub>(BF) nanocomposite successfully prepared by in-situ sol-gel auto-combustion method. The experimental results showed that EG/BF nanocomposite has better EMW absorbing performance than pure EG and BF, the sandwich microstructured EG/BF connected with carbon nanotubes (CNTs) could further improve the electromagnetic performance effectively. The obtained CNT/EG/BF nanocomposite exhibited a saturation magnetization of 26.5 emu•g<sup>-1</sup> at room temperature and an excellent EMW absorbing performance. The maximum reflection loss of the sandwich microstructured CNT/EG/BF composites with a thickness of 1 mm was up to -45.8 dB and the frequency bandwidth below -10 dB could reach to 4.2 GHz within the frequency range of 2-18 GHz. The research results indicated that the prepared nanocomposite showed great potential as a new type of microwave absorbing material.

## **Invited Speech 6: Isolation and Functionalization of Nanocellulose from Kenaf Core Wood for Environmental Remediation and Sensor Applications**

**Speaker:** Dr. Chin Hua CHIA, The National University of Malaysia, Malaysia

**Time:** 11:15-11:45, Sunday Morning, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

Many research attentions have been focused on the utilization of agricultural lignocellulose biomass to produce value-added products due to its highly abundance, biocompatibility and biodegradability. One of our major research focuses is to extract nanocellulose from lignocellulosic biomass and further used it to produce functionalized materials. Conventional acid hydrolysis method was used to isolate cellulose nanocrystals (CNC) from holocellulose of oil palm empty fruit bunch (EFB) fibres and kenaf core wood. While two different homogenization systems, high speed blender and Silverson mixer, were used to defibrillate holocellulose to produce cellulose nanofibrils (CNF). Silver nanomaterials (nanoparticles, nanoprisms and nanowires) and silver-nanocellulose nanocomposites were produced using various approaches for different applications including Surface-enhanced Raman Scattering (SERS) sensing and catalytic reaction in the decomposition of organic compounds in water.

## **Material Series: Invited Session II**

## **Invited Speech 8: Free and Bound Charge Properties of Nanocrystalline Spinel Ferrite**

**Speaker:** Dr. Manoranjan Kar, Indian Institute of Technology Patna, India

**Time:** 14:00-14:30, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

The modern human society made their need of small size, lightweight, portable, flexible and reliable devices with high battery back up along with fast charging and minimal heat dissipation which could support for long life of the devices. That requires a good dielectric material with understanding of their electrical transport property. Electrical conductivity is basically due to the bound charge carrier and/or free charge carriers. Cobalt ferrite is a hard ferrimagnetic material which exhibits unique properties high Curie temperature, high

coercivity, high magneto-crystalline anisotropy, moderate saturation magnetization, high dielectric permittivity, low eddy current losses, dielectric losses, good mechanical hardness, and chemical stability. These unique properties make it useful for development of microwave and spintronic devices, solar cells, magnetostrictive sensors, drug delivery, transducers, actuators, Li batteries, super capacitors, and memory devices, etc. Because of this unique feature, recently metal ion substitution for  $\text{Fe}^{3+}/\text{Co}^{2+}$  ions in spinel ferrite gaining importance for utilization in high charge storage device as dielectric material in capacitors and battery applications. It is important to note that these materials exhibit both free and bound charges. Hence, its electrical properties became complicated because it depends upon different factors (i.e. method of preparation, crystallite size, substitution element etc.). Hence, it is necessary to understand bound as well as free electron transport of nanocrystalline spinel ferrite for technological applications. It is interesting to note that, there is an important correlation exists between bound charge and free charge properties on nanocrystalline cobalt ferrite. Two transitions takes place in both the temperature depended ac and DC conductivity curve. The transport properties can be understood by employing the different models.

## **Invited Speech 9: Conjugated Polymers for Noble Applications**

**Speaker:** Prof. Aung Ko Ko Kyaw, Southern University of Science and Technology, China

**Time:** 14:30-15:00, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya

### **Abstract**

Conjugated polymers offer unique properties that are not made possible by conventional semiconductors – for example, light-weight, low-cost and flexible. Since the discovery of the first conjugated polymers called polyacetylene,<sup>1</sup> several conjugated polymers have been synthesized and explored the possibilities in various applications. Although the initial intention of conjugated polymers is for plastic metals, they are also applied in many other applications such as solar cells, LEDs, thin film transistors and sensors. In this talk, I will present our recent work in conjugated polymers for noble applications.

First, I will present sterilizable polymer transistor for application in reusable medical devices .<sup>2</sup> Employing a thermally stable semiconducting polymer , which is stable up to 350°C in N<sub>2</sub> and 200°C in air, as a channel layer and in-house designed composite film laminate as moisture barrier, we realize a thermally stable polymer transistor which is able to endure the standard autoclave sterilization for reusable medical devices. In the second part, I will discuss polymer transistor array for electronic skin application.<sup>3</sup> In our electronic skin design, a pressure-sensitive elastomer called Ecoflex is incorporated as a dielectric layer of a polymer transistor. This polymer transistor is able to sense in a low-pressure region (< 10 kPa) with a linear sensitivity and short relaxation time, demonstrating as electronic skin for tactile sensing.

In the last part, I will present about flexible and foldable thermoelectric module that consists of an array of thermoelectric legs made from highly conductive polymer. To make the

thermoelectric modules, first, the conductive polymer film is fabricated on a paper by a transfer method. The conductivity of the polymers film reaches to  $1800 \text{ Scm}^{-1}$  and Seebeck coefficient of  $16 \mu\text{VK}^{-1}$  by using this method. Then, the conductive paper is cut into small rectangular pieces which are used as thermoelectric legs. The legs are glued to another paper and connected in series or parallel by conductive ink to form the thermoelectric module. The module with 400 legs produces the power output of  $1.2 \mu\text{W}$  at no load condition when the temperature of  $10\text{K}$  is applied. This flexible and foldable thermoelectric module can be potentially used in wearable electronics to generate power from human body.

## **Invited Speech 10: Ordered liquid crystal hierarchical superstructures enabled by photoalignment**

**Speaker:** Dr. Wei Hu, Nanjing University, China

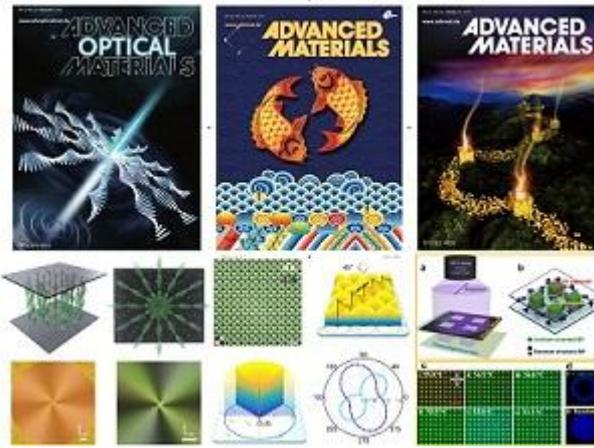
**Time:** 15:00-15:30, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

Mesoscopic hierarchical superstructures bridge the micro and macro worlds, and provide insights for the development of new functional materials. Much effort has been devoted to mimic the hierarchical organization observed in nature, however, the precise realization and rational control of ideal large-area hierarchical superstructures remains challenging. Liquid crystals (LCs) are excellent building blocks due to their extra field controllable self-assembly behavior and resultant physical property. Among them, cholesteric liquid crystal, smectic liquid crystal and blue phase liquid crystal which are featured by periodic helices, ordered lamellar structures and cubically arranged double-twist cylinders have drawn intensive attention. Here, a LC photopatterning technique [1,2] which enables the accurate, arbitrary and reconfigurable azimuthal angle control of LCs is introduced to manipulate the LC hierarchical superstructures. By this means, the in-plane helical axes of cholesteric liquid crystals [3,4], the spacial smectic layer curvature of SmA phase [5] and the crystallographic directions of blue phase [6] are rationally designed and arbitrarily controlled over centimeter scales. The growth of unique fingerprint textures including spiral and wave-like continuous gratings are demonstrated. Such CLC superstructures could also be obtained in semi-free films. The dopant of an azobenzene chiral molecular switch further supplies great flexibility to realize a continuous grating rotation under photo stimuli. Freely tailoring of the geometry and clustering characteristics of focal conic domains of smectic A has been realized, which have great potentials in polarization imaging. Patterned crystallographic orientation of cubic blue phase soft lattice is demonstrated and several advanced reflective photonic applications have been presented. This study broadens the fundamental understanding of self-assembled soft materials and enhances the construction of desired hierarchical superstructures. It will bring new opportunities to the design of novel advanced photonic devices.



**Figure.** Ordered liquid crystal hierarchical superstructures formed by photoaligned cholesteric liquid crystals, smectic liquid crystal and blue phase liquid crystal

## **Invited Speech 11: A challenge to analyze slight change of lattice spacing in a compositionally step-graded SiGe thin film using STEM moiré**

**Speaker:** Dr. Junji Yamanaka, University of Yamanashi, Japan

**Time:** 15:30-16:00, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

In the field of semiconductor devices, it is very important to study lattice strains or lattice-space distributions because they are strongly affected electric properties. Recently very unique new method to analyze lattice strains using STEM moiré has been proposed by Y. Kondo and N. Endon, and by other researchers. In this technique, the moiré between the crystal lattices and the scanning lines controlled by STEM is utilized to show lattice-spacing distribution. Our group also reported our experimental results about STEM moiré observation of Ge/Si. In this study, this new technique is applied to the compositionally step-graded SiGe thin film which is grown onto Si (110) substrate by MBE. The composition step between the each SiGe layers is about 2at%. (From pure Si to Si-22at%Ge.) Image analysis software “sMoiré” produced by HREM Research Inc. is utilized in this study. The results show the potential of this technique that can distinguish a slight difference of the lattice spacing between the SiGe layers.

## Invited Speech 12: Neuromorphic Devices and Computing

**Speaker:** Prof. Yuhui He, Huazhong University of Science & Technology, China

**Time:** 16:15-16:45, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

The spiking neural network (SNN), where the coding scheme is based on the spike timing of neurons, has nowadays attracted tremendous research interests for their potential applications in many fields of artificial intelligence. The development of SNN could be roughly divided into two parts: 1) Hardware: design and fabrication of artificial neurons and synapses; 2) Software: development of SNN algorithms and architectures. In this talk, we are going to show the fabrication of neuromorphic devices and the associated design of spiking neural network. We highlight a hardware/software codesign approach of SNN.

## Invited Speech 13: Structure Optimization to Polymeric Dielectric

### Materials for Advanced Film Capacitors

**Speaker:** Dr. Qi Li, Tsinghua University, China

**Time:** 16:45-17:15, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

Polymeric dielectric materials enable film capacitor technology that is critical in high-power energy storage and pulsed power systems, hybrid electric vehicles, aerospace power conditioning and advanced electromagnetic weapons. Conventional high-temperature polymeric dielectric materials dissipate a large amount of heat as they are involved in continuous operations under high temperature and strong electric field conditions, which, unfortunately, leads to thermal runaway and failure of film capacitors. We propose to tackle the key issues associated with thermal runaway in plastic film capacitors by focusing on the suppression of charge injection from electrodes and thermally activated migration of charge carriers, rather than following the traditional design of high-temperature polymer dielectrics that only concerns the thermal stability of materials. Advanced composite approaches, thin-film deposition technologies, comprehensive characterizations of dielectric and capacitive energy storage properties as well as computational simulations are utilized to cover from structure control to material preparation, to performance assessment and to device modeling. The ultimate goal of this study is to develop novel high-temperature polymer dielectrics that can maintain dielectric stability and energy storage properties under high electric field and high temperature, and effectively suppress the thermal runaway of plastic film capacitors.

## **Invited Speech 14: Photocatalytic removal of environmental pollutants by a new kind of photocatalyst Ti-substituted hydroxyapatite**

**Speaker:** Prof. Jing Shang, Peking University, China

**Time:** 17:15-17:45, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

Ti-substituted hydroxyapatite (TiHAP) is a new and promising photocatalyst with high adsorption capacity and photocatalytic activity. The photocatalytic (PC) and photoelectrocatalytic (PEC) removal of bisphenol A (BPA), hexavalent chromium (Cr(VI)) and carbon dioxide (CO<sub>2</sub>) over TiHAP and fluorine-doped TiHAP (TiFHAP) films were conducted. Field emission scanning electronic microscope (FESEM), UV-Vis spectrophotometry, X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) techniques were used to characterize the morphologies, structure and composition of the samples. Compared to TiO<sub>2</sub>, TiHAP provided enhanced PC and PEC activities towards these three pollutants. The influence factors (such as F doping, relative humidity) and the reaction mechanism were investigated. The result suggested that it was on the surface of TiHAP photoanode where Cr(VI) was mainly reduced. High CO formation rate always accompanied high CH<sub>4</sub> formation selectivity, indicating that deep CO<sub>2</sub> reduction can proceed rapidly over TiFHAP samples. This study supports the idea that TiHAP may be a novel and efficient photocatalyst for the removal of environmental pollutants.

## **Invited Speech 15: Faceted macrosteps in the step droplet zone in non - equilibrium steady states**

**Speaker:** Prof. Noriko Akutsu, Osaka Electro-Communication University, Japan

**Time:** 17:45-18:15, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

Faceted macrosteps are known to degrade grown crystals. SiC, for example, is being considered for use in future power devices. However, faceted macrosteps keep grown crystal from reaching sufficient crystal quality for preparing devices.

To study the dynamics of faceted macrosteps, we proposed a lattice model which keeps faceted macrostep at equilibrium. The lattice model is a restricted solid-on-solid model with a

point-contact-type step-step attraction (p-RSOS model) [1-4]. Here, “restricted” means that the height difference between nearest neighbor site is restricted to  $\{-1, 0, 1\}$ . The origin of the point-contact-type step-step attraction is considered to be the orbital overlap of the dangling bonds at the meeting point of the neighboring steps. The energy gained by forming the bonding state  $\epsilon_{int} (<0)$  is regarded as the attractive energy between steps.

We calculated surface tension of the vicinal surface [1-4] on the p-RSOS model and drew the polar graph of the surface tension (Wulff figure) [3,4]. To obtain reliable results in one dimension, we used the density matrix renormalization group (DMRG) method. The calculated surface tension was discontinuous at low temperatures.

Corresponding to the connectivity of the surface tension calculated by the DMRG method, we obtained the faceting diagram [3]. For the strength of step-step attraction, there are two transition temperatures. One is  $T_{f,1}$ . For the temperatures  $T < T_{f,1}$ , the surface tension of the (111) surface becomes discontinuous. The other is  $T_{f,2}$ . For  $T < T_{f,2} < T_{f,1}$ , the surface tension of the (001) surface becomes discontinuous. The area  $T_{f,2} < T < T_{f,1}$  is the step-droplet zone. Thanks to the anomaly of the surface tension at the (111) surface, the faceted macrosteps whose side surface is the (111) exist stably at equilibrium.

Then, by using the Monte Carlo method, we calculated the driving force  $\Delta\mu$  dependence of the height of the faceted macrostep in the non-equilibrium steady state. Without other kinetic effects such as surface diffusion, volume diffusion, elastic effects, etc., the height of the faceted macrostep decreases as the absolute value of  $\Delta\mu$  increases. For  $\Delta\mu R < |\Delta\mu|$ , the vicinal surface crossover to a rough surface kinetically.

[1] N. Akutsu, “Non-universal equilibrium crystal shape results from sticky steps”, *J. Phys. Condens. Matter*, 23, 485004 (2011); “Sticky steps inhibit step motions near equilibrium”, *Phys. Rev. E* 86, 061604 (2012).

[2] N. Akutsu, “Faceting diagram for sticky steps”, *AIP Advances*, 6, 035301 (2016).

[3] N. Akutsu, (Invited) “Profile of a Faceted Macrostep Caused by Anomalous Surface Tension”, *Adv. Condens. Matter Phys.*, 2017, Article ID 2021510, doi:10.1155/2017/2021510.

[4] N. Akutsu, “Disassembly of Faceted Macrosteps in the Step Droplet Zone in Non-Equilibrium Steady State”, *Crystals*, 7, Article ID cryst7020042, doi:10.3390/cryst7020042.

## **Invited Speech 16: Polymer-grafted particles at the air/water and oil/water interfaces**

**Speaker:** Dr. Emiko Mouri, Kyushu Institute of Technology, Japan

**Time:** 18:15-18:45, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

Interfaces are the places where the specific phenomena can occur occur due to the asymmetrical nature of the interfaces. I have been investigating on the structures of polymer-grafted particle monolayer at soft interfaces, air/water [1-4] and oil/water interfaces[5] to give insight to the polymer chain conformation at the interfaces by introducing sub-micron spherical particles as a maker. I systematically investigated the effects of molecular weight, graft density, core particle, polymer species, and interface a on the polymethacrylate-grafted particle monolayer structure by  $\pi$ -A isotherm measurement, SEM observation and X-ray reflectivity measurement. The occupied areas obtained in  $\pi$ -A isotherms indicates much larger size than those in the solution and suggests that the grafted polymethacrylates chains are fairly extended on a water surfaces. The tendency is commonly observed in three kinds of polymer species. Molecular weight of grafted polymer, not the graft density, and core particle surface characteristics, is the most effective parameter on the particle monolayer structure, which is contributed by the extended polymer chain conformation.

## **Invited Speech 17: Thin films and nanostructures obtained at low temperature for thermal management of opto and microelectronic devices**

**Speaker:** Prof. Abdou Djouadi, Institut des Matériaux-Jean Rouxel

**Time:** 18:45-19:15, Sunday Afternoon, January 14, 2018

**Location:** Beijing Room[北京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

TBD

## Mathematics Series: Invited Session I

### Invited Speech 1: Deep Transfers of p-Class Tower Groups

**Speaker:** Prof. Daniel C. Mayer, Austrian Science Fund, Austria

**Time:** 08:30-09:00, Sunday Morning, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



#### Abstract

Given a prime number  $p$  and an algebraic number field  $F$ , the Galois group  $G$  of the maximal unramified pro- $p$  extension of  $F$  is called the  $p$ -tower group of  $F$ . In a previous paper, we have proved that the abelian type invariants of  $p$ -class groups of unramified abelian extensions with degree  $p$  of  $F$ , and the capitulation of  $p$ -classes of  $F$  in these extensions, which correspond to kernels of shallow transfers from  $G$  to its maximal subgroups of index  $p$  and their abelian quotient invariants, determine a finite batch of candidates for the second derived quotient  $G/G''$  of  $G$ , usually consisting of isoclinic but non-isomorphic  $p$ -groups. In the present lecture, we describe our most recent success in proving that individual members in such a batch of isoclinic  $p$ -groups can be identified by the principalization behavior of  $p$ -classes of unramified abelian  $p$ -extensions of  $F$  with low degree (the prime  $p$ ) in the first Hilbert  $p$ -class field of  $F$ , that is, an unramified abelian  $p$ -extension with high degree (a power of  $p$ ), which corresponds to kernels of deep transfers from maximal subgroups of the  $p$ -tower group  $G$  to its commutator subgroup  $G'$ , according to the Artin reciprocity law.

### Invited Speech 2: Fuzzy posets and some fuzzy functions in groupoids

**Speaker:** Prof. Hee Sik Kim, Hanyang University, Republic of Korea

**Time:** 09:00-09:30, Sunday Morning, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



#### Abstract

In this paper, we reintroduce the class of pogroupoids as another class of groupoids (binary systems) associated with posets having minimal elements in a categorical/functorial fashion. Having done we investigate several of its resulting properties. Finally, we introduce results of an associated fuzzy nature and we also develop a method of fixing many scalar fields as fuzzy fields/spaces using a parameter system described below in a simple manner. Moreover, we discuss and analyze fuzzy structure mappings in posets and pogroupoids, and its extension of fuzzy sets and fuzzy spaces.

## Invited Speech 3: On Hirano inverses in rings

**Speaker:** Dr. Huanyin Chen, Nanjing University

**Time:** 09:30-10:00, Sunday Morning, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

We introduce and study a new class of generalized inverses in rings. An element  $a$  in a ring has Hirano inverse  $b$  if  $a^2 - ab \in N(R)$ ,  $ab = ba$  and  $b = bab$ . This is the dual of Drazin inverses in rings. We prove that an element  $a \in R$  has Hirano inverse if and only if  $a^2$  has strongly Drazin inverse, if and only if  $a - a^3 \in N(R)$ . If  $\frac{1}{2} \in R$ , we prove that  $a \in R$  has Hirano inverse if and only if there exists  $p^3 = p \in \text{comm}^2(a)$  such that  $a - p \in N(R)$ , if and only if there exist two idempotents  $e, f \in \text{comm}^2(a)$  such that  $a + e - f \in N(R)$ . Clines formula and additive results for this generalized inverse are thereby obtained.

## Invited Speech 4: 3-Variable additive functional inequalities and applications

**Speaker:** Prof. Choonkil Park, Hanyang University, Republic of Korea

**Time:** 10:15-10:45, Sunday Morning, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

We introduce and solve 3-variable additive functional inequalities and prove the Hyers-Ulam stability of the 3-variable additive functional inequalities in complex Banach spaces. This is applied to investigate homomorphisms in  $C^*$ -algebras, Lie  $C^*$ -algebras and  $JC^*$ -algebras, and derivations on  $C^*$ -algebras, Lie  $C^*$ -algebras and  $JC^*$ -algebras associated with the 3-variable additive functional inequalities. Moreover, we study homomorphisms in  $C^*$ -ternary algebras and  $C^*$ -triple systems, and derivations  $C^*$ -ternary algebras and  $C^*$ -triple systems associated with the 3-variable additive functional inequalities.

## Invited Speech 5: METHOD OF CLASSIFICATION OF HUMAN FUNCTIONAL STATE AND EVALUATION OF THE LEVEL OF ITS CONSTITUENTS ON THE BASIS OF HYBRID FUZZY MODELS

**Speaker:** Prof. Riad Taha Al-kasasbeh, Al Balqa Applied University, Jordan

**Time:** 10:45-11:15, Sunday Morning, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

The work deals with the issues of the synthesis of combined fuzzy decision rules for classification and evaluation of the level of functional states on two blocks of heterogeneous characteristics: the subjective test questionnaires and indices describing the human attention.

Key words: fuzzy logic, classification, functional state, confidence in decision-making, membership function.

## Invited Speech 6: Asymptotic Gap Probability Distributions of the Gaussian Unitary Ensembles and the Jacobi Unitary Ensembles

**Speaker:** Prof. Yang Chen, University of Macau, China

**Time:** 11:15-11:45, Sunday Morning, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

We address a class of problems in Unitary Ensemble. Specifically, we study the probability that a gap symmetric about 0, i.e.,  $(-a, a)$  is found in the Gaussian Unitary ensembles (GUE) and the Jacobi Unitary ensembles (JUE) (where in the JUE, we take the parameters  $\alpha = \beta$ .) By exploiting the even parity of the weight, a doubling of the interval to  $(a^2, \infty)$  for the GUE, and  $(a^2, 1)$  for the (symmetric) JUE, shows that the gap probabilities may be determined as the product of the smallest eigenvalue distributions the LUE with parameter  $\alpha = -1/2$  and  $\alpha = 1/2$  and the (shifted) JUE with weights  $x^{1/2} (1-x)^\beta$  and  $x^{-1/2} (1-x)^\beta$ .

## Mathematics Series: Invited Session II

### Invited Speech 8: Central Schemes: A Powerful Black-Box Solver for Nonlinear Hyperbolic PDEs

**Speaker:** Prof. Alexander Kurganov, Southern University of Science and Technology, China

**Time:** 14:00-14:30, Sunday Afternoon, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



#### Abstract

The talk will be focused on non-oscillatory central schemes, which are simple, efficient, highly accurate and robust Godunov-type finite-volume methods for general hyperbolic systems of conservation laws. I will first show their derivation and then recent applications.

I will first give a brief description of Godunov-type finite-volume methods for general hyperbolic systems of conservation laws. These methods consist of two types of schemes: upwind and central. My lecture will focus on the second type -- non-oscillatory central schemes.

Godunov-type schemes are projection-evolution methods. In these methods, the solution, at each time step, is interpolated by a (generically discontinuous) piecewise polynomial interpolant, which is then evolved to the next time level using the integral form of conservation laws. Therefore, in order to design an upwind scheme, (generalized) Riemann problems have to be (approximately) solved at each cell interface. This, however, may be hard or even impossible.

The main idea in the derivation of central schemes is to avoid solving Riemann problems by averaging over the wave fans generated at cell interfaces. This strategy leads to a family of universal numerical methods that can be applied as a black-box solver to a wide variety of hyperbolic PDEs and related problems. At the same time, central schemes suffer from (relatively) high numerical viscosity, which can be reduced by incorporating of some upwinding information into the scheme derivation -- this leads to central-upwind schemes, which will be presented in the lecture.

### Invited Speech 9: Cloud Strategy Computations in Internet of Things with BigData-Blockchain and Artificial Intelligence

**Speaker:** Prof. Wanyang Dai, Nanjing University, China

**Time:** 14:30-15:00, Sunday Afternoon, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



#### Abstract

We study the strategy computations in Generalized Internet of Things with multiple cloud centers and Blockchain in handling smart and complex resource allocations. These systems include FinTech, communication, power and energy systems with Big Data and strict security requirements as special cases. The artificial intelligence (AI) aided policies are aimed at providing efficient admission control, capacity scheduling, network routing, switching, and portfolio selection. Blockchain is proposed to satisfy the system security requirements. Comparing with the well-known zero-sum game based AlphaGo and AlphaGo Zero random decision processes, our dynamical policies are non-zero-sum game based ones, which reflect the trend of the fast developing shared economy and cooperative systems. In addition, our policies have the advantage to select multiple decision points in a single step to meet the requirements for a game with multiple players. Randomly-evolving Pareto-optimal Nash equilibrium policies are derived and simulation examples are presented to show the effectiveness of our AI based “win-win” resource control decisions.

## Invited Speech 10: TBD

**Speaker:** Dr. Elham Hashemizadeh, Karaj Azad University, Iran

**Time:** 15:00-15:30, Sunday Afternoon, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

TBD

## Invited Speech 11: TBD

**Speaker:** Dr. Shiqing Zhang, Sichuan University, China

**Time:** 15:30-16:00, Sunday Afternoon, January 14, 2018

**Location:** Macao Room[澳门厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya

### Abstract

TBD

## Physics Series: Invited Session I

### Invited Speech 1: Photons as signature for dark matter and dark energy: The Cast experiment at CERN

**Speaker:** Prof. Dieter HH Hoffmann, Xi'An Jiaotong University, China; Technical University of Darmstadt, Germany

**Time:** 08:30-09:10, Sunday Morning, January 14, 2018

**Location:** Tokyo Room[东京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



#### Abstract

The CAST experiment is designed to search for solar axions which are produced in the dense plasma the interior of the sun via the Primakoff effect. Detection of axions and their energy spectrum will immediately reveal the temperature of the core plasma. The central part of the experiment, the helioscope is an LHC prototype magnet that has attached different types of sensitive detectors for x-rays in the regime of 1-10 keV. The experiment has been taking data since 2003 and provided the most restrictive limits on the axion-photon coupling in a broad mass range. Beyond  $0.02 \text{ eV}/c^2$  the mass the sensitivity is degraded due to coherence loss. In order to restore coherence, the magnet was filled with a buffer gas providing an effective mass to the photon. By changing the pressure of the buffer gas in steps, CAST did scan the range of axion mass values from 0.02 eV to 1.18 eV. CAST has set the strongest limit yet on Axion-photon coupling across a wide range of Axion masses (i.e., any rest mass below 1.18 eV), surpassing astrophysical limits for the first time.

An overview of the total data set and data analysis will be presented.

The significant upgrades of CAST in 2014 allows first experiments to shed some light into the dark energy sector by searching for axions with its better performance due to a 2nd XRT, while continuing the search for solar chameleons in the sub-keV range. Gravitational lensing may enhance the sensitivity by many orders of magnitude. At this point the equation of state of Jupiter and other planets play a significant role. Proposals for the future include an International Axion Observatory (IAXO) as a 4th generation Axion Helioscope.

## Physics Series: Invited Session II

### Invited Speech 1: Vibration Suppression by Means of Elastic-Viscoelastic-Elastic Composite Structures

**Speaker:** Prof. Fulei Chu, Tsinghua University, China

**Time:** 14:00-14:40, Sunday Afternoon, January 14, 2018

**Location:** Tokyo Room[东京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



#### Abstract

Elastic-viscoelastic-elastic composite (EVEC) structure is an efficient vibration suppression technology which can be applied to a variety of environments. The method to determine the parameters of the Biot constitutive model of the viscoelastic material, to incorporate the model into EVEC finite element dynamic equations and to reduce the dimension of the equations, is investigated. The conventional nonlinear curve fitting problem is transformed into the nonlinear optimization problem with constraints in complex frequency domain. The Biot model is integrated into the finite element dynamic equations of the EVEC structures by introducing the auxiliary coordinate after a series of mathematical transformations, and then the modal parameters can be solved directly. The traditional iterative can be avoided, and the calculation process is greatly simplified. The finite element shear, compressional and combination models of the EVEC beam structure are established based on different energy consumption patterns. The convergence of the corresponding finite elements is investigated. The linear and nonlinear vibration characteristics of the EVEC beam structure are studied for different boundary conditions and structural parameters. Numerical simulation results show the scope of application of the three finite element models, and the damping mechanism of the EVEC beam structure are revealed as well. The EVEC beam / plate structures are studied experimentally. The storage modulus and loss factor of the ZN-1 type viscoelastic material are measured for nonlinear curve fitting to determine the parameters of the Biot model. Thirty EVEC beams with different thicknesses are tested to obtain the natural frequencies and loss factors. The experimental results provide validation for the finite element shear, compressional and combination models of the EVEC beam structures. The scopes of application of the three models are determined from the quantization.

## Invited Speech 2: Meshless parametric modeling of vibroacousticsystems

**Speaker:** Prof. Wenlong Li, Advanced Information Services, China

**Time:** 14:40-15:20, Sunday Afternoon, January 14, 2018

**Location:** Tokyo Room[东京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

A general modeling method, the so-called Spectro-Geometric Method (SGM), is discussed for the vibroacoustical analysis of complex systems which are composed of a number of familiar constituent components in the forms of beams, plates, shells, acoustic spaces, etc. The coupling conditions between any two components are generally described in terms of continuous, partial or discrete joints with arbitrary characteristic parameters, thus allowing adequately modeling most coupling mechanisms encountered in industrial applications. The solution variable(s) on each component plate are analytically expressed as accelerated Fourier series expansions and the expansion coefficients are considered as the generalized coordinates to be determined using the Rayleigh-Ritz technique. The SGM model is essentially a parametric and meshless (or grid-free) modeling of complex vibroacoustic systems, and is more suitable for sensitivity studies and design optimization. Of equal importance, it can be easily used to obtain the results of statistical significance through properly taking into account model uncertainties and engineering and manufacturing errors. This method does not involve any artificial assumptions or intermediate/derived variables. The accuracy and reliability of the present model are demonstrated through numerical examples.

## Invited Speech 3: Photoacoustic Spectroscopic Application for the Properties of Solids

**Speaker:** Prof. Bimal Kumar Sarkar, Galgotias University, India

**Time:** 15:20-16:00, Sunday Afternoon, January 14, 2018

**Location:** Tokyo Room[东京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### Abstract

Photoacoustic spectroscopic (PAS) technique can be used for investigating the properties of solids. In this technique, one has to detect the photoacoustic signal produced when a sample placed in a cell is irradiated by an intensity modulated beam of light. The amplitude and phase of the photoacoustic (PA) signal depends on the thermal and optical properties of the sample. Hence the wealth of information contained in the PA signal can be used to investigate the properties of solids. The absorption of light is essential for the generation of the PA signal, light that is transmitted or elastically scattered by the sample does not interfere with the inherently absorptive PA measurements. This enables one to work with

essentially transparent media or highly light scattering materials such as powders, amorphous solids, gels and colloids. In this work we have emphasized over the theoretical, experimental issues on the application of photacoustic spectroscopy for the investigation of the properties of solids.

## **Invited Speech 4: TBD**

**Speaker:** Dr. Anupam Khanna, D. A. V. College Sadhaura, India

**Time:** 16:15-16:55, Sunday Afternoon, January 14, 2018

**Location:** Tokyo Room[东京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya

### **Abstract**

TBD

## **Invited Speech 5: Ceramic nanoparticle synthesis at lower temperatures for LTCC and MMIC technology**

**Speaker:** Dr. Madhuri Wuppulluri, VIT University, India

**Time:** 16:55-17:35, Sunday Afternoon, January 14, 2018

**Location:** Tokyo Room[东京厅], 3<sup>rd</sup> Floor, Conference Building, International Asia-Pacific Convention Center Sanya



### **Abstract**

$\text{Ni}_{1-x}\text{Mg}_x\text{Fe}_2\text{O}_4$  ( $x = 0.2$  to  $0.8$ ) nano particles are prepared by hydrothermal synthesis followed by microwave processing. Effect of microwave processing in reducing the required heat treatment are discussed. The samples are characterized by powder X-ray diffraction, field emission scanning electron microscopy, transmission electron microscopy, vibrating sample magnetometer and LCR bridge. Microwave processing has enhanced the chemical reaction to form ferrite without any stray ferric oxide phases. Microscopic images have confirmed that the particles still retain nano scale after microwave processing. An appreciably high magnetic moment is noticed. The experimental magnetic moment is used to estimate the cation distribution in tetrahedral and octahedral sites. Temperature and frequency dependence of initial permeability is discussed in the light of magnetic spin canting.

## Part III Technical Sessions

### Material Series: Invited Session 1

Session Chair: TBD

Beijing Room[北京厅], 3<sup>rd</sup> Floor

08:30-12:00, Sunday Morning, January 14, 2018

ID	Paper Title	Author	Affiliation
<b>Invited</b> <b>08:30-09:00</b>	TBD	Prof. Aharon Gedanken	Bar-Ilan University, Israel
<b>Invited</b> <b>09:00-09:30</b>	Fabrication and modification of different nanoparticles by laser irradiation process	Prof. Alexander Pyatenko	National Institute of Advanced Industrial Science and Technology (AIST), Japan
<b>Invited</b> <b>09:30-10:00</b>	Bulk inversion asymmetry effect on band structure and optical properties of cubic CsSnBr <sub>3</sub> perovskite	Dr. Weijun FAN	Nanyang Technological University, Singapore
<b>10:00-10:15</b>	<b>Coffee Break</b>		
<b>Invited</b> <b>10:15-10:45</b>	Interface Engineering and Force Tuning Electrical Transport Behavior of Nano-devices Based on Atomic Layered MoS <sub>2</sub>	Prof. Junjie Qi	University of Science & Technology Beijing, China
<b>Invited</b> <b>10:45-11:15</b>	Synthesis of sandwich microstructured expanded graphite/barium ferrite connected with carbon nanotube composite and its electromagnetic wave absorbing properties	Prof. Ting-kai ZHAO	Northwestern Polytechnical University
<b>Invited</b> <b>11:15-11:45</b>	Isolation and Functionalization of Nanocellulose from Kenaf Core Wood for Environmental Remediation and Sensor Applications	Dr. Chin Hua CHIA	The National University of Malaysia, Malaysia
<b>Oral</b> <b>11:45-12:00</b>	Surface Roughness of SiGe/Si (110) Formed by Stress-Induced Twins and the Solution to Produce Smooth Surface	Junji Yamanaka	University of Yamanashi

## Material Series: Invited Session II

Session Chair: TBD

Beijing Room[北京厅], 3<sup>rd</sup> Floor

14:00-18:00, Sunday Afternoon, January 14, 2018

<b>ID</b>	<b>Paper Title</b>	<b>Author</b>	<b>Affiliation</b>
<b>Invited 14:00-14:30</b>	Free and Bound Charge Properties of Nanocrystalline Spinel Ferrite	Dr. Manoranjan Kar	Indian Institute of Technology Patna, India
<b>Invited 14:30-15:00</b>	Conjugated Polymers for Noble Applications	Aung Ko Ko Kyaw	Southern University of Science and Technology
<b>Invited 15:00-15:30</b>	Ordered liquid crystal hierarchical superstructures enabled by photoalignment	Dr. Wei Hu	Nanjing University, China
<b>Invited 15:30-16:00</b>	A challenge to analyze slight change of lattice spacing in a compositionally step-graded SiGe thin film using STEM moiré	Dr. Junji Yamanaka	University of Yamanashi, Japan
<b>16:00-16:15</b>	<b>Coffee Break</b>		
<b>Invited 16:15-16:45</b>	Neuromorphic Devices and Computing	Prof. Yuhui He	Huazhong University of Science & Technology, China
<b>Invited 16:45-17:15</b>	Structure Optimization to Polymeric Dielectric Materials for Advanced Film Capacitors	Dr. Qi Li	Tsinghua University, China
<b>Invited 17:15-17:45</b>	Photocatalytic removal of environmental pollutants by a new kind of photocatalyst Ti-substituted hydroxyapatite	Prof. Jing Shang	Peking University, China
<b>Invited 17:45-18:15</b>	Polymer-grafted particles at the air/water and oil/water interfaces	Dr. Emiko Mouri	Kyushu Institute of Technology, Japan
<b>Invited 18:15-18:45</b>	Faceted macrosteps in the step droplet zone in non - equilibrium steady states	Prof. Noriko Akutsu	Osaka Electro-Communication University
<b>Invited 18:45-19:15</b>	Thin films and nanostructures obtained at low temperature for thermal management of opto and microelectronic devices	Prof. Abdou Djouadi	Institut des Matériaux-Jean Rouxel

## Material Series: Oral Session I

Session Chair: TBD

Beijing Room[北京厅], 3<sup>rd</sup> Floor

08:30-12:00, Monday Morning, January 15, 2018

ID	Paper Title	Author	Affiliation
<b>1-1</b> <b>Oral</b>	Whispering gallery mode laser from carbon dots-NaCl hybrid crystals	Hongzhen Liu	Chinese Academy of Sciences
<b>1-2</b> <b>Oral</b>	Self-powered microfluidic sensors based on piezoelectric energy harvesting of PVDF nanofibers	Zhao Wang	Hubei University
<b>1-3</b> <b>Oral</b>	Photodegradation and Aggregation Prevention of Natural Melanin Nanoparticles by Silica Coating Method	Yujia Liang	Institute of Frontier Material, Deakin University
<b>1-4</b> <b>Oral</b>	Preparation and characterization of flame retardant PC/ABS/ montmorillonite nanocomposites	Shyh-shin Hwang	Chien-hsin University of Science and Technology
<b>1-5</b> <b>Oral</b>	Dual enhanced MRI of tumor vascular endothelial cells based on targeting peptide-conjugated manganese ferrite nanomicelles	Zou Liguang	Xinqiao Hospital
<b>1-6</b> <b>Oral</b>	Static and dynamic properties of magnetite nanoparticles grown in glass matrices	Viorel Sandu	National Institute of Materials Physics
<b>1-7</b> <b>Oral</b>	Fast photo conductive responses in organometal halide perovskite photodetectors	Jingjing Mei	Chinese Academy of Sciences
<b>10:00-10:15 Coffee Break</b>			
<b>1-8</b> <b>Oral</b>	NaGdF <sub>4</sub> :Tb <sup>3+</sup> -RB based X-ray induced photodynamic nano-therapeutics for deep cancer treatment	zhang xiaofeng	qq 281798189
<b>1-9</b> <b>Oral</b>	Simple dehydration enables the formation of paper-based flexible microfluidic channels	Jinho Hyun	Seoul National University
<b>1-10</b> <b>Oral</b>	Synthesis of Silver Nanoprisms using Nanocellulose as Template	Siew-Xian CHIN	National University of Malaysia
<b>1-11</b> <b>Oral</b>	STRUCTURE-PROPERTY RELATIONSHIPS IN HDPE FOR PRESSURE PIPES	Riyadh AlHomoud	Saudi Arabia

<b>1-12 Oral</b>	Interfacial and electrical properties improvement in 4H-SiC MOS capacitor by implementing lanthanum silicate passivation interlayer	Qian Wang	Chinese Academy of Sciences
<b>1-13 Oral</b>	Insights into the oxidation of Ag (111) supported $\chi^3$ Borophene	Gang Liu	Beijing University of Technology
<b>1-14 Oral</b>	A novel approach to predicting surface properties generated during metal forming processes.	Sergey Alexandrov	Beihang University
<b>1-15 Poster</b>	Mechanical properties and biocompatibility of porous Ti-10Zr biomaterials produced by space holder method	KEEDO WOO	Chonbuk National University
<b>1-16 Poster</b>	Formation of Poly-Si films on glass substrates by using microwave plasma heating and fabrication of TFT's on the films	Hiroki Nakaie	University of Yamanashi
<b>1-17 Poster</b>	Formation of Al <sub>2</sub> O <sub>3</sub> coatings on magnesium alloys based on megnetron sputtering and micro arc oxidation	Xiaobo Wang	China Academy of Engineering Physics
<b>1-18 Poster</b>	Effect of (NaPO <sub>3</sub> ) <sub>6</sub> on Micro-arc Oxidation Process and Coating Structure on Magnesium Alloy	Jingjing Ding	China Academy Of Engineering Physics

## Material Series: Oral Session II & Poster Session I

Session Chair: TBD

Beijing Room[北京厅], 3<sup>rd</sup> Floor

08:30-12:00, Monday Morning, January 15, 2018

<b>ID</b>	<b>Paper Title</b>	<b>Author</b>	<b>Affiliation</b>
<b>2-1 Oral</b>	Uranium corrosion problem and a promising protection method	Yidong Jiang	China Academy Of Engineering Physics
<b>2-2 Oral</b>	Hollow Doughnut Shape Mesoporous Silica Nanoparticles for Reduction of the Thermal Expansion Coefficient of Poly(ether sulfone) Films	Nhat Tri Vo	Sungkyunkwan University
<b>2-3 Oral</b>	Organic Field-Effect Transistor Nonvolatile Memory	Xu Gao	Soochow University, China

<b>2-4 Oral</b>	Experimental study of electrodeposition of erbium thin film from mine wastewater	Sunjung Kim	University of Ulsan
<b>2-5 Oral</b>	Electrodeposition of metal thin films on atomic-layer-deposited diffusion barrier layers and its electrochemical impedance spectroscopy	Hongmin Youn	University of Ulsan
<b>2-6 Oral</b>	Electrochemical synthesis of alloy anode material and its thin film growth characteristic analysis	Geonheum Yeon	University of Ulsan
<b>2-7 Oral</b>	Effect of Multiple Factors on the Micro-leakage Test of Constic Self-adhering Flowable Resin	Zhiyong Zhang	The 2nd hospital of HEBEI medical university
<b>2-8 Oral</b>	Thermal, Mechanical and Rheological Properties of Low Density / Linear Low Density Polyethylene Blend for Packing Application	Meshal alsamhan	KISR
<b>10:15-10:30</b>	Coffee Break		
<b>Poster Session I</b>			
<b>1-1 Poster</b>	Mechanical properties and biocompatibility of porous Ti-10Zr biomaterials produced by space holder method	KEEDO WOO	Chonbuk National University
<b>1-2 Poster</b>	Formation of Poly-Si films on glass substrates by using microwave plasma heating and fabrication of TFT's on the films	Hiroki Nakaie	University of Yamanashi
<b>1-3 Poster</b>	Formation of Al <sub>2</sub> O <sub>3</sub> coatings on magnesium alloys based on megnetron sputtering and micro arc oxidation	Xiaobo Wang	China Academy of Engineering Physics
<b>1-4 Poster</b>	Effect of (NaPO <sub>3</sub> ) <sub>6</sub> on Micro-arc Oxidation Process and Coating Structure on Magnesium Alloy	Jingjing Ding	China Academy Of Engineering Physics

## Mathematics Series: Invited Session I

Session Chair: TBD

Macao Room[澳门厅], 3<sup>rd</sup> Floor

08:30-12:00, Sunday Morning, January 14, 2018

<b>ID</b>	<b>Paper Title</b>	<b>Author</b>	<b>Affiliation</b>
<b>Invited 08:30-09:00</b>	Deep Transfers of p-Class Tower Groups	Prof. Daniel C. Mayer	Austrian Science Fund, Austria
<b>Invited 09:00-09:30</b>	Fuzzy posets and some fuzzy functions in groupoids	Prof. Hee Sik Kim	Hanyang University, Republic of Korea
<b>Invited 09:30-10:00</b>	On Hirano inverses in rings	Dr. Huanyin Chen	Nanjing University
<b>10:00-10:15</b>	<b>Coffee Break</b>		
<b>Invited 10:15-10:45</b>	3-Variable additive functional inequalities and applications	Prof. Choonkil Park	Hanyang University, Republic of Korea
<b>Invited 10:45-11:15</b>	METHOD OF CLASSIFICATION OF HUMAN FUNCTIONAL STATE AND EVALUATION OF THE LEVEL OF ITS CONSTITUENTS ON THE BASIS OF HYBRID FUZZY MODELS	Prof. Riad Taha Al-kasasbeh	Al Balqa Applied University, Jordan
<b>Invited 11:15-11:45</b>	Asymptotic Gap Probability Distributions of the Gaussian Unitary Ensembles and the Jacobi Unitary Ensembles	Prof. Yang Chen	University of Macau, China

## Mathematics Series: Invited Session II & Oral Session I

Session Chair: TBD

Macao Room[澳门厅], 3<sup>rd</sup> Floor

14:00-18:00, Sunday Afternoon, January 14, 2018

<b>ID</b>	<b>Paper Title</b>	<b>Author</b>	<b>Affiliation</b>
<b>Invited 14:00-14:30</b>	Central Schemes: A Powerful Black-Box Solver for Nonlinear Hyperbolic PDEs	Prof. Alexander Kurganov	Southern University of Science and Technology, China
<b>Invited 14:30-15:00</b>	Cloud Strategy Computations in Internet of Things with BigData-Blockchain and Artificial Intelligence	Prof. Wanyang Dai	Nanjing University, China

<b>Invited</b> <b>15:00-15:30</b>	TBD	Dr. Elham Hashemizadeh	Karaj Azad University, Iran
<b>Invited</b> <b>15:30-16:00</b>	TBD	Dr. Shiqing Zhang	Sichuan University, China
<b>16:00-16:15</b>	<b>Coffee Break</b>		
<b>1-1</b> <b>Oral</b>	Holder Regularity for Abstract Fractional Cauchy Problems With order in $(0,1)$	Chenyu Li	SiChuan University
<b>1-2</b> <b>Oral</b>	Fractional difference approximations for time-fractional telegraph equation	Ru Liu	College of Information Science and Engineering, Chengdu University
<b>1-3</b> <b>Oral</b>	Examples of New nonstandard hulls of topological vector spaces	Adel Khalfallah	King Fahd University of petroleum and Minerals
<b>1-4</b> <b>Oral</b>	The commutativity of Ring with homoderivation	Najat Mathni	King Abdulaziz University
<b>1-5</b> <b>Oral</b>	Morphological Group Theory of Material Structure	Zi Qiang ZHOU	Shanghai University
<b>1-6</b> <b>Oral</b>	ALMOST SEMIPRIME AND QUASI SEMIPRIME IDEALS OF COMMUTATIVE RINGS	Rashid ABU-DAWWAS	Yarmouk University
<b>1-7</b> <b>Oral</b>	Invertible Graded Rings	Mohammad Al-Dolat	Jordan University of Science and Tecnology
<b>1-8</b> <b>Oral</b>	Research on Initialization on EM Algorithm Based on Gaussian Mixture Model	Yiyan Chen	UK Systems Science Association
<b>1-9</b> <b>Oral</b>	Local times for spectrally negative Levy processes	Xiaowen Zhou	Concordia University and Changsha University of Science and Technology
<b>1-10</b> <b>Oral</b>	Improvement of an Anonymous and Lightweight Authentication Scheme for TMIS	Chien-Ming Chen	Harbin Institute of Technology Shenzhen Graduate School
<b>1-11</b> <b>Oral</b>	Forecasting container throughput based on wavelet transforms within a novel decomposition ensemble methodology	Gang Xie	Academy of Mathematics and Systems Science, Chinese Academy of Sciences
<b>1-12</b> <b>Oral</b>	Iterative solution of mesh constrained optimal control problems with two-level mesh approximations of parabolic state equation	Erkki Laitinen	University of Oulu

# Physics Series: Invited & Oral Session I

Session Chair: TBD

Tokyo Room[东京厅], 3<sup>rd</sup> Floor

08:30-12:00, Sunday Morning, January 14, 2018

ID	Paper Title	Author	Affiliation
<b>Invited</b> <b>08:00-09:10</b>	Photons as signature for dark matter and dark energy: The Cast experiment at CERN	Prof. Dieter HH Hoffmann	Xi'An Jiaotong University, China; Technical University of Darmstadt, Germany
<b>1-1</b> <b>Oral</b>	Research on Nature of Dark Matter - Dark Matter Particle is Zhongjizi	Li wei Wang	Zhaoyuan County Teachers Training School
<b>1-2</b> <b>Oral</b>	Analytical criteria of Hill stability in the elliptic restricted four body problem	Chao Liu	Tsinghua University
<b>1-3</b> <b>Oral</b>	Stationkeeping Control of Electric-Propulsion Spacecraft on Libration Point Orbits	Yinan Ding	China Academy of Space Technology
<b>1-4</b> <b>Oral</b>	YORP Effect on the Evolution of Asteroid Spin State	Xiaoran Yan	Tsinghua University
<b>10:00-10:15</b>	<b>Coffee Break</b>		
<b>1-5</b> <b>Oral</b>	Operation of Laser-driven Sails in Extremely Low Earth Orbit	Shahin Firuzi	Tsinghua University
<b>1-6</b> <b>Oral</b>	Minimum-Time Trajectory Design of Multiple Asteroid Exploration Missions Using Solar Sail	Yu Song	Tsinghua University
<b>1-7</b> <b>Oral</b>	Equilibria and Stability of retrograde coorbital resonance in the three-body problem	Miao Li	Tsinghua University
<b>1-8</b> <b>Oral</b>	Deep learning of collision probability of spacecraft close formation	Wei Jiang	School of Aerospace Engineering, Tsinghua University, Beijing, China
<b>1-9</b> <b>Oral</b>	Entropy of Born-Infeld-de Sitter black hole	Jinbo Fan	Beijing University of Technology
<b>1-10</b> <b>Oral</b>	Large-Scale Modeling of Parametric Asteroid Surfaces Using Polynomial Series	Shuai Wang	Beihang University
<b>1-11</b> <b>Oral</b>	Tackling tangledness of cosmic strings by knot polynomial topological invariants	Xinfei Li	Beijing University of Technology

<b>1-12 Oral</b>	Chances for laboratory planetary science using heavy ion beams at HIRFL and HIAF	Yongtao Zhao	Xi'an Jiaotong University & Institute of Modern physics, CAS
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## Physics Series: Invited & Oral Session II

Session Chair: TBD

Tokyo Room[东京厅], 3<sup>rd</sup> Floor

14:00-18:00, Sunday Afternoon, January 14, 2018

<b>ID</b>	<b>Paper Title</b>	<b>Author</b>	<b>Affiliation</b>
<b>Invited 14:00-14:40</b>	Vibration Suppression by Means of Elastic-Viscoelastic-Elastic Composite Structures	Prof. Fulei Chu	Tsinghua University, China
<b>Invited 14:40-15:20</b>	Meshless parametric modeling of vibroacousticsystems	Prof. Wenlong Li	Advanced Information Services, China
<b>Invited 15:20-16:00</b>	Photoacoustic Spectroscopic Application for the Properties of Solids	Prof. Bimal Kumar Sarkar	Galgotias University, India
<b>16:00-16:15</b>	<b>Coffee Break</b>		
<b>Invited 16:15-16:55</b>	TBD	Dr. Anupam Khanna	D. A. V. College Sadhaura, India
<b>Invited 16:55-17:35</b>	Ceramic nanoparticle synthesis at lower temperatures for LTCC and MMIC technology	Dr. Madhuri Wuppulluri	VIT University, India
<b>1-1 Oral</b>	Study on Acoustically Transparent Test Section of Aeroacoustic Wind Tunnel	Jinlei Lv	China Aerodynamics research and Development Center
<b>1-2 Oral</b>	Desnoise method for Microseismic signals by using EMD and S transform	Jing Zheng	China University of Mining & Technology, Beijing
<b>1-3 Oral</b>	Application of Microperforated-panel Absorber in Communication Products	Wenfang Yu	ZTE Corporation
<b>1-4 Oral</b>	Computation of BPF Pressure Pulsations in a Screw-Centrifugal Pump	Timushev Sergey	Moscow Aviation Institute (National Research University)
<b>1-5 Oral</b>	The acoustic structure coupling characteristic of a piezoelectric micro-jet for 3D printing	Kai Li	Harbin institute of technology

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<b>1-6 Oral</b>	Dual-band infrared plasmonic metamaterial absorber for ultrasensitive refractive index sensing applications	Yongzhi Cheng	Wuhan University of Science and Technology
<b>1-7 Oral</b>	Numerical research on the micro-structure of a triple-layer-coated microdisk resonator	Wang Mengyu	University of Science and Technology of China
<b>1-8 Oral</b>	Dynamic electromagnetically induced transparency in a robust nanostructure quasi-cylindrical microcavity system	Xueying Jin	University of Science and Technology of China

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## Part IV Abstracts

### Material Series: Oral Session I

**ID:** CN2018\_10001

**Title:** Whispering gallery mode laser from carbon dots-NaCl hybrid crystals

**Name:** Hongzhen Liu

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#### Abstract

Carbon dots (CDs)-NaCl hybrid crystals are obtained by incorporating the CDs into NaCl matrix through a simple process. The embedded CDs have added the luminescence centers into NaCl, as the result, the hybrid crystals present the fluorescence centered at 510 nm under the illumination of 365 nm light. Meanwhile, the phosphorescence with an average lifetime of 314 milliseconds (ms) is achieved after the 365nm light was turned off. Furthermore, optical gain and lasing phenomenon has been observed from hybrid crystals. When the pump power is low, a weak spontaneous emission can be observed from the hybrid crystal, while the lasing action was observed under high pump power. The lasing threshold is found to be 0.08 mW and corresponding Q factor is calculated to be 447. The tiny cubic crystal in hybrid crystals offers the whispering gallery mode (WGM) resonant cavity for lasing emission. That has provided a new approach for realizing lasing materials.

**ID:** CN2018\_10003

**Title:** Self-powered microfluidic sensors based on piezoelectric energy harvesting of PVDF nanofibers

**Name:** Zhao Wang

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#### Abstract

The rapid development of micro-scaled piezoelectric energy harvesters has provided a simple and highly efficient way for building self-powered sensor systems through harvesting the mechanical energy from the ambient environment. In this work, a self-powered microfluidic sensor that can harvest the mechanical energy of the fluid and simultaneously monitor their characteristics was fabricated by integrating the flexible piezoelectric poly(vinylidene fluoride) (PVDF) nanofibers with the well-designed microfluidic chips. Those devices could generate open-circuit high output voltage up to 1.8 V when a droplet of water is flowing past the suspended PVDF nanofibers and result in their periodical deformations. The impulsive output voltage signal allowed them to be utilized for droplets or bubbles counting in the microfluidic systems. Furthermore, the devices also exhibited self-powered sensing behavior due to the decreased voltage amplitude with increasing input pressure and liquid viscosity.

**ID:** CN2018\_10007

**Title:** Photodegradation and Aggregation Prevention of Natural Melanin Nanoparticles by Silica Coating Method

**Name:** Yujia Liang

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#### Abstract

Melanin, the main photoreceptor in living organisms, is largely abundant in pigmented hair tissues. Its promising properties have been widely studied in order to fully explore the corresponding applications. However, the photodegrading and aggregating natures of melanin, to some extent,

restrict the development of this eco-friendly bio-material. This study is conducted to overcome both disadvantages by a mature method that coating the original melanin nanoparticles with silica as shells. The results revealed that the aggregation of the melanin/silica nanoparticles (MSNPs) was de-creased obviously by a 5 h coating and appeared a uniformly mono-dispersed solution. The MSNP that coated for 20 h provided an efficient protection on the photo-degradation of the melanin with a 50% maintenance of the melanin content compared with 16% of original melanin and 2% of MSNP-5h.

**ID:** CN2018\_10008

**Title:** Preparation and characterization of flame retardant PC/ABS/ montmorillonite nanocomposites

**Name:** Shyh-shin Hwang

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#### **Abstract**

Blends of polycarbonate (PC) and Acrylonitrile-butadiene-styrene (ABS) have a wide range of applications in various industries, such as automotive, machinery, electronics, and communication. In this study, PC/ABS extensively used in electronics and electrical equipment were used as the matrix to prepare composite materials. Environmentally-friendly inorganic flame retardants (magnesium hydroxide (MH)) and a halogen-free phosphorus flame retardant additive (bisphenol A bis(diphenylphosphate)(BDP)) were added to PC/ABS. Layered silicate (montmorillonite (MMT)) was added to make nanocomposites. We used a high temperature type banbury mixer to prepare PC/ABS/MH/BDP/OMMT nanocomposites, which were characterized by various analytical techniques. The XRD results showed expansion in the distance between layers of MMT from 1.28 to 1.8 nm. The five types of prepared PC/ABS nanocomposites did not reveal characteristic peaks of MMT between  $3^\circ$  and  $6^\circ$  indicating that MMT

dispersed in the nanocomposites. The thermal analysis indicated that either MH or BDP contributes to an increase in the char residue; adding two materials together provide a synergistic effect through increasing the char residue. The LOI value rose to 29 when two flame retardants were added, significantly higher than the LOI values when only one of the materials was used.

**ID:** CN2018\_10012

**Title:** Dual enhanced MRI of tumor vascular endothelial cells based on targeting peptide-conjugated manganese ferrite nanomicelles

**Name:** Zou Liguang

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#### **Abstract**

**Purpose:** To detect tumor angiogenesis using T1- and T2-enhanced magnetic resonance imaging (MRI) nanoprobe based on targeting peptide-conjugated manganese ferrite nanomicelles.

**Methods and Materials:** In this study, a novel T1 and T2 dual modality nanoprobe was successfully fabricated. The prepared nanoprobe comprise peptides CL 1555, poly( $\epsilon$ -caprolactone)-block-poly(ethylene glycol) amphiphilic copolymer shell, and dozens of manganese ferrite (MnFe<sub>2</sub>O<sub>4</sub>) nanoparticle core. The morphology, size, and size distribution of MnFe<sub>2</sub>O<sub>4</sub> and PEG-b-PCL-MnFe<sub>2</sub>O<sub>4</sub> were measured using TEM. Cell Count Kit-8 were used a to test the cytotoxicity of CL-PEG-MnFe<sub>2</sub>O<sub>4</sub> on TVECs. Serial metal (Fe + Mn) concentrations of MnFe<sub>2</sub>O<sub>4</sub> and labeled cells suspended in agarose gel were scanned in a head coil using a 3.0 T clinical MR scanner.

**Results:** The results showed that the hydrophobic MnFe<sub>2</sub>O<sub>4</sub> nanoparticles were of uniform spheroidal appearance and narrow size distribution. Due to the self-assembled nanomicelles structure, the prepared probes were of high relaxivity of 281.7 mM<sup>-1</sup> s<sup>-1</sup>, which was much higher than

that of MnFe<sub>2</sub>O<sub>4</sub> nanoparticles (67.5 mM<sup>-1</sup> s<sup>-1</sup>). After being grafted with the targeted CD105 peptide CL 1555, the nanomicelles can combine TVECs specifically and make the labeled TVECs dark in T<sub>2</sub>-weighted MR imaging. With the passage on, the Mn<sup>2+</sup> ions were released from MnFe<sub>2</sub>O<sub>4</sub> and the size decreased gradually, making the signal intensity of the second and third passage of labeled TVECs increased in T<sub>1</sub>-weighted MR imaging.

Conclusion: CL-poly(ethylene glycol)-MnFe<sub>2</sub>O<sub>4</sub> can conjugate TVECs, induce signal intensity contrast in MR imaging, and act as a novel molecular probe for T<sub>1</sub>- and T<sub>2</sub>-enhanced MR imaging of tumor angiogenesis.

**ID:** CN2018\_10013

**Title:** Static and dynamic properties of magnetite nanoparticles grown in glass matrices

**Name:** Viorel Sandu

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#### **Abstract**

Static and dynamic magnetic properties of magnetite nanoentities grown in a glassy matrix by crystallization of Fe-containing glass-melts in the presence of either Cr<sub>2</sub>O<sub>3</sub> or P<sub>2</sub>O<sub>5</sub> as nucleating agents are presented. The static properties are correlated with the structural deficiencies found on the magnetite sublattices of the nanograins, as revealed by Mössbauer spectroscopy, and with the multimodal size distribution as revealed by high resolution electron microscopy. Dynamic magnetic response revealed that superparamagnetism and superspin-glass compete at different temperatures.

**ID:** CN2018\_10002

**Title:** Fast photoconductive responses in organometal halide perovskite photodetectors

**Name:** Jingjing Mei

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#### **Abstract**

Inorganic semiconductor-based photodetectors have been suffering from slow response speeds, which are caused by the persistent photoconductivity of semiconductor materials. For realizing high speed optoelectronic devices, the organometal halide perovskite thin films were applied onto the interdigitated (IDT) patterned Au electrodes, and asymmetrical structured photoconductive detectors were achieved. The detectors were sensitive to the incident light signals, and the photocurrents of the devices were 2–3 orders of magnitude higher than dark currents. The responsivities of the devices could reach up to 55 mA W<sup>-1</sup>. Most importantly, the detectors have a fast response time of less than 20 μs. The light and bias induced dipole rearrangement in organometal perovskite thin films has resulted in the instability of photocurrents, and Ag nanowires could quicken the process of dipole alignment and stabilize the photocurrents of the devices.

**ID:** CN2018\_10005

**Title:** NaGdF<sub>4</sub>:Tb<sup>3+</sup>-RB based X-ray induced photodynamic nano-therapeutics for deep cancer treatment

**Name:** zhang xiaofeng

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#### **Abstract**

X-ray induced photodynamic therapy (XE-PDT) as a new modality for deep cancer treatment, breaks down the limitation of light penetration in tissues comparing with traditional PDT due to using X-ray as energy source and the combination of X-ray excitable nanoparticles (XENP) and photosensitizer (P.S.). However, low singlet oxygen generation efficacy in deep tissues and high cytotoxicity of XENP-P.S. system are primary issues to be resolved.

Here, we proposed a novel nanoparticle system, hexagonal phase (β-) NaGdF<sub>4</sub>:Tb<sup>3+</sup>-Rose Bengal (RB) for high efficiency XE-PDT with sub-10 nm size, ultra-high P.S. loading, and excellent

biocompatibility. The  $\beta$ -NaGdF<sub>4</sub> was successfully synthesized by solvothermal process, and characterized by TEM and XRD to confirm Tb<sup>3+</sup> ions doped into NaGdF<sub>4</sub> host. Notably, the high efficient energy transfer from  $\beta$ -NaGdF<sub>4</sub>:Tb<sup>3+</sup> with optimized doping level of 15% to RB could be achieved due to the perfect matching of the emission peaks from  $\beta$ -NaGdF<sub>4</sub>:Tb<sup>3+</sup> and the absorption peak of RB. Afterward, approximate 2000 RB molecules were immobilized on one  $\beta$ -NaGdF<sub>4</sub>:Tb<sup>3+</sup> and confirmed with the luminescent spectrum, which showed a high efficient singlet oxygen generation and quantified with 1,3-diphenylisobenzofuran (DPBF). The corresponding cell killing efficacy with/without X-ray radiation was also provided. Besides the high PDT efficacy,  $\beta$ -NaGdF<sub>4</sub>:Tb<sup>3+</sup>-RB also presented excellent biocompatibility, which was confirmed by MTT assay and cellular uptake study. No cytotoxicity was detected with the concentration of such nanodrug up to 1 mg/mL in both NP and NP-RB treatment group. The nanoparticles enter the cells via endocytosis and stay stable in the endo/lysosomes, which were confirmed by confocal microscopy and cell TEM, with 92% overlapping rate of  $\beta$ -NaGdF<sub>4</sub>:Tb<sup>3+</sup>-RB and lysosome.

With the PDT efficacy and bravo biocompatibility, the obtained NaGdF<sub>4</sub>:Tb<sup>3+</sup>-RB based XE-PDT nano-therapeutics provide a promising platform for improving deep cancer treatment in the future.

**ID:** CN2018\_10010

**Title:** Simple dehydration enables the formation of paper-based flexible microfluidic channels

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#### **Abstract**

The structure printed freely in bulky cellulose nanofiber (CNF) hydrogels was able to retain its highly resolved 3D features in an ultrathin 2D paper using a simple drying process. The dimensional change in CNF hydrogels from 3D to 2D resulted from simple dehydration of CNFs

and provided transparent, stackable paper-based 3D channel devices. As a proof of principle, the rheological properties of CNF hydrogels, 3D structure of ink, formation of channels by evacuation of ink, and highly localized selectivity of the devices are described.

**ID:** CN2018\_10011

**Title:** Synthesis of Silver Nanoprisms using Nanocellulose as Template

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#### **Abstract**

The features of templates, such as physical dimensions or functional groups, often affect the in situ growth process of nanoparticles. In this study, a rapid thermal synthesis method was adopted for the synthesis of Ag nanoprisms (AgNPRs) on cellulose nanofibrils (CNF), which were obtained via defibrillations of holocellulose. In comparison, holocellulose and pure cellulose also were used for the attempted synthesis of AgNPRs. The produced nanocomposites were examined for their optical and physical properties using ultraviolet-visible spectroscopy, transmission electron microscopy and X-ray diffraction. The results demonstrate that the reduced of the fibres into nanosize and carboxylate functional groups present on the cellulosic template affects the formation of AgNPRs, with which CNF is able to form AgNPRs. The surface-enhanced Raman scattering (SERS) activity of the CNF-AgNPRs composite was studied and exhibited a higher enhancement, compared to the spherical AgNPs-anchored CNF. The CNF prepared from carboxylated holocellulose not only served as nanoparticles support for the SERS application, it also facilitated the formation of AgNPRs that resulted in a better enhancement SERS signal.

**ID:** PMS2018\_10002

**Title:** STRUCTURE-PROPERTY

## **RELATIONSHIPS IN HDPE FOR PRESSURE PIPES**

**Name:** Riyadh AlHomoud

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### **Abstract**

Fast predictive test method for long-term plasticity controlled failure is employed<sup>2</sup> to evaluate the long-term performance of bimodal HDPE pipes. According to such new accelerated method, Yield stress versus strain rate at higher temperature would provide an adequate indication of the long-term plasticity controlled failure. Selected grades of HDPE with different molecular structures such as molecular weight and short chain branches content have been tested in order to evaluate the influence of these molecular parameters on long-term performance. Yield stresses versus strain rates at high temperature demonstrates multiple relaxation processes. Wide and small angle X ray analysis have shown that tangible improvement in the long term plasticity controlled failure is observed when higher degree of crystallinity is attained. On the other hand, higher molecular weight with moderate content of short chain branching as demonstrated by PE new generation pipe grade may well compensate quite some reduction in the degree of crystallinity reflecting an additional support that can be provided by semi-rigid amorphous phase to the crystalline lamellae.

On top of that, several HDPE samples varied in their molecular parameters, short chain branches content are exposed to electron beam irradiation in the solid state to study the influence of crosslinking the rigid amorphous phase on chain mobility, yield stress and long term plasticity controlled failure. Proton melt-state NMR T2 relaxation analysis is used to evaluate the chemical crosslinking efficiency upon irradiation. It shows a more rapid signal decay (i.e. restricted motion) in all irradiated samples compared to the initial ones which is an obvious indication of the presence of chemical crosslinks. The crosslinking efficiency are evaluated for different samples including homo

and copolymer PE. A slight decline in the crosslinking efficiency is seen in samples irradiated under air compared to inert environment. The weight fraction of crystalline and semi rigid amorphous phases of irradiated samples is measured by proton solid state NMR at 70 °C using single pulse excitation. DSC and density measurements are used to quantify the degree of crystallinity. The crystalline phase was intact and no noticeable variation detected in samples prior and after irradiation treatment, In addition, strain hardening that is considered as a convenient indicator of crack growth resistance<sup>3</sup> is observed to be enhanced by introduction of the crosslinks within tie chains.

**ID:** SIM2018\_10001

**Title:** Interfacial and electrical properties improvement in 4H-SiC MOS capacitor by implementing lanthanum silicate passivation interlayer

**Name:** Qian Wang

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### **Abstract**

The detrimental sub-oxide (SiO<sub>x</sub>) interfacial layer formed during the 4H-SiC metal-oxide-semiconductor (MOS) capacitor fabrication will drastically damage its device performance. In this work, an ultrathin lanthanum silicate (LaSiO<sub>x</sub>) passivation layer was introduced to enhance the interfacial and electrical characteristics of 4H-SiC MOS capacitor with Al<sub>2</sub>O<sub>3</sub> gate dielectric. The interfacial LaSiO<sub>x</sub> formation was investigated by high resolution transmission electron microscopy and X-ray photoelectron spectroscopy. The 4H-SiC MOS capacitor with ultrathin LaSiO<sub>x</sub> passivation interlayer shows excellent interfacial and electrical characteristics, including lower leakage current density, higher dielectric breakdown electric field, smaller C-V hysteresis, and lower interface states density and border traps density. The involved mechanism implies that the LaSiO<sub>x</sub> passivation interlayer can effectively restrain SiO<sub>x</sub> formation

and improve the Al<sub>2</sub>O<sub>3</sub>/4H-SiC interface quality. This technique provides an efficient path to improve dielectrics/4H-SiC interfaces for future high-power device applications.

**ID:** SIM2018\_10003

**Title:** Insights into the oxidation of Ag (111) supported  $\chi$ 3 Borophene

**Name:** Gang Liu

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#### **Abstract**

The superstructure of  $\chi$ 3 borophene on Ag (111) has recently been synthesized in experiment. In this work, we investigate its structural, electronic properties and the oxidation mechanism through first-principles calculations. We find the superstructure of  $\chi$ 3 borophene on Ag (111) maintain the planar characteristics, like its free-standing form, owing to the weakly interaction between adsorbate and substrate. Moreover, oxygen molecule can be spontaneously adsorbed on its superstructure in a manner of chemical adsorption. Importantly, the barrier energy for oxygen dissociation of about 0.35 eV indicates its chemically relative stability in ambient conditions compared with the active silicene. Furthermore, the mobility of O<sub>2</sub>-dissociation-induced O atom is poor at room temperature, implying the difficult migration of O atom on borophene surface. On the other hand, due to the strong B-O bonding, desorption of O<sub>2</sub>-dissociation-induced O atoms on superstructure of  $\chi$ 3 borophene becomes impossible, ultimately leading to form the boron oxides.

**ID:** SIM2018\_10004

**Title:** A novel approach to predicting surface properties generated during metal forming processes.

**Name:** Sergey Alexandrov

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#### **Abstract**

Narrow fine grain layers of material are often generated in the vicinity of frictional interfaces in manufacturing processes as a result of severe shear deformation and change surface properties of machine parts. The latter affects the performance of structures and machine parts under service conditions. Therefore, it is of importance to develop a method to connect parameters of manufacturing processes and parameters that characterize properties of fine grain layers generated by these processes. The strain rate intensity factor is the coefficient of the leading singular term in a series expansion of the equivalent strain rate in the vicinity of maximum friction surfaces. Such expansions are available for several material models that are often adopted to describe the response of material in metal forming processes. The objective of the present paper is to develop a general approach to relate the strain rate intensity factor and parameters that characterize the microstructure and thickness of fine grain layers. This approach is used in conjunction with axisymmetric drawing. The thickness of the fine grain layer is determined experimentally. Also determined is the distribution of average grain size and hardness near the friction surface. The strain rate intensity factor is found using an available semi-analytical solution.

## **Material Series: Oral Session II & Poster Session I**

**ID:** TFTA2018\_10007

**Title:** Uranium corrosion problem and a

**promising protection method**

**Name:** Yidong Jiang

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### Abstract

Uranium (U) has been used in many military and civilian applications due to its high density and nuclear properties. But it is susceptible to corrosion when exposed to salty, humid and high temperature environments. Surface modification and coating techniques have been applied to ameliorate this concern. Al coating is a preferable choice which can be realized by hot dipping, thermal spraying deposition and physical vapor deposition. Unfortunately, the methods mentioned above have encountered certain limitations. Room-temperature ionic liquids (RTILs) provide an appropriate alternative for electrodeposition of Al coating on reactive metals, for its wide potential windows, high solubility of metal salts, avoidance of water and oxygen, high conductivity and low viscosity. A uniform, compact and smooth coating was obtained by electrodepositing aluminum (Al) on uranium (U) substrate from aluminum chloride ( $\text{AlCl}_3$ )-1-ethyl-3-methylimidazolium chloride (EMIC) ionic liquid at room temperature. The Al coating significantly enhanced the corrosion resistance of U by reducing the corrosion current density by one order of magnitude. The adhesion of Al coating to U substrate was improved by anodic etching of U in  $\text{AlCl}_3$ -EMIC ionic liquid. The anodic behavior of uranium in  $\text{AlCl}_3$ -EMIC was also investigated. In the anodic process, metal uranium can be oxidized to  $\text{U}^{3+}$ . The corresponding products accumulated on the metal/ILs interface will form a viscous layer, which will facilitate a uniform dissolution of the substrate surface. The mass transport mechanism and limiting species during the electrodisolution of U were confirmed. The rate control step in the electrodisolution process is therefore only the diffusion of  $\text{U}^{3+}$  ions away from the anode. The mass transport mechanism in electrodisolution of U follows the salt precipitation model. The electropolishing of U was then conducted by dissolving metal U at limiting current. The surface

after electropolishing was smooth and flat with trace of well-defined grain boundaries. Besides, we demonstrated a simple and convenient galvanic deposition technique to prepare dense Al coating on U, which is spontaneous and with no external power supply. The deposition occurs via the following reaction:  $\text{U} + 4\text{Al}^{2+} + 7\text{Cl}^- \rightarrow \text{Al} + \text{U}^{3+} + 7\text{AlCl}_4^-$ .

**ID:** TFTA2018\_10012

**Title:** Hollow Doughnut Shape Mesoporous Silica Nanoparticles for Reduction of the Thermal Expansion Coefficient of Poly(ether sulfone) Films

**Name:** Nhat Tri Vo

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### Abstract

A decrease in the coefficient of thermal expansion of poly(ether sulfone) film is achieved by the incorporation of hollow doughnut shaped mesoporous silica nanoparticles (hd-MSN). The new class of silica nanoparticles with unprecedented structural morphology is synthesized by hydrolysis of tetraethyl orthosilicate (TEOS) in the presence of cetyltrimethylammonium bromide (CTAB), L-arginine, and ammonium metatungstate (AMT) composite template, all in aqueous ethanol. 46.1% and 48.0% decrease in the coefficient of thermal expansion (CTE) of poly(ether sulfone) film are observed in range of 30-90 °C and 30-150 °C, respectively, when 2.0 wt% of hd-MSNs are loaded. Furthermore, the small size (< 50 nm diameter) of doughnut shape mesoporous silica nanoparticles helps to decrease light scattering, and thus maintains high transmittance of nanocomposite film. The effect of the hd-MSN was also investigated on both the thermal stability and the mechanical stability. We expect the hd-MSN synthesized in this study can be used as a promising filler to improve the thermal and mechanical stability of the PES substrate without losing its optical transparency.

**ID: TFTA2018\_10010**

**Title: Organic Field-Effect Transistor Nonvolatile Memory**

**Name:** Xu Gao

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**Abstract**

With the increasing demand for flexible and wearable products, nonvolatile memories based on organic field-effect transistors (OFET) have attracted more and more attention, due to the merits of nondestructive reading process, integration of switching and storage, single transistor realization and architectural compatibility with logic circuits. In-depth understanding of memory mechanism may offer useful insights into device design and performance improvement for OFET memories. Our work presents from the perspective of device physics, to probe the charge trapping mechanism, including: (1) evaluation of OFET memory performance upon the defined “transition point”; (2) spatial profile of charge storage; (3) elucidation of ambient gas effects; (4) photo-energy-dependent light effects in OFET memory. Based on the understanding of work mechanism, several approaches were suggested to improve the device performance. Furthermore, OFET memory in application of selective solar-blind photodetection was also demonstrated.

**ID: TFTA2018\_10013**

**Title: Experimental study of electrodeposition of erbium thin film from mine wastewater**

**Name:** Sunjung Kim

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**Abstract**

Most of rare earth elements are generally refined using a large amount of acid solutions. Mine wastewater generated from the refining process contains plenty of heavy metals and some rare

earth metal elements. Theoretically rare earth elements have very negative reduction potential, thus it is difficult or almost impossible to recover them by electro-winning compared with heavy metals. Currently erbium is used in nuclear control rod, laser source for skin care, and optical fiber. In this study, we prepared a synthesized mine wastewater solution by dissolving erbium chloride in hydrochloric acid. For electro-recovery of erbium, it has a quite negative reduction potential of -2.32 V. In order to drag the negative potential to positive, we tried various organic complexing agents to chelate erbium ions. We present experimental results of electrodeposition of erbium thin film by controlling process parameters such as temperature, composition, pH of the synthesized solution in this presentation.

**ID: TFTA2018\_10014**

**Title: Electrodeposition of metal thin films on atomic-layer-deposited diffusion barrier layers and its electrochemical impedance spectroscopy**

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**Abstract**

Microelectronic devices have become much more integrated with a very high degree of device density and a very high aspect-ratio interconnect pattern. Subsequently it becomes important to electrodeposit interconnect metals within wiring patterns, not creating any void or seam. In this study, we do not use pre-deposited copper seed layer to electrodeposit void-free interconnect line; instead, direct electrodeposition of interconnect metals on atomic-layer-deposited diffusion barrier layers like tungsten carbide was applied. A sulphuric acid solution of pH 7 was used as an electrolyte containing iminodiacetic acid (IDA) as a complexing agent. Potentiostatic deposition of copper thin films in the range of -1.0 to -1.6 V vs Ag/AgCl electrode was conducted on both blanket and patterned specimens. Electrochemical impedance spectroscopy of copper electrodeposition was also carried out to explain

the kinetic behaviour of copper reduction in the interface of the electrolyte and the diffusion barrier layer.

**ID: TFTA2018\_10015**

**Title: Electrochemical synthesis of alloy anode material and its thin film growth characteristic analysis**

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#### **Abstract**

As a number of portable electronic devices are widely used, there are growing demands for rechargeable batteries such as lightness, portability, and longer operating times and longevity. Accordingly, studies on batteries with increased specific capacity and more stable charge-discharge performance have been actively conducted. Sn anode has a higher specific capacity than conventional carbon anode; however, the large volume change and cracking of the Sn anode occurs due to de-lithiation reaction during repetitive charge-discharge process. On the other hand, the Ni anode material is highly resistant to cracking during charge-discharge process. Therefore, in this study, the electrochemical formation of porous Sn-Ni alloy anode material in a manner of thin film growth is investigated using a polyurethane template of three-dimensional open-cell structure for lithium ion batteries having high specific capacity and improved structural reliability.

**ID: INM2018\_10004**

**Title: Effect of Multiple Factors on the Micro-leakage Test of Constic Self-adhering Flowable Resin**

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#### **Abstract**

Effect of Multiple Factors on the Micro-leakage Test of Constic Self-adhering Flowable Resin

#### **ABSTRACT**

**Objectives:**The aim of the study reported here was to provide a theoretical basis on the micro-leakage of Constic resin and Filtek<sup>TM</sup> Supreme Ultra, Dentsply<sup>TM</sup> Spectrum TPH3 filling cervical cavity under occlusal cyclic loading, and the resins after filling different positions of the teeth surface.

#### **Methods:**

The first test: The micro-leakage test of different resins fill in cervical cavity under occlusal cyclic loading.

A total of 40 intact human premolars extracted for orthodontic reasons were utilized in this research. Teeth were divided randomly into four groups (n=10). Cavity was prepared on the buccal surface of each tooth with half of the cavity above the cemento-enamel junction (2mm) and the other half below it (2mm). All cavity preparations have the uniform dimensions mesiodistal width of 2 mm and the depth of 2 mm. Group A Constic were filled directly. Group B Constic were filled after all-etching bonding system and Constic Group C were filled after all-etching bonding system and Filtek<sup>TM</sup> Supreme Ultra. Group D were filled after all-etching bonding system and Dentsply<sup>TM</sup> Spectrum TPH3. Each tooth was inserted into self-curing resin mold with the long axis perpendicular to the acrylic resin base, and then were placed on the testing machine to perform occlusal cyclic loading. After storage of the specimen in normal saline for 24 hours, the specimen were performed by thermal cycling machine. Sticky wax was used to seal the root apex of each tooth. After this, teeth were immersed in 50% silver nitrate solution for 24 hours in light-sealed container. Then each was immersed for 10 hours in photo-developing solution while being exposed to fluorescent light to allow the silver ions to transform into metallic silver. Longitudinal sectioning of teeth buccolingually was performed through the restoration center to be subjected to electron

microscopy analysis. Evaluation criteria: 0= No silver ion infiltration between interface of filling body and tooth tissue; Grade 1, Silver ion infiltration is less than or equal to the half of depth; Grade 2, Silver ion infiltration is higher than the half of depth; Grade 3, Silver ion infiltration arrives at the bottom of the cavity and even more than the bottom of the cavity. Statistical analysis: Micro-leakage values were statistically analyzed by Kruskal-Wallis H test and LSD at 5% confidence level.

The second test: The micro-leakage test of the resins after filling different positions of the teeth surface.

A total of 120 intact non-carious human molars extracted for impacted reasons were utilized in this research. Teeth were divided randomly into three groups (n=40). Cavity preparation was performed on the occlusal surface of each tooth (All cavity preparations to have uniform dimensions of 4 mm Buccolingual width and 2 mm mesiodistal width, the depth was set at 1.5mm). (1) Teeth were performed on the enamel. (2) Teeth were performed on the dentin. (3) Teeth were performed on the EDJ (enamel-dentinal junction). Each group was further subdivided into four equal subgroups (n=10): (group A) Constic, (group B) Constic + adhesive, (group C) 3MTM FiltekTM Supreme Ultra, (group D) DentsplyTM Spectrum TPH3. Group A were filled directly, Group B Group C Group D were filled after all-etching bonding system and resin. Similar to the first study after thermal cycling test, SEM was used to observe the micro-leakage of each sample. SPSS was used for statistical analysis: Micro-leakage values were statistically analyzed by Kruskal-Wallis H test and LSD at 5% confidence level.

#### Results:

1. The first test: The micro-leakage value of four groups have significant difference detected by Kruskal-Wallis H test ( $P < 0.05$ ). While the LSD test found that the micro-leakage value of Group A Group C and Group D have no significant differences ( $P > 0.05$ ), but significantly higher than Group B ( $P < 0.05$ ).

2. The second test: The Kruskal-Wallis H test

shown that the micro-leakage value of different positions of teeth surface filled with Group A, Group B and Group C have statistically difference ( $P < 0.05$ ), and no significant difference in filled with Group D ( $P > 0.05$ ). The micro-leakage value of group 1 and group 3 after filling different resins have statistical difference ( $P < 0.05$ ), and Group 2 have no statistical difference ( $P > 0.05$ ). Multiple-comparisons of the micro-leakage value used LSD test indicate that the micro-leakage value of the same resin after filling different positions of the teeth surface: group 1 and group 2, group 3 have statistically difference ( $P < 0.05$ ), group 2 and group 3 have no statistical difference ( $P > 0.05$ ). The micro-leakage value of the different resins filling in the same position: Group B and group A group C group D, group C and group D have statistical difference in enamel ( $P < 0.05$ ), group A and group C group D have no statistical difference ( $P > 0.05$ ); Group B and group A group D have statistical difference ( $P < 0.05$ ), group C and group B group D, group A and group D have no statistical difference ( $P > 0.05$ ).

#### Conclusions:

The micro-leakage condition of Constic was similar to FiltekTM Supreme Ultra and Spectrum TPH3.

Constic has the advantages of simple operation, reduce the operation time and better clinical steps. If applied, auxiliary adhesive effect can meet the demand of clinical application.

**ID:** INM2018\_10010

**Title:** Thermal, Mechanical and Rheological Properties of Low Density / Linear Low Density Polyethylene Blend for Packing Application

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#### Abstract

Packaging is the subject of considerable commercial development by a variety of organizations around the world. In this study the mechanical, thermal and rheological properties were investigated for different blend ratios of low

density polyethylene (LDPE) and linear low density polyethylene (LLDPE). The weight percent of the LDPEs used in the blends were 50, 60, 70, 80 and 90. The polymer blends were prepared in a twin screw extruder to produce a thin sheet (1-mm thickness) similar to the packaging grade. Tensile results showed the 50/50 composition exhibited the highest stress at break, where the differential scanning calorimetry results indicated a co-crystalline phase in some blends. The results produced by the rheometer revealed the LLDPE effect over the complex viscosity and consequently on blend easy processing. The present study conclusively demonstrates at low weight percent of linear low density polyethylene in the blend displays better properties for packaging application.

**ID: TFTA2018\_10008**

**Title: Formation of Al<sub>2</sub>O<sub>3</sub> coatings on magnesium alloys based on megnetron sputtering and micro arc oxidation**

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#### **Abstract**

With many excellent physical and mechanical properties, magnesium and its alloys have been utilized in a lot of fields. However, poor corrosion resistance and wearing resistance restrict their further applications. Surface modification techniques have thus been developed for the protection of magnesium alloys. Al<sub>2</sub>O<sub>3</sub> has a good corrosion resistance and wearing resistance. In this study aluminium coatings were fabricated on magnesium alloy by megnetron sputtering and then Al<sub>2</sub>O<sub>3</sub> was fabricated by micro-arc oxidation(MAO) process.The coatings were examined using scanning electron microscopy for surface morphology and cross sectional investigation, X-ray diffraction for phase determination, friction-abrasion testing for wearing resistance and electrochemical tests for corrosion resistance evaluation. The different

MAO treatment times in the electrolyte result in different surface and cross-section morphologies, coating thickness,consequently,the corrosion resistance and wearing resistance of the coatings.First the coating is mainly composed of  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> and with treatment time increasing the main phase turns to  $\alpha$ -Al<sub>2</sub>O<sub>3</sub>.And when the aluminium coating consumed, MgO was detected in the bottom of the coating.It is beneficial to the cohesion and the compact layer of the coating.The TAFEL results and friction-abrasion testing indicate that a aluminium-comsumed treatment time is beneficial to the corrosion resistance and wearing resistance for a thick coating, the formation of $\alpha$ -Al<sub>2</sub>O<sub>3</sub> and a compact layers in the structure of the MAO coatings.

**ID: TFTA2018\_10009**

**Title: Effect of (NaPO<sub>3</sub>)<sub>6</sub> on Micro-arc Oxidation Process and Coating Structure on Magnesium Alloy**

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#### **Abstract**

Magnesium alloy is the lightest structural metallic material, which makes it one of the favored materials to lower vehicle weight and therefore to reduce exhaust gas emissions in transport applications. However, the application of magnesium alloys is limited by their undesirable properties, such as the poor resistance to wear and corrosion. Micro-arc oxidation (MAO) has been developed for the protection of magnesium alloys. Additives have important effect on MAO process, coating structure and properties. In this study, MAO coatings have been prepared on AZ31 magnesium alloy, and the effect of (NaPO<sub>3</sub>)<sub>6</sub> on MAO process and coating structure has also been discussed. The results show that the number of micro-pores decreases while the size of micro-pores increases in the coating formed in electrolytes containing (NaPO<sub>3</sub>)<sub>6</sub>. Raising the concentration of (NaPO<sub>3</sub>)<sub>6</sub> in the electrolytes will

decrease both the arcing voltage and working voltage considerably, however increase the coating thickness, which will facilitate an effective decrease in the energy consumption for per unit coating volume during MAO processes. Furthermore, the addition of  $(\text{NaPO}_3)_6$  improves the corrosion resistance of the coatings, thus leading to a broader application of MAO technique.

**ID:** CN2018\_10004

**Title:** Mechanical properties and biocompatibility of porous Ti-10Zr biomaterials produced by space holder method

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#### **Abstract**

In this society, biomaterials are widely used for biomedical area such as bone cement, artificial hip joint, and scaffolds. Ti alloy which is kind of the biomaterials and widely used due to their good mechanical properties and biocompatibility. In this study, porous Ti-Zr biomaterials were successfully fabricated using Ti-10Zr milled powders with 5~30wt% NaCl powder and sintered by spark plasma sintering (SPS) process at 973K under 35MPa load. NaCl was used to produce the pores as space holder. The effect of space holder content on the pore size and distribution of the Ti-10Zr

biomaterial was observed by scanning electron microscopy (SEM). These microstructure observations revealed that the volume fraction of the pores increased with increasing space holder content and rough pore was successfully fabricated by adding NaCl as space holder. Accordingly, elastic modulus of Ti-10Zr biomaterials were decreased with increasing space holder contents. And good biological properties were shown in Hanks balanced salt solution (HBSS).

**ID:** TFTA2018\_10000

**Title:** Formation of Poly-Si films on glass substrates by using microwave plasma heating and fabrication of TFT's on the films

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#### **Abstract**

We have developed an apparatus for producing high-density hydrogen plasma. The atomic hydrogen density was  $3.0 \times 10^{21} \text{ m}^{-3}$  at a pressure of 30 Pa, a microwave power of 1000 W, and a hydrogen gas flow rate of 5 sccm. We confirmed that the temperatures of tungsten films increased to above 1000°C within 5 s when they were exposed to hydrogen plasma formed using the apparatus. We applied this phenomenon to the selective heat treatment of tungsten films deposited on amorphous silicon films on glass substrates and formed polycrystalline silicon films. To utilize this method, we can perform the crystalline process only on device regions. TFTs were fabricated on the polycrystalline silicon films and the electron mobilities of 60  $\text{cm}^2/\text{Vs}$  were obtained.

## **Mathematics Series: Oral Session I**

**ID:** ICFA2018\_10001

**Title:** Holder Regularity for Abstract Fractional Cauchy Problems With order in (0,1)

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#### **Abstract**

In this paper, we study the regularity of mild solution for the following fractional abstract Cauchy problem  $D_t^\alpha u(t) = Au(t) + f(t)$ ,  $t \in (0, T]$   $u(0) = x_0$  on a Banach space  $X$  with order  $\alpha \in (0, 1)$ , where the fractional derivative is understood in the sense of Caputo fractional derivatives. We show that if  $A$  generates an analytic  $\alpha$ -times resolvent family on  $X$  and  $f \in L^p([0, T]; X)$  for some  $p > 1/\alpha$ , then the mild solution to the above equation is in  $C^{\alpha-1/p}[\epsilon, T]$  for every  $\epsilon > 0$ . Moreover, if  $f$  is Hölder continuous, then so are the  $D_t^\alpha u(t)$  and  $Au(t)$ .

**ID: ICFA2018\_10003**

**Title: Fractional difference approximations for time-fractional telegraph equation**

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**Abstract**

In this paper, we approximate the solution to time-fractional telegraph equation by two kinds of difference methods: the Grunwald formula and Caputo fractional difference.

**ID: ICFA2018\_10005**

**Title: Examples of New nonstandard hulls of topological vector spaces**

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**Abstract**

We construct new nonstandard hulls of topological vector spaces using convex subrings of  $*R$  (or  $*C$ ) and we show that such spaces are complete. Some examples of locally convex spaces are provided to illustrate our construction. Namely, we show that the new nonstandard hull of the space of polynomials is the algebra of Colombeau's entire holomorphic generalized functions. The proof is based on the existence of global representatives of

entire generalized functions

**ID: ICGA2018\_10000**

**Title: The commutativity of Ring with homoderivation**

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**Abstract**

In this paper, we will prove the commutativity of prime or semiprime ring admits a homoderivation that satisfying some conditions

**ID: ICGA2018\_10004**

**Title: Morphological Group Theory of Material Structure**

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**Abstract**

The correct formulation and understanding of micro-images is one of the difficulties that occur to microstructures science today, which need to develop a new appropriate mathematics for micro-images of matter system. Here I study the image mathematics and physics description of micro-images of material system by topology, set theory, symbolic logic and show that there is a naturally morphological equation, that is a law of qualitative structure of matter system, the law of the unity of two kinds of morphological structure (Jordan and hidden structure), which can be used to describe not only the common feature of different correlated matter, but also to correct classify the micro-images into different classes, so that to study the morphology groups for materials science and Algebraic geometry.

The morphology equation can be found a number of applications for the observation and analysis of micro-images of material system and other natural sciences, some important basic concepts of Algebraic geometry can also be newly explained by the morphology equation. , such as : (1) to

construct the image-mathematical language and to construct the image mathematics model (IMM) for microstructures; (2) to construct complex geometric structures (Concave polygon) then analyze these complex shape structure by analytic geometry and algebraic geometry, to study complicated operators on complicated spaces; (3) A new explanation for the logical basis, concept definition and proof way of algebraic geometry and uses it to analyze morphological structure of the new and parent phase and the problem of Hodge's theory and structure type, and points out that there may be a counterexamples for Hodge's conjecture.

**ID: ICGA2018\_10006**

**Title: ALMOST SEMIPRIME AND QUASI SEMIPRIME IDEALS OF COMMUTATIVE RINGS**

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**Abstract**

Let  $R$  be a commutative ring with nonzero unity 1. In this article, we introduce the concept of almost semiprime ideals. We investigate some basic properties and characterizations under homomorphisms and some ring constructions. Then we introduce the concept of quasi semiprime ideals and give some results concerning the relationship between quasi semiprime ideals and almost semiprime ideals. A proper ideal  $P$  of  $R$  is almost semiprime if whenever  $a, b \in R$  such that  $a^2 b \in P - P^2$ , then  $ab \in P$ . Every semiprime ideal is almost semiprime and every quasi semiprime ideal is almost semiprime. But the converse of both results need not be true. If  $I, J$  are two ideals of  $R$  such that  $J \subseteq I$ , then  $I$  is an almost semiprime ideal of  $R$  if and only if  $I/J$  is an almost semiprime ideal of  $R/J$ . We show  $I, J$  are almost semiprime ideals of  $R_1, R_2$  respectively if and only if  $I \times R_2$  and  $R_1 \times J$  are almost semiprime ideals of  $R_1 \times R_2$ . We show that when  $f$  is a ring homomorphism, the inverse image of an almost semiprime ideal is an almost semiprime ideal, and

the image of an almost semiprime ideal that contains  $\text{Ker}(f)$  is an almost semiprime ideal. We show that an ideal  $P$  of  $R$  is almost semiprime if and only if  $P/P^2$  is a quasi semiprime ideal of  $R/P^2$

**ID: ICGA2018\_10008**

**Title: Invertible Graded Rings**

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**Abstract**

Let  $G$  be a group and  $R$  a commutative  $G$ -graded ring with unity. In this article, we introduce the concept of invertible graded rings;  $(R, G)$  is said to be invertible if the identity component  $R_e$  is a field. We study the relations between invertible graded rings and the concepts of strongly graded rings and first strongly graded rings. Several results are investigated. For example, we prove that if  $(R, G)$  is invertible, then  $R_g$  is cyclic  $R_e$ -module for all  $g \in G$ . Also, we prove that if  $(R, G)$  is invertible, then  $R$  is graded simple. Finally, we study invertible graded rings as a vector space over  $R_e$

**ID: ICPSA2018\_10002**

**Title: Research on Initialization on EM Algorithm Based on Gaussian Mixture Model**

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**Abstract**

The EM algorithm is a very popular maximum likelihood estimation method, the iterative algorithm for solving the maximum likelihood estimator when the observation data is the incomplete data, but also is very effective algorithm to estimate the finite mixture model parameters. However, EM algorithm can not guarantee to find the global optimal solution, and often easy to fall into local optimal solution, so it is sensitive to the determination of initial value to iteration. Traditional EM algorithm select the

initial value at random, we propose an improved method of selection of initial value. First, we use the k-nearest-neighbor method to delete outliers. Second, use the k-means to initialize the EM algorithm. Compare this method with the original random initial value method, numerical experiments show that the parameter estimation effect of the initialization of the EM algorithm is significantly better than the effect of the original EM algorithm.

**ID: ICPSA2018\_10004**

**Title: Local times for spectrally negative Levy processes**

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**Abstract**

Spectrally negative Levy processes are Levy processes with no positive jumps. We identify several joint Laplace transforms involving local times for spectrally negative Levy processes. The Laplace transforms are expressed in terms of scale functions. We also point out an application of such results. This talk is based on joint work in Li and Zhou (2017).

**ID: ISCAM2018\_10003**

**Title: Improvement of an Anonymous and Lightweight Authentication Scheme for TMIS**

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**Abstract**

Telecare Medicine Information Systems (TMIS) provides flexible and convenient healthcare for patients. However, the medical data transmitted between patients and doctors are exposed to unsecure public networks. To protect the patient's personal information, many authentication schemes are proposed. Recently, Kang et al.

proposed a hash based authentication scheme for TMIS and claimed that it could resist various kinds of attacks. However, in this paper we find that their scheme is vulnerable to a traceability attack and a user impersonation attack. In order to enhance the security and preserve the efficiency of Kang et al.'s scheme, we proposed a new anonymous and lightweight scheme. The security analysis demonstrate that the proposed scheme is superior to Kang et al.'s and the related schemes in security.

**ID: ISCAM2018\_10008**

**Title: Forecasting container throughput based on wavelet transforms within a novel decomposition ensemble methodology**

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**Abstract**

In this study, based on the wavelet transforms, a novel decomposition ensemble methodology is proposed for container throughput forecasting. Four main steps are involved, namely, sample data on container throughput at ports is decomposed into several components, the components are reconstructed based on data characteristic analysis (DCA) to capture inner factors and reduce computational cost complexity, a single model is used for the prediction of each reconstructed component, and the forecasting results (in terms of the decomposed subtasks) are combined as an aggregated output. Empirical analysis is conducted for illustration and verification purposes, by using the time series of container throughput at two ports in China. The results suggest that the proposed hybrid models can achieve better forecasting performance than other models in the most cases.

**ID: ISCAM2018\_10001**

**Title: Iterative solution of mesh constrained optimal control problems with two-level mesh**

## approximations of parabolic state equation

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### Abstract

We consider a linear-quadratical optimal control problem of a system governed by parabolic equation with distributed in right-hand side control and control and state constraints. We

construct a mesh approximation of this problem using different two-level approximations of the state equation, ADI and fractional steps approximations in time among others. Iterative solution methods are investigated for all constructed approximations of the optimal control problem.

Their implementation can be carried out in parallel manner.

## Physics Series: Oral Session I

**ID:** APSS2018\_10008

**Title:** Research on Nature of Dark Matter - Dark Matter Particle is Zhongjizi

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### Abstract

Abstract text: On the basis of Planck quantum hypothesis and Einstein photon quantum hypothesis, Zhongjizi (a new elementary particle) hypothesis was proposed: that the harmonic oscillator constituting the matter radiates and absorbs a minimum energy element  $h$  with a fixed value for each vibration. The energy radiated and absorbed by the harmonic oscillator can only be an integer multiple of the minimum energy element  $h$  and proportional to the vibration frequency  $\nu$  of the harmonic oscillator, and the proportional coefficient is minimum energy element  $h$  (its energy is equal to the Planck constant of  $6.62606876 \times 10^{-34} \text{J}$  in value, Energy cannot be separated from matter, the matter with very small energy corresponding to the minimum energy element  $h$  can be named as Zhongjizi, Through theoretical calculation, the mass of Zhongjizi is  $7.37249577 \times 10^{-51} \text{kg}$ ). To reveal the essence of photon, the origin of mass, the quantum property of gravitation, and the nature of dark matter. The results show that photon is essentially a set of Zhongjizi, is a set of  $\nu$  ( $\nu$  is the frequency of light) Zhongjizi, light is composed up of Zhongjizi,

the nature of light is particle property, the property of light is determined by the property of Zhongjizi, and the quantum property of light is essentially Zhongjizi property of light, the quantum of light is Zhongjizi, The so-called wave-particle duality of light can be united by Zhongjizi property of light. Zhongjizi is the most basic particle in the universe and the origin of mass, which gives mass to other particles. The gravitation interaction is essentially generated by exchange of energy through (realized by the exchange of Zhongjizi) between matters. The acting force is proportional to the energy radiated between the two matters per unit time, and inversely proportional to the square of the distance between the two matters. Zhongjizi is particle transmitting the gravitation, gravitation transmission speed is equal to the speed of light. the quantum property of gravitation is essentially the property that the gravitation is transmitted by Zhongjizi. The so-called dark matter is essentially Zhongjizi filling the universe and transmitting the gravitation, and Zhongjizi is the so-called dark matter particle. Because Zhongjizi are also the constituent particles of light, but Zhongjizi themselves do not emit light or absorb light, so Zhongjizi (the so-called dark matter) filling the universe and transmitting gravitation are not detected. Although we can detect light filling the universe, but we do not know the constituent particles of light—Zhongjizi are the particles transmitting gravitation and generating gravitational effect, that is, Zhongjizi is the so-called particle of dark matter. It can be called

that we look at the dark matter particles but cannot see them. The mass of Zhongjizi is  $7.37249577 \times 10^{-51}$  kg (Because light is a set of Zhongjizi and Zhongjizi has mass, so photon also has mass. At present, people believe that the mass of photon is zero, which is caused by the current definition of mass (mass is "the difficulty in accelerating matter"[1])), and the number density of photons in the universe today is 400 per cubic centimeter[2]. Because photon is a set of  $\nu$  ( $\nu$  is the frequency of light) Zhongjizi, a photon with frequency of  $\nu$  contains  $\nu$  Zhongjizi. In order to obtain the mass density of Zhongjizi in the universe, the average frequency ( $5.7 \times 10^{14}$  Hz) of the visible light with wavelength range of (400~760 nm) can be taken as the frequency of photon in the universe. Thus the mass density of Zhongjizi filling the universe can be calculated as  $400 \times 10^6 \times 5.7 \times 10^{14} \times 7.4 \times 10^{-51} = 1.7 \times 10^{-27}$  kg/m<sup>3</sup>. The total matter density in the universe is about  $2.5 \times 10^{-27}$  kg/m<sup>3</sup>[3], so we can see that Zhongjizi filling the universe accounts for about 68% of the total matter amount in the universe. In recent years, detection of microwave background radiation gives out the composition of cosmic matter: ordinary matter accounts for about 4%, dark matter accounts for about 23%, and dark energy accounts for about 73%[4]. Dark matter and dark energy account for the vast majority of cosmic matter, indicating that there is a certain relationship between Zhongjizi and dark energy in the universe.

Keywords: nature of dark matter; origin of mass; quantum property of gravitation; essence of photon; Zhongjizi hypothesis; Zhongjizi

References

- [1] Wang Mingyang. Searching for God's Particles [J]. World of Science, 2012, 3: 8.
- [2] Yu Yunqiang. Cosmic evolution and thermal loneliness [J]. Physics, 2011, 40 (9): 563.
- [3] Li Bin yi. Interpretation of blueprint for the universe [J]. Science, 2004, 4:45.
- [4] Zhang Yuanzhong, Zhang Xinmin and Cai Ronggen. Physics Development Report [M]. Beijing: China Science and Technology Press, 2008: 186.

**ID: APSS2018\_10009**

**Title: Analytical criteria of Hill stability in the elliptic restricted four body problem**

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**Abstract**

The three-body problem is a commonly used model both in celestial mechanics and astrodynamics, and the notion of Hill stability in restricted three-body problem dates back to many years ago. The notion has been extended to the general three-body problem and been well studied by several authors. The concept of Hill stability in the four-body problem is still not well understood. Gong and Liu (2016, 2017) discussed the criteria of Hill stability in general coplanar four-body systems. They defined the notion of Hill stability in the four-body problem and derived the criteria by using the equation of the zero velocity hypersurfaces for the general coplanar four-body problem (Loks & Sergysels, 1985).

In this work, we consider a spatial restricted four-body system including a binary subsystem. The distance between the binary is much less than that between the third primary and the barycenter of the binary. The fourth body is massless and does not affect the motion of the primaries. The orbits of the three primaries are considered to be elliptic. Due to the time-dependent Jacobi integral in the elliptic restricted four-body problem, it is difficult to develop analytical criteria of Hill stability. Based on the bifurcation of the extremum of the Jacobi integral, we establish several analytical criteria of Hill stability. The criteria are used to judge the Hill stability of the orbit with orbital element completely known. Using the model we also provide a study of the phenomenon of the gravitational capture.

**ID: APSS2018\_10012**

**Title: Stationkeeping Control of Electric-Propulsion Spacecraft on Libration**

## **Point Orbits**

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## **Abstract**

Since ancient times, mankind has never stopped exploring space. From the United States explored the moon successfully in 1960s, humans have continued trying to break through the Earth's gravity and launch detector to other planets not only in the solar system but also the outside. With the increasing complexity of the detector's implementation, the requirements of propulsion technology and navigation control technology are augmenting. So finding a more efficient energy-saving propulsion device and track control technology has been studied recent years.

Considering the electro-thrust system has a huge advantage over the traditional chemical fuel propeller, and libration points which have many special dynamic characteristics are very suitable for the spacecraft's mission., this paper focuses on the problem of stationkeeping control of electric-propulsion spacecraft on libration point orbits.

According to the basic assumptions of the circular restrictive three-body problem, the dynamic model of the solar system is established for the spacecraft. In order to facilitate the analysis of the nonlinear system, it is linearized near the libration point, and the dynamics of the point is studied. Then the stability of the periodic orbit near the translational point is studied and the approximate analytic solution of the third-order Halo periodic orbit is obtained. In this paper, the stability of the periodic orbit near the translational point is studied, and the approximate analytic solution of the third-order Halo periodic orbit is obtained. Then the differential correction algorithm is introduced. The nonlinear dynamic equation is numerically integrated with the initial value differential corrected to get an accurate numerical orbit. Furthermore, the linear active disturbance rejection controller is designed as the orbit preserving strategy of the spacecraft, and the effect of the control strategy which is applied to the

approximate analytic is compared with accurate numerical orbit. Considering that there is much random disturbance in the spacecraft performs task, the Monte Carlo simulation method is used to detect the robustness of the control strategy.

**ID:** APSS2018\_10013

## **Title: YORP Effect on the Evolution of Asteroid Spin State**

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## **Abstract**

With the rise of the second deep space exploration, more and more attention has been paid to the research of asteroid as well as the YORP effect. The YORP effect, arising from the absorption of sunlight and its re-emission as thermal radiation from an irregularly shaped surface, may cause significant changes in the spin state of an asteroid over a million years. The study of the YORP effect plays an important role in understanding the evolution history of asteroids, the formation of binary systems, and the origin and development of the solar system.

There are several methods on the evaluation of the YORP effect based on different models in the existing literature. This study reviews the theory of the YORP effect, and improves the derivation of the formula. Based on the asteroid polyhedral model, an algorithm is proposed to attain the relationship between the inclination of the asteroid rotation axis and the YORP moment and to simulate the spin state evolution numerically. Comparisons on theoretical analyses and numerical calculations are performed for several simple polyhedrons to validate the performance of the algorithm. Then, using the precise polyhedral shape models derived from radar observations, the YORP moment of various asteroids and its rotation state evolution are investigated. This study will help to reveal the formation and evolution of different asteroid structures and is of great significance to the target selection and target physical properties characterization of future

asteroid exploration missions.

**ID: APSS2018\_10014**

**Title: Operation of Laser-driven Sails in Extremely Low Earth Orbit**

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#### **Abstract**

Solar sails are a type of space propulsion which use solar radiation pressure (SRP) to accelerate. Launching solar sails to extremely low-Earth orbit (ELEO) can provide unique opportunities for operating propellantless satellites in ELEO in non-Keplerian orbits, or cheap launches to space by orbit-raising from ELEO. The main problem in this way is the enormous atmospheric drag on a satellite with large area-to-mass ratio which hinders the operation of solar sails in the orbits below 600 km. The proposed method is to use laser-driven sails with the laser base located in orbit or on the moon which is powerful enough to push the sail through atmosphere. The required laser power for different altitudes is calculated. The main difficulty of using such a method is to guide the laser beam to a relatively small sail from a large distance in the presence of time delays caused by the distance. We developed a predictive model based on extended Kalman filter to predict the position of the sail for the arrival time of the laser beam to the sail, at the time of the firing of the laser beam. The Kalman filter is developed using the dynamics of the sail in LEO by considering the uncertainties in laser radiation pressure (LRP) and environmental disturbances. An orbit-raising mission from ELEO is simulated to show the efficacy of the proposed method.

**ID: APSS2018\_10016**

**Title: Minimum-Time Trajectory Design of Multiple Asteroid Exploration Missions Using Solar Sail**

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#### **Abstract**

As its scientific value and its potential threats to the Earth, Near-Earth-Asteroids (NEAs) has been the most promising targets in the space exploration. Recent years, solar-sail spacecraft shows great advantages in interplanetary transfer missions compared to chemical propulsion for its independence of fuel[1]. This work focus on the trajectory optimization using solar sail to rendezvous multiple asteroids simultaneously, which is essentially a multi-object optimization problem.

There are several methods studied for years to solve the optimal problem of solar sail orbit transfer mission, including direct method and indirect method. The indirect method employs the calculus of variation and Pontryagin maximum principle, which guarantees the local optimality of the solution[1]. When an indirect method is employed in the multi-object rendezvous trajectory optimization process, the corresponding multi-point boundary value problem (MPBVP) is extremely sensitive to the initial guess of the co-states, especially for a long time mission or a small sail characteristic acceleration[3]. On the other hand, a direct method has the disadvantages of requiring a high number of parameters for the discretization process. This work presents a novel methodology for solving the multi-object rendezvous trajectory optimization problem. For the sake of computational efficiency and optimality, the solution of a single segment rendezvous problem obtained by indirect method will be used as the initial guess of the multiple segment problem solved by direct method. Moreover, the static conditions of endpoints and interior points will be checked to evaluate the optimality of the solution. Numerical test cases will be performed to show the efficiency and effectiveness of the proposed method.

**ID: APSS2018\_10017**

**Title: Equilibria and Stability of retrograde coorbital resonance in the three-body problem**

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### **Abstract**

Resonances are common in celestial mechanics. They may excite different behaviour of orbital elements, and possibly destabilize the motion. Mean motion resonances (MMRs) may occur when the mean motions of two or more orbits are near commensurable. MMRs are prevalent in the solar system and exoplanets. Asteroid BZ509 was demonstrated as a retrograde coorbital asteroid of Jupiter. Retrograde coorbital asteroids of Jupiter and other planets may be more common than previously expected (Paul Wiegert et al. 2017). Morais and Namouni (2013) discussed the dynamics of retrograde resonances in the planar three-body problem and explored the phase-space near the main retrograde resonances ( $2/-1$ ,  $1/-1$  and  $1/-2$ ). And they confirmed that stable coorbital modes exist at all inclinations, including retrograde and polar orbits (2017).

In this work, we study the dynamics of coorbital retrograde motion by systematically investigating the equilibria and stability in three-body problem. We numerically integrated the equations of motion using the Hybrid symplectic integrator of the package MERCURY (Chambers. 1999) with an accuracy parameter 10-12. In the planar three-body problem, we construct phase portrait to analyse the equilibrium points and stability of a retrograde coorbital asteroid by searching different orbital elements with the same Jacobi integral  $C$ . We find it's more complicated and varied in three dimensions because of different combinations of resonant angles ( $\phi_1$ ,  $\phi_2$ ). We find new coorbital modes and equilibrium points in three dimensions. We examine the similarities and differences between planar and three dimensional cases. The Kozai-Lidov resonance play a key role in coorbital resonance at different  $w$ . This work encourages the search for retrograde motion in solar system.

**ID:** APSS2018\_10018

**Title:** Deep learning of collision probability of

### **spacecraft close formation**

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### **Abstract**

The requirement for collision avoidance is one of the most urgent challenges we face when designing the orbits of spacecraft in a close formation, where the relative distances can be tens of meters or even several meters. To get reliable collision probability of a new formation immediately with the knowledge of collision probabilities of formation examples, the method of deep learning is introduced. We first generalize 0.4 million examples of spacecraft close formations as the training and development set, and label them the accurate collision probabilities. Several types of neural network are trained through the training set and tested on the development set to select the well-performed one. Examples of other papers are used to test the performance of the neural network. The parameters in the network could be helpful to the preliminary design of the spacecraft formation that are free of collision.

**ID:** APSS2018\_10021

**Title:** Entropy of Born-Infeld-de Sitter black hole

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### **Abstract**

We study the entropy of Born-Infeld-de Sitter black hole, based on the view that the black hole and the cosmological horizon of black hole in de Sitter spacetime are not independent each other. The total entropy of the system should contain an extra term which originated from the entanglement of the two horizons, apart from the sum of the two horizons entropy. The total entropy is found to be diverge as the two horizons tend to coincide by using the globally effective first law.

**ID:** APSS2018\_10027

**Title:** Large-Scale Modeling of Parametric Asteroid Surfaces Using Polynomial Series

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### Abstract

Precise description of the shapes and surface geomorphological features of small bodies is an important research direction in modern observational astronomy, which also gives crucial information for an in situ exploration mission to asteroids, especially in the pre-research phase. By using detailed modelling of asteroids' surfaces, several significant findings on the geographic evolution processes of these small worlds have been unveiled. Recent studies on the asteroid geological structure shows that most asteroids have asymmetric and irregular mass distributions. It posed a challenge in accurately modelling of such asteroids' surfaces. Methodologies to describe the irregular shapes have been developed in multidisciplinary. The spherical harmonics have been successfully applied in medical science to describe the shapes of organs. And for the solar system small bodies, the most widely-applied method is to discretize their surfaces into triangular meshes, which is also known as the polyhedron method.

This paper presents a new approach for large-scale modeling of parametric surface using Polynomial Series. We use the right-handed Cartesian coordinates to match the definition of Polynomial Series. To create a Polynomial Series model for an asteroid surface, we first need to perform surface parameterization that establishes a bijective mapping between each vertex on an asteroid surface and coordinates on the unit sphere. A satisfactory mapping often requires a minimization of some types of distortions such as length distortion, angle distortion, or area distortion. Here we use the CALD algorithm to control area and length distortions at same time. The parameterization has the form of  $(x, y, z) = (r_1 \cos \theta \cos \phi, r_1 \cos \theta \sin \phi, r_1 \sin \theta)$ , where  $r_1$ ,  $\theta$ , and  $\phi$  are three functions defined on the sphere. Thus in

order to describe the object surface, we need to expand these three spherical functions using Polynomial Series. By using the Polynomial expansion, we compute the coefficients up to a user-desired degree with an iterative residual fitting algorithm applied. The asteroid surface can be then reconstructed using the Polynomial coefficients. In comparison to the polyhedron method, the polynomials provide an explicit analytical description of asteroid surfaces, which is continuously differentiable and keeps high universality to different shapes. In comparison to the spherical harmonics, we demonstrate the method proposed in this paper can reduce the computational complexity of the expansion series functions while ensure the fitting accuracy. This method is thus expected to be applied to rapid surface reconstruction of target asteroids in future explorations, as well as to be applied as a rapid collision detection algorithm in the full two-body problem.

**ID:** APSS2018\_10030

**Title:** Tackling tangledness of cosmic strings by knot polynomial topological invariants

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### Abstract

Cosmic strings in the early universe have received revived interest in recent years. In this paper, we derive these structures as topological defects from singular distributions of the quintessence field of dark energy. Our emphasis is placed on the topological charge of tangled cosmic strings, which originates from the Hopf mapping and is a Chern-Simons action possessing strong inherent tie to knot topology. It is shown that the Kauffman bracket knot polynomial can be constructed in terms of this charge for unoriented knotted strings, serving as a topological invariant much stronger than the traditional Gauss linking numbers in characterizing string topology. Especially, we introduce a mathematical approach of breaking-reconnection which provides a promising

candidate for studying physical reconnection processes within the complexity-reducing cascades of tangled cosmic strings.

**ID:** APSS2018\_10028

**Title:** Chances for laboratory planetary science using heavy ion beams at HIRFL and HIAF

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### **Abstract**

Matter in planets such as earth, Jupiter and Saturn stays at extreme state with pressure larger than 1Mbar. The laboratory study for these extreme states of matter, which is defined as High Energy Density Matter (HEDM), is of great significance for both basic physics and planetary science. High power laser facility has been used for the related study for years, and accelerator-based heavy ion beams open a new path for it. On one hand, the heavy ion beam could heat the target in uniform and quasi-isometric way, and then HEDM with high pressure and high entropy would be generated for equation of state study. On the other hand, the ion beam could be used for the ion-plasma interaction study and for HEDM diagnostic through ion beam radiography.

## **Physics Series: Oral Session II**

**ID:** CAVNC2018\_10001

**Title:** Study on Acoustically Transparent Test Section of Aeroacoustic Wind Tunnel

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### **Abstract**

On the purpose of accurate data acquisition for the aeroacoustic testing mostly in open jet test section of aeroacoustic wind tunnel, the large scale

Currently, HIAF project is already launched in Huizhou, China. It is expected to deliver ion beams over a wide range of parameters of ion species, ion energy, charge state as well as the intensity. Two Rings are in the scheme. One is the Booster Ring (B-Ring) in the first phase of the project. Take  $^{238}\text{U}$  ion beam as an example, the current plan of B-Ring allows for the beam energy to 800 MeV/u and the maximum intensity could reach to  $5 \times 10^{10}$  particles per pulse with duration of 150 ns. In the second phase of HIAF project, the Compression Ring (B-Ring) will be constructed. This will allow to deliver  $5 \times 10^{11}$  1100 MeV/u  $^{238}\text{U}$  ions in 50 ns. These beam parameters will lead to a considerable energy deposition of tens of kJ/g in target, and heavy ion beam induced warm dense matter would be available in laboratory.

Extensive theoretical work has been carried out in our group to propose various experiment designs at HIAF[1-3]. The results demonstrate that using the heavy ion beam that will be available at HIAF, one can generate physical conditions that have been predicted to exist in the interior of giant planets. What's more, HEDM diagnostic techniques such as ion/electron beam radiography for the density diagnostic and pyrometer for radiation temperature diagnostics are developed in our group [4-6]. In the report, some detailed results will be presented.

anechoic chamber is specifically designed to build the low background noise environment. A newly acoustic test section is presented in this paper, of which the contour is similar as the closed test section, and the wall is fabricated by the fiber fabric, both the characteristics of closed and open jet test section of conventional wind tunnel are combined in it. By thoroughly researching on the acoustics and aerodynamics of this acoustically transparent test section, significant progress in reducing the background noises in test section and improving the ratio of energy of the wind tunnel

and some other aspects have been achieved. Acoustically transparent test section behaves better in acoustics and aerodynamics than conventional acoustic test section because of their high definition in detecting the sound sources and great performance in transmitting sounds

**ID: CAVNC2018\_10009**

**Title: Desnoise method for Microseismic signals by using EMD and S transform**

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#### **Abstract**

A scheme is designed to remove noise from noisy microseismic signals based on EMD and S transform. It can be realized in five steps: 1) apply EMD on the microseismic data to get the IMFs of different channels; 2) perform S transform on the IMFS to estimate the parameters such as delay and frequency information of the IMFs; 3) design a filter to remove the invalid signals; 4) apply an inverse S transform to the filtered signals; 5) add all components of filtered IMFs. The simulation results show that the proposed method can get the denoised signals when the SNR is higher than 0dB.

**ID: CAVNC2018\_10011**

**Title: Application of Microperforated-panel Absorber in Communication Products**

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#### **Abstract**

Base on Prof. Maa Dah-You's general theory of the microperforated-panel(MPP) absorber, We designed a noise reduction structure---sound attenuating cabinet(SAC). It can be applied to air-cooled communication products. This article introduces engineering design method of SAC and laboratory test noise reduction results of

application of SAC.

**ID: CAVNC2018\_10012**

**Title: Computation of BPF Pressure Pulsations in a Screw-Centrifugal Pump**

**Name:** Sergey Timushev, Dmitry Klimenko, Sergey Fedoseev

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#### **Abstract**

Improving the reliability and lifetime of high speed screw centrifugal pumps is now of great importance. The key objective is to reduce the hydrodynamic vibration of screw-centrifugal pumps caused by pressure pulsations in the pump casing. Due to the flow nonuniformity at the impeller outlet, pressure pulsations emerge at the rotor blades passing frequency, its harmonics and combination components of spectra. The pressure pulsations cause a dynamic load on the components of pump flow path generating its vibration, so the computational modeling of the pressure pulsations amplitude in the screw-centrifugal pump at the early stage of the development is a relevant task. When defining pressure pulsations generated by the three-dimensional vortex flow of the screw-centrifugal pump their dual nature should be considered. At the outlet of the cen-trifugal impeller acoustic oscillations appear that are propagated at the speed of sound in the operating fluid. At the same time, there are vortex disturbances that are convected by the main flow. Vortex perturbations of the main flow parameters is called "pseudo-sound" or the vortex mode. The modeling of generation and propagation of pressure pulsation in screw-centrifugal pumps has been carried out using the acoustic-vortex decomposition of the compressible fluid pressure field. The computations have proved that the reduction of BPF amplitude from the impeller exit downstream to the pump outlet section is more than 20 dB. The appearance of discrete components in the pressure pulsations spectrum at

(combined) frequencies is explained by the amplitude modulation of the flow stepwise inhomogeneity in the centrifugal impeller by the uneven flow at the screw inducer outlet.

**Keywords**

Pressure Pulsations, Centrifugal Pump, Discrete BPF Component, Acoustic Impedance

**Acknowledgements**

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**ID: CAVNC2018\_10013**

**Title: The acoustic structure coupling characteristic of a piezoelectric micro-jet for 3D printing**

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**Abstract**

Thanks to the advantages of quick response, simple structure and high precision of piezoelectric micro-jet, it has been applied in various industrial fields. In this paper, a designed piezoelectric micro-jet is used for ejecting cyanoacrylate based solidable fluid which is biodegradable and has low viscosity. A coupling method for analyzing the coupling effect between piezoelectric vibrator and the ejected fluid is proposed. The acoustic structure coupling characteristics of the piezoelectric micro-jet are analyzed. And, the recommended working frequency is given by the coupling analysis. Experiments are carried out, the feasibility of 3D printing by the designed piezoelectric micro-jet is proved. The coupling method is proved to be effective by comparing the results of experiments with simulations.

**ID: ICEA2018\_10000**

**Title: Dual-band infrared plasmonic metamaterial absorber for ultrasensitive refractive index sensing applications**

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**Abstract**

We present the design of a dual-band infrared plasmonic metamaterial absorber (MMA) for ultra-sensitive refractive index sensing applications. The proposed dual-band MMA only consisted of an assembly of vertical-split-ring (VSR) structure array adhered on a continuous film. The MMA can achieve absorbance of 99.1% and 98.8% with quality-factor (Q-factor) of 16.4 and 19.8 at 163.6 THz and 258.8 THz, respectively. The physical origin of the observed dual-band absorption is elucidated through distributions of magnetic field at resonances. The designed dual-band MMA served as a refractive index (RI) sensor can achieve sensitivity of 1518 and 959 nm/refractive index unit (RIU) with FOM of 189.75 and 79.91, respectively. The proposed dual-band MMA can be a desirable candidate for applications in the refractive index sensing detection and the enhanced infrared spectroscopy.

**ID: ICEA2018\_10003**

**Title: Numerical research on the micro-structure of a triple-layer-coated microdisk resonator**

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**Abstract**

We report an electromagnetic application to micro-structure. We demonstrate that whispering gallery modes (WGMs) in a microdisk resonator with three layers of high, low, and high refractive index (RI) are analyzed by using the finite difference time domain (FDTD) method. To make light couple in and out of the micro-disk, a phase matched waveguide is used to overlap the WGMs evanescent radiation field. Resonant properties have been observed by analyzing the electromagnetic (EM) field distributions and the

relative intensity and transmission spectra. An exceeding ring with strong electric field is found inward in the inner layer and outer layer of peripheral resonator surface. Such properties show its potential in high-sensitivity sensor application.

**ID:** ICEA2018\_10004

**Title:** Dynamic electromagnetically induced transparency in a robust nanostructure quasi-cylindrical microcavity system

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**Abstract**

The control of electromagnetically induced transparency (EIT) is of critical importance to all-optical switching devices, highly sensitive sensors, and quantum information processors. In this paper, we experimentally and theoretically

demonstrate that dynamic EIT and Fano resonances can be achieved in a single quasi-cylindrical microresonator (QCMR). We first fabricate a high-Q QCMR using a fiber fusion splicer and construct a robust microfiber-QCMR coupling system. Based on this stable platform, EIT-like lineshapes can be tailored and convert into Fano resonances by vertically moving the resonator along its axis while in touch with the microfiber. The interesting phenomenon results from the destructive interference between two coexisting whispering gallery modes. Compared with previous work where tuning Fano resonances is performed by adjusting the coupling gap, our resonator is always in touch with the fiber taper during the engineering process and, as a result, the system is insensitive to air flow and tiny mechanical vibrations. Our approach, demonstrated in this work, provides a robust photonic platform for accessing, controlling, and engineering the Fano resonances.

## Part V Instructions for Presentations

### Oral Presentation

#### Devices Provided by the Conference Organizing Committee:

- Laptops (with MS-office & Adobe Reader)
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- Laser Sticks

#### Materials Provided by the Presenters:

- PowerPoint or PDF files

#### Duration of each Presentation:

- Regular Oral Session: 10 Minutes of Presentation
- Plenary Speech: 30 Minutes of Presentation

### Poster Presentation

#### Materials Provided by the Conference Organizing Committee:

- X Racks & Base Fabric Canvases (60cm×160cm, see the figure below)
- Adhesive Tapes or Clamps

#### Materials Provided by the Presenters:

- Home-made Posters

#### Requirement for the Posters:

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## Part VI Hotel Information

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**Fax:** (86 898) 88332266

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