

NanoFlorida 2009 – Schedule

Name: Andre Gesquiere
Email: andre@mail.ucf.edu
Contributors: Zhongjian Hu, Daeri Tenery
Contact: Andre Gesquiere
Title: **Composite Organic Nanoparticles for Solar Cell Applications: Exciton Migration and Morphology Investigated at the Nanoscale**
Abstract: Composite organic nanoparticles were fabricated and studied to investigate structure-property relationships of blended functional organic material systems at the molecular- and nanoscale. In this talk the effects of material morphology and phase separation on exciton delocalization and collapse (trapping) in composite conjugated polymer/fullerene nanoparticles based on amorphous and crystalline conjugated polymers will be discussed.
Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Chemistry, and CREOL, The College of Optics and Photonics

Name: Ming Su
Email: mingsu@mail.ucf.edu
Contributors:
Contact: Ming Su
Title: **Advanced thermal management materials for energy and biological applications**
Abstract: The solid to liquid phase change materials (PCMs) can adsorb a lot of heat energy during phase changes, and are promising for many applications including thermal energy storages, heat transfers, and biological detections. Dissipating thermal energy into PCMs will result in a nearly isothermal heat exchange without temperature rise. The melting temperatures can be adjusted by choosing different PCMs including paraffin waxes, inorganic salt hydrates and metal alloys. The unique property of encapsulated PCM nanoparticles will be discussed in two examples. These nanoparticles are added into a single phase coolant, poly- α -olefin (PAO), in order to enhance the thermophysical properties such as thermal conductivity and latent heat of nanofluid. We have used encapsulated PCM nanoparticles as thermal barcodes to detect multiple biomarkers. The sharp melting peak, wide temperature range and composition-dependent melting behavior enable the direct detection of multiple biomarkers from a small amount of sample without considering the optical property, salt, and pH condition of the sample.
Affiliation: University of Central Florida

Name: Ke-Gang Wang
Email: kwang@fit.edu
Contributors:
Contact: Ke-Gang Wang
Title: **Ostwald ripening and its application to synthesis of hollow nanostructures**
Abstract: The study of Ostwald ripening is critical to synthesis of nanocrystals and to microstructure evolution. In this talk, I will show multiparticle diffusion simulation and field-phase simulation for the study of Ostwald ripening. Kinetics of Ostwald ripening and microstructures (or nanostructures) will be revealed. In addition, I will show the applications of Ostwald ripening to fabrication of a range of different hollow nanostructures such as oxide TiO₂ nanostructure and Cu₂O hollow nanospheres that may be potentially useful for harvesting solar energy in the visible range.

Affiliation: Florida Institute of Technology

Name: Artem E. Masunov **Time:** 13:00
Email: amasunov@mail.ucf.edu **Session:** Modeling of Nanosstructures
Contributors: **Occupation:** Faculty
Contact: Artem E. Masunov **Type:** Invited Talk
Title: **Computational Design of Nanomagnets Using Density Functional Theory Methods**
Abstract: Single-molecule magnets (SMMs) recently emerged as building blocks for molecular spintronics. Theoretical prediction of the spin state energy splitting in these systems and its dependence on the environmental effects, electron and energy transfer could greatly assist in the rational design of these materials. Due to the size of the system, Density Functional Theory (DFT) is the only feasible method to predict spin state energy splitting from the first principles. Here we present our recent work using hybrid DFT and DFT+U methods to study Mn based molecular magnets, including Mn₁₂ molecular wheel.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: J. Manuel Perez **Time:** 13:30
Email: jmperez@mail.ucf.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Santimukul Santra, Charalambos Kaittanis **Occupation:** Faculty
Contact: J. Manuel Perez **Type:** Invited Talk
Title: **Multifunctional Nanoparticles for the Dual Targeted Imaging and Treatment of Cancer**
Abstract: A major problem of contemporary cancer chemotherapy is the systemic administration of potent therapeutic agents, causing severe side effects to healthy organs. Therefore, developing novel targetable nanoparticle formulations is of grave importance, as tumor-specific drug delivery can minimize any side effects. Furthermore, it is desirable to have multifunctional nanoparticles that can be traceable drug vehicles, allowing imaging of the drug's homing and monitoring of treatment progress and tumor regression. This can be achieved by functionalizing the nanoparticle with targeting ligands that have affinity towards receptors that are over-expressed by the cancer cells. Our group has recently developed iron oxide and polymeric multifunctional nanoparticles that are able to encapsulate a variety of cargos, such as near-infrared fluorescent dyes and anticancer drugs. Via simple surface chemistry modifications, the nanoparticles were functionalized with a variety of targeting ligands. As proof of principle, we used folic acid, as it is the ligand of the folate receptor which is over-expressed in numerous tumors. We will present in vitro data that shows that these multifunctional nanoparticles can be used to target cancer cells that over-expressed the folate receptor, without causing cytotoxicity to cells lacking this receptor.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Glenn Walter **Time:** 16:00
Email: glennw@ufl.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Mary de Castro, Sean Germain, Heather Cornell, Darin Falk, Nic Bengtsson, **Occupation:** Faculty
Brij Moudgil, Parvesh Sharma, Ed Scott and Swadeshmukul Santra
Contact: Glenn Walter **Type:** Invited Talk
Title: **Nanomaterials for cell and gene Tracking in vivo**

Abstract: The ability to obtain resolution approaching that of a single cell (5-50 μm) makes MRI particularly well suited for noninvasive cell tracking studies. Recently MR techniques have helped identify and monitor cell migration in vivo. This has been achieved through the use of a super-paramagnetic iron-oxide nanoparticle to alter proton T1, T2, and T2* relaxivities within the labeled cells. Whereas we have shown that this approach is highly sensitive, allowing the detection of a small number cells, it is inherently insensitive to the intracellular environment. Dependence on the intracellular environment is important due to the most useful probes will not only reveal information about initial cell location, but will provide a noninvasive readout for a number of biological parameters including cell viability and gene expression. In order to develop materials that are sensitive to the intracellular environment (or water exchange) and that can be used for cell or gene targeting we have developed a new class of multimodal contrast agents that rely on a high payloads of paramagnetic lanthanides. These unique nanocomposite materials are detectable by fluorescence, ultrasound, as well as by magnetic resonance (MR) imaging. The challenges of developing nanocomposite materials for high field MR imaging that have the sensitivity for cell tracking and detecting gene expression will also be discussed.

Affiliation: University of Florida, Departments of Physiology and Functional Genomics

Name:	Bobby Jeanpierre	Time:	09:30
Email:	bjeanpie@mail.ucf.edu	Session:	NanoEducation
Contributors:		Occupation:	Faculty
Contact:	Bobby Jeanpierre	Type:	Invited Talk
Title:	Career Award: Connecting Science Education Research and Practice: Inquiry Teaching and Learning		

Abstract: We have little knowledge of teachers' views about the goals and purposes of inquiry, the processes by which they carry it out, or their motivation for undertaking a more complex and often difficult to manage form of instruction (Keys and Bryant, 2000). To couple the need to know more about teachers' goals and purposes for carrying out inquiry-based instruction is the importance of understanding how inquiry is implemented in diverse low SES urban middle school classrooms. This longitudinal study which spanned five years collected survey data from over 300 K-8 teachers on their inquiry beliefs and practices, along with classroom observational case study data of five, grades 3-8 teachers to learn why they choose to use inquiry science. Findings support that there was congruence between teachers' reported inquiry beliefs and their actual classroom instruction practices. Also, teachers effectively used questions to obtain students' responses to science content and knowledge-based questions. The type of questioning teachers used also directly related to the kind of inquiry experiences they often provided to students. Classrooms where questioning was not consistently focused on science concepts and big ideas in science rarely facilitated student use of advanced inquiry skills (for example, designing and testing their own hypotheses) and open inquiry. Therefore, instruction in several of these classrooms was less likely to align with science reform instruction as recommended in the National Science Education Standards (1996). A summary of survey data results will be discussed along with classroom observations findings to support case study assertions. Implications for what 21st Century science education needs to look like and how nanoeducation may provide support to foster the kind of reform in science instruction envisioned in the National Science Education Standards will also be discussed.

Affiliation: University of Central Florida, College of Education

Name:	James Brenner	Time:	13:00
Email:	jbrenner@fit.edu	Session:	NanoEducation
Contributors:		Occupation:	Faculty
Contact:	James Brenner	Type:	Invited Talk
Title:	How to Teach Nanotechnology to Students Coming from Multiple Disciplines		

Abstract: Students taking nanotechnology come from a wide variety of disciplines including physics, chemistry, biology, materials science, and chemical, mechanical, aerospace, and electrical engineering. To be able to make a meaningful contribution to the field of nanotechnology, one needs to be a master of one of these fields and have some knowledge in a variety of several of these fields. Very few people have a sufficiently broad background to write a textbook that encompasses such a broad range of disciplines. Without a comprehensive, yet easily understood, text, establishing a curriculum, syllabus, or even a common set of prerequisites has been challenging. In our nanotechnology, biomaterials and tissue engineering, and materials characterization courses, we have implemented three-hour crash courses on the expected prerequisite topics. The key to the success of these classes has been to assemble a set of highly marked-up news items (with links to accompanying articles) describing recent innovations in the field that students must scan to find answers to questions that guide the student reader to partly home school themselves. Requiring the student to look at the questions while reading forces them to actively learn only the salient subject matter; by marking up the news items carefully beforehand, the professor keeps the amount of reading down to a reasonable amount. If the student goes beyond what is required, the amount of material to cover makes the course overwhelming to students. To provide depth of understanding, students work either alone or in multidisciplinary teams on an end-of-semester group project in their area of specialization within nanotechnology. The role of the professor during class is to a) address questions associated with the previous homework, b) provide a general overview to the next week's subject area, and c) highlight the key questions that the students will encounter for homework due the following week.

Affiliation: Florida Institute of Technology, Chemical Engineering

Name: Lei Zhai

Email: lzhai@mail.ucf.edu

Contributors: Jianhua Zou, Jianhua Liu

Contact: Lei Zhai

Title: Carbon Nanotube/Conjugated Polymer Composites

Abstract: Carbon nanotubes (CNTs) and conjugated polymers have demonstrated promising applications in nanoscale electronics including sensors, photovoltaics, and supercapacitors. Multifunctional CNT/conjugated polymer composite materials offer a wide range of candidates for such applications. A versatile approach to fabricate CNT/conjugated polymer composites has been developed using conjugated block copolymers. Upon a simple sonication, the conjugated polymer block such as polythiophenes can form strong p-p interactions with CNT walls, while the non-conjugated polymer block provides the de-bundled CNTs with a good solubility and stability in a wide range of organic solvents and host polymer matrices. Various block copolymers have been utilized to fabricate CNT nanocomposites with unique mechanical and electrical properties. The conductive block copolymers not only provide a universal system to disperse CNTs but also introduce other interesting properties into the system. Additionally, ordered conjugated supramolecular structures have been generated. Such non-invasive approach generates promising CNT composites for nanoscale electronics.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Jiangeng Xue

Email: jxue@mse.ufl.edu

Contributors:

Contact: Jiangeng Xue

Title: Organic and Hybrid Nanostructures for Photovoltaic Applications

Time: 09:30

Session: Nanomaterials for Energy

Occupation: Faculty

Type: Invited Talk

Time: 13:00

Session: Nanomaterials for Energy

Occupation: Faculty

Type: Invited Talk

Abstract: The interest in using organic semiconductors in electronic and optoelectronic applications has grown rapidly due to many technological advantages intrinsic to these unconventional electronic materials, such as low material cost, ease of processing, and compatibility with flexible substrates. Many organic-based devices, including organic light-emitting devices (OLEDs), photovoltaic (PV) cells, photodetectors, thin-film transistors, and memories, have been demonstrated over the last two decades, with OLEDs now available in commercial display products. This talk is focused on organic-based PV cells, which can potentially provide low-cost solar energy conversion to revolutionize the world's energy supply. I will present some recent work in my group on the growth of vertically aligned, polycrystalline, molecular nanorods and describe their applications in efficient organic solar cells. The use of inorganic semiconductor nanocrystals along with conjugated polymers to form hybrid organic-inorganic PV cells will also be discussed.

Affiliation: University of Florida, Department of Material Science and Engineering

Name:	Jingjiao Guan	Time:	13:35
Email:	guan@eng.fsu.edu	Session:	Nanomaterials for Energy
Contributors:		Occupation:	Faculty
Contact:	Jingjiao Guan	Type:	Invited Talk

Title: **Manipulating DNA for Nanofabrication and Biosensing Applications**

Abstract: DNA encodes genetic information that is critical to both fundamental studies and clinical diagnosis. Various methods have been developed for DNA biosensing ranging from conventional biological assays to emerging nanotechnologies. DNA as a polymeric molecule is also widely used as a nanomaterial to prepare various nanostructures. We are developing a series of methods to manipulate DNA for biosensing and nanofabrication. In the first method, long DNA chains are stretched into a well-defined nanostrand array by controlling dewetting of the DNA solution on a surface containing microfabricated wells. The stretched DNA array may be used as a platform for developing a new type of DNA microarray. By using a surface containing micropillars, we generated an array of long DNA wires, which can be functionalized by incorporating nanoparticles or by vapor coating. The nanowire array holds potential for developing high sensitivity and multiplex biosensors. By using the DNA nanowires as sacrificial templates, we have also fabricated nanochannels, which possess a set of unique properties suitable for manipulation and transport of biological macromolecules such as DNA. The arrays of DNA nanostrands, DNA nanowires, and nanochannels promise to develop large-scale, high-throughput biosensing devices.

Affiliation: Florida State University, Department of Chemical and Biomedical Engineering, Integrative NanoScience Institute

Name:	Winston Schoenfeld	Time:	09:30
Email:	winston@mail.ucf.edu	Session:	Nanophotonics and Nanoelectronics
Contributors:		Occupation:	Faculty
Contact:	Winston Schoenfeld	Type:	Invited Talk

Title: **The physics and challenges of realizing quantum teleportation using quantum dots within a quantum network**

Abstract: Semiconductor quantum dots are well known for their discrete density of states that have been exploited for considerable performance enhancements in many modern device technologies. As we enter into a new frontier of quantum information and computation, many researchers have begun to seek out platforms that can serve as quantum bits (qubits) within quantum systems. Quantum dots offer many attractive features that are critical to quantum information systems such as carrier localization and long decoherence times. One often overlooked element of quantum information is the quantum counterpart to information transfer within a classical circuit. Classically this is simply the reproduction of a binary bit through the charging or uncharging of a capacitive element. In quantum information one is subject to greater constraints since quantum bits are represented as superpositions of states that are not simply reproduced. In essence, reproduction or relocation of a quantum state requires quantum teleportation, thus enabling quantum bit transfer within a quantum network. In this talk a system for realizing quantum teleportation within quantum networks will be presented that relies on the entanglement of a single photon polarization with a single excess electron within a single quantum dot. The basic physics behind the teleportation process will be presented along with an outline of some of the existing hurdles that remain in moving towards the physical realization of such a teleportation platform within a quantum network.

Affiliation: University of Central Florida, CREOL College of Optics and Photonics

Name:	Paul H. Holloway	Time:	13:00
Email:	pholl@mse.ucf.edu	Session:	Nanophotonics and Nanoelectronics
Contributors:	Debasis Bera, Lei Qian, Ying Zheng, Jihua Yang and Jiangeng Xue	Occupation:	Faculty
Contact:	Paul H. Holloway	Type:	Invited Talk
Title:	Zinc Oxide: The 'Wonder' Nanomaterial		

Abstract: Synthesis, properties and applications of nano-sized ZnO will be discussed. Synthesis of nanospheres with diameters from 2 to 10nm by hot solution and sol gel methods will be emphasized. The effects on photoluminescence of a ZnO/MgO core/shell structure will be presented. The use of ZnO nanoparticles as a sensitizer in phosphors and as electron injection or extraction layers in OLEDs or organic-hybrid solar cells, respectively, will also be illustrated. In the case of OLEDs and solar cells, it will be shown that nano-ZnO increased both the device efficiency and lifetime. Finally, emission of 2.1eV photons at an OLED voltage of 1.4V will be attributed to an Auger process at the organic/ZnO interface which was only observed for ZnO nanospheres < 5nm.

Affiliation: University of Florida, Department of Material Science and Engineering

Name:	Clara Hofmeister	Time:	14:50
Email:	chofmeister@knights.ucf.edu	Session:	Designer Nanostructures
Contributors:		Occupation:	Graduate Student
Contact:	Yongho Sohn	Type:	Oral
Title:	Composition and structure of Nitrogen-containing dispersoids in tri-modal metal matrix composites		

Abstract: Aluminum tri-modal composite reinforced with B4C particulates has been fabricated successfully, and exhibited an extremely high yield strength and tailorable ductility. The fabrication of this composite starts from the cryomilling of 5083 Al alloy powders with B4C particles, which yields agglomerates containing sub-micron B4C particles solidly bonded with nanocrystalline Al (NC-Al) grains. These agglomerates are then blended with coarse grain Al powders, and consolidated to form the bulk composite. In this study, secondary ion mass spectrometry was employed to determine the composition of Nitrogen that linearly varied a function of cryomilling time. Crystalline and amorphous dispersoids containing Nitrogen and other constituents were documented by analytical transmission electron microscopy. The influence of composition and structure of the dispersoids on the strength of the composite will be discussed.

Affiliation: University of Central Florida

Name: Mehdi Khodayari
Email: mkhodaya@mail.usf.edu
Contributors: Mehdi Khodayari, Alex A. Volinsky
Contact: Alex A. Volinsky

Time: 15:10
Session: Designer Nanostructures
Occupation: Graduate Student
Type: Oral

Title: **Electrochemical noise measurements for nano-pitting corrosion monitoring**

Abstract: Electrochemical noise measurement (ENM) is one of the analytical methods employed to characterize corrosion behavior. Despite the numerous works on the subject of ENM, electrochemical noises still bear unfamiliar features which could provide new insights into corrosion processes. In this study, the difference in the number of potential noise peaks and corresponding current noise generated from pitting corrosion of two carbon steel electrodes immersed in a simulated concrete environment is discussed and results are generalized. To describe electrochemical noises behavior, fluctuations are attributed to two kinds of pits. The first kind are short-lived, meta-stable pits, which do not affect the corresponding current noise profoundly, but create a fluctuation in the potential noise. The second kind are long-lived, meta-stable or stable pits, which bring fluctuations in both the current and potential noises. It is the coexistence of the two kinds of pits that leads to the difference in the number of current and potential noises peaks.

Affiliation: University of South Florida

Name: Ehsan Yakhshi Tafti
Email: ehsan@mail.ucf.edu
Contributors: Ghanashyam Londe, Anindarupa Chunder, Lei Zhai, Hyoung J. Cho
Contact: Ehsan Yakhshi Tafti

Time: 16:00
Session: Designer Nanostructures
Occupation: Graduate Student
Type: Oral

Title: **Flow regulation in microchannels using wettability control of nanostructure-embedded thermo-responsive surfaces**

Abstract: This work addresses the modeling, synthesis, integration and characterization of a novel nano-structured thermo-responsive material for microfluidic applications. An analytical model is proposed for describing the transfer characteristic (variation of contact angle versus temperature) of a unique nano-structured, thermo-responsive switchable surface consisting of silica nanoparticles and the thermo-responsive polymer, Poly(N-isopropylacrylamide) (PNIPAAm) which changes its wetting angle upon heating. Important metrics of the polymeric surface such as the absolute lower critical solution temperature, threshold & saturation temperatures and gain are modeled and quantified by mathematical expressions. The layer-by-layer (LBL) deposition technique was utilized for constructing the thermoresponsive polymer and silica nano particles were immobilized on the surface. It was found that nanoscale structures with micrometer spacing provided the best surface conditions in terms of super hydrophobic / hydrophilic properties. Integrated microheaters together with surface-modified thermoresponsive coatings offer smart surfaces that can be used for various applications including microfluidic flow regulation. The design and fabrication of the smart surface consisted of integrating a switchable, nanostructured, thermoresponsive surface together with a gold microheater for wettability control in a microchannel. The integrated thermoresponsive surface performed effectively as a microfluidic thermal valve. The microfluidic device consisted of a simple T junction with one inlet and two outlets. Depending on the temperature, the thermoresponsive polymer could passively regulate the flow between the two outlet channels, allowing fluid to pass at room temperature and preventing the flow at elevated temperatures (above its lower critical solution temperature). The thermo-responsive flow regulation properties were tested and quantitative data for pressure and flow rate were recorded as a function of surface temperature in straight microchannels. This work lays out a new microfluidic device concept with built-in regulatory functions.

Affiliation: University of Central Florida

Name: Travis Patterson
Email: travis.j.patterson@gmail.com
Contributors:

Time: 16:20
Session: Designer Nanostructures
Occupation: Graduate Student

Contact: Yongho Sohn **Type:** Oral
Title: Evolution of Nanostructure in Trimodal Aluminum Metal Matrix Composites After Friction Stir Weld
Abstract: Microstructure evolution of trimodal aluminum/boron carbide (B4C) reinforced metal matrix composite was examined after friction stir weld (FSW) process. The fabrication of this composite starts from the cryomilling of 5083 Al alloy powders with B4C particles, which yields agglomerates containing sub-micron B4C particles solidly bonded with NC-Al grains. These agglomerates are then blended with CG-Al powders, and consolidated to form the bulk composites. The composites are commercially being produced as structural components of armor with product size up to two feet by two feet. The FSW process is being examined to as a potential method to join (e.g., increase the size and complexity of part geometry) the composites. Welds were produced using two sets of welding parameters; (1) M4 "hot and slow" with a tool rotational speed of 250RPM and tool travel speed of 1.5in/min. (2) M5 "cold and fast" had tool rotational and travel speed of 150RPM and 10in/min, respectively. Microstructure evaluation was conducted using optical, scanning electron, and transmission electron microscopy. The average size of B4C reinforcement decreased from a few micrometers to 360~420nm, however independent of rotational speed of FSW. The FSW process also produced grain growth of NC-Al from 50nm to 200~300 nm, but reduced the size of CG-Al from a few micrometers to 200~300 nm, both independent of FSW parameters.

Affiliation: University of Central Florida

Name: Bijoyraj Sahu **Time:** 16:40
Email: bijoyraj@ufl.edu **Session:** Designer Nanostructures
Contributers: Kam K. Leang **Occupation:** Graduate Student
Contact: Curtis R. Taylor **Type:** Oral
Title: A novel multifunctional SPM probe with modular quick-change tips for fully automated probe-based nanofabrication
Abstract: The potential of scanning probe microscope (SPM) tips as nanoscale manufacturing tools has been widely proposed. However, it is critical to address the issues of low throughput, frequent replacement of damaged or worn tips, tip contamination, and scalability. This presentation will discuss the design, analysis, and fabrication of a novel active cantilever that addresses the above critical issues. The active cantilever is equipped with an electrothermal microgripper at its distal end that automatically detects, loads and unloads tips from an array of modular probe tips. Position control and sensing is achieved by using a thermal proximity-based method to determine the relative location between the microgripper and tool tip. The ability to provide fully automated on-demand probe tip change will improve the overall efficiency, process quality, and reliability of tip-based nanofabrication by replacement of damaged or worn tips. By simply switching tips, multiple operations including nanoscale patterning, imaging, machining, and metrology can be performed. We have successfully designed a microgripper that provides the adequate range of actuation, gripping force, stiffness, and dynamic response required for the microgripping mechanism. The design has been validated by a coupled electrical-thermal-mechanical finite element analysis model. Initial prototype fabrication based on silicon-on-insulator (SOI) method has also demonstrated the feasibility and batch fabrication of the microgripper.

Affiliation: University of Florida

Name: Bo Yao **Time:** 17:00
Email: bo555252@gmail.com **Session:** Designer Nanostructures
Contributers: **Occupation:** Postdoc
Contact: Yongho Sohn **Type:** Oral
Title: Multiscale Structural Features of Commercial-Scale Lightweight Nanoengineered Trimodal Aluminum Metal Matrix Composites

Abstract: Trimodal Al metal matrix composites (MMCs) consisting of nanocrystalline Al phase (NC-Al), B4C reinforcement particles, and coarse grain Al (CG-Al) phase were fabricated successfully on a commercial scale. The fabrication of this composite starts from the cryomilling of 5083 Al alloy powders with B4C particles, which yields agglomerates containing sub-micron B4C particles solidly bonded with NC-Al grains. These agglomerates are then blended with CG-Al powders, and consolidated to form the bulk composite. This paper reports highlights from our comprehensive microstructural and spectroscopic characterization of multiscale features that contribute to the exceptional high strength of tri-modal Al MMCs. In addition to the composition, variation in size and distribution of the each constituent (i.e., NC-Al, B4C particles, CG-Al), size, distribution, and distribution uniformity of hierarchal microstructural domain (i.e., NC-Al/B4C agglomerates, CG-Al domains) were found to be important factors that influence the strength of the trimodal MMCs. Additional microstructural characteristics that contribute to the exceptional high strength are reported including (1) nanoscale dispersoids of Al₂O₃, crystalline and amorphous AlN, and Al₄C₃, (2) high dislocation density, both in NC-Al and CG-Al, (3) interfaces between different constitutes, (4) nitrogen concentration and distribution.

Affiliation: University of Central Florida

Name:	Ghazal Shafai	Time:	17:20
Email:	ghazal@physics.ucf.edu	Session:	Designer Nanostructures
Contributors:	Marisol Alcantara Ortigoza	Occupation:	Graduate Student
Contact:	Talat S. Rahman	Type:	Oral
Title:	Effect of an Fe substitutional impurity on the geometric and electronic structure of Au₁₃ cluster		

Abstract: We have carried out spin-polarized density functional theory calculations based on the pseudopotential method to determine the changes in the characteristics of the Au₁₃ cluster when one Au atom is replaced by Fe. For a pure Au₁₃ cluster, the 2D geometry is the lowest-energy isomer, followed closely by a flake structure, while the icosahedron is higher in energy by 2.98 eV and is not stable since it is found to undergo Mackay transition to form a cuboctahedron. When a surface or central Au atom is replaced by Fe, we find dramatic changes in the energy ordering of these nanoparticles, since Fe tries to move inwards so as to be highly coordinated. In fact the distorted icosahedron and a biplanar structure obtain the lowest energy. The structure of the Fe-centered icosahedron is slightly distorted (Jahn-Teller distortion), so that the degeneracy on two bands near Fermi level is removed. The lowest energy isomer in this study has the highest magnetic moment (3.98 μ_B) in comparison with that of the other isomers. The magnetic moment of the icosahedron with an Fe atom at the center is 3.1 μ_B , which is in agreement with previous findings.

Affiliation: University of Central Florida

Name:	Mark Jack	Time:	10:00
Email:	mark.a.jack@gmail.com	Session:	Modeling of Nanosctructures
Contributors:		Occupation:	Faculty
Contact:	Mark Jack	Type:	Oral
Title:	Quantum Electron Transport in Functionalized Carbon Nanorings		

Abstract: Electronic transport through nanotube structures [1] is sensitive to applied fields, defects, and changes in lattice binding parameters, properties that render them suitable for applications as biosensors. Here, we model biomolecules attached to the nanotorus (NT) via an anthracene tether [2,3]. A small lead bias voltage drives currents through the NT, and magnetic flux through the toroidal plane creates Aharonov-Bohm oscillations [4-6]. Changes in the current amplitude or to the magnetic-field allow for two alternative biosensor detection modes. The dependence of transport through the NT is presented. Changes to quantum interference in transport when the biomolecule attaches creates a sensitive, alternative detection mode. Moreover, these modifications to the interference signature could also permit a location-sensitive detection mode. The small bias density-of-states, transmission function and conductivity are calculated in tight-binding approximation. Results are computed for a (3,3) armchair NT with 1800, 3600 and 5400 carbon atoms respectively and for different lead attachments. A corrected electronic hopping parameter g_{\square} is employed in a tight-binding description at the atomic contact sites where the anthracene tether couples weakly (non-covalently) to the torus lattice. Results produced by this fast tight-binding algorithm are compared with density functional theory (DFT) based transport calculations using the parallel open source code `Quantum Espresso` [7], available on NSF TeraGrid computer resources. Successive comparisons of the two approaches shall allow realistic self-consistent modeling of the I-V characteristics after biopolymer-functionalization of the NT. REFERENCES: [1] S. Iijima, Nature (London) 354, 56 (1991). [2] M. Simmons et al., Phys. Rev. Lett. 98, 086802 (2007). [3] B.R. Goldsmith et al., Science 315, 77 (2007). [4] M.P. Anantram and T.R. Govindan, Phys. Rev. B 58 (8), 4882 (1998). [5] H.-K. Zhao and Phy. Lett. A 338, 425 (2005). [6] M. Encinosa and M. Jack, J. Comp.-Aided Mat. Des. 14 (1), 65 (2007); J. Mol. Simul. 34 (1), 9 (2008). [7] P. Giannozzi et al., <http://www.quantum-espresso.org>.

Affiliation: Florida A&M University

Name:	Yijian Ouyang	Time:	10:30
Email:	yijianoy@ufl.edu	Session:	Modeling of Nanosctructures
Contributers:	Dr. Jing Guo	Occupation:	Graduate Student
Contact:	Yijian Ouyang	Type:	Oral
Title:	Quantum Transport Simulation of Silicide-Silicon Contacts		

Abstract: In nanoscale Si-MOSFET, the contact resistance could considerably lower the on-current and significantly increase the delay. This trend is expected to exacerbate as scaling continues. Most models of metal-semiconductor and silicide-silicon contacts remain over-simplified. Quantum transport simulations based on the non-equilibrium Green's function (NEGF) formalism have been developed to model and investigate the transport properties of technologically important silicide-silicon contacts. The Schrodinger equation is self-consistently solved in NEGF formalism with the Poisson equation. The simulation takes the SB height (SBH) from ab initio simulations or treats it as a fitting parameter. An Effective mass Hamiltonian is used for silicon. The silicide at interface is treated by a phenomenological self-energy. Unlike the widely used WKB approximation, the NEGF formalism rigorously solves the quantum transport equation over a wide energy range relevant to transport. We have also modeled image-charge-induced barrier lowering in the NEGF quantum transport equation. Comparison between the theory and experiment indicates an increasingly important role of image charge induced barrier lowering and accurate calculation of the tunneling current as the doping density of the silicon increases. By extracting the barrier height and dielectric constant for image force from fitting the simulation to the measured contact resistivity at two specific doping densities, the simulator predicted contact resistivity in agreement with the experiment over a wide range of silicon doping densities.

Affiliation: University of Florida

Name:	Jyotsna Chauhan	Time:	10:50
Email:	jyotsna.chauhan@ufl.edu	Session:	Modeling of Nanosctructures
Contributers:	Bo Liu, Andrew Rinzler, Jing Guo	Occupation:	Graduate Student

Contact: Jyotsna Chauhan

Type: Oral

Title: A Computational Study of Graphene-Semiconductor Heterojunctions

Abstract: The graphene and carbon nanotube (CNT) film have been studied experimentally as the contact to silicon or organic material channel for thin-film transistor and light emitting transistor applications. These carbon-nanostructure-based contacts are electrically highly conductive, optically transparent, and mechanically flexible, which are ideal for various device applications. Experiments with CNTs have demonstrated - a considerable on-off ratio with the capability of gate induced modulation of contact barrier. The atomically thin two-dimensional graphene has been the focus of intensive research as it offers high carrier mobilities in addition to high current delivery capability. Gate modulated Graphene contact is formulated using Non Equilibrium Greens function to include modeling of nano scale contacts. The simulator solves 2D Poisson equation self consistently with the equilibrium carrier statistics of the device using finite difference method. The interfacial charge is modeled. The contact resistance is computed using the non-equilibrium Green's function formalism, which rigorously models carrier injection from the graphene contact to the semiconductor channel by quantum-mechanical tunneling. We compared the behavior of Gate modulated Graphene contact with Metal Semiconductor contact's classical behavior. Depletion width of modeled device shows inverse square root dependence on doping density of channel as in Metal Semiconductor contacts. However the barrier height is not fixed as in Metal semiconductor contacts and can be modulated by over 200meV when the doping density is increased from $10^{17}/\text{cm}^3$ to $10^{20}/\text{cm}^3$. This behavior is attributed to the Graphene being a semi metal where its linear DOS relationship allows the barrier to be modulated. Gate modulation of barrier is also examined. However interfacial donor states are found to limit the gate modulation of graphene contact. If the interfacial state density becomes very high the barrier becomes essentially pinned at a smaller value and gate loses control over the barrier. This concludes to the fact that if the surface is made cleaner, barrier height increases and this can prove to be useful in decreasing the dark current by turning off the device more effectively. We also examined the effect of oxide thickness on electrostatics. Decreasing the oxide thickness helps to raise the gate modulation of the heterojunction barrier.

Affiliation: University of Florida

Name: Sampyo Hong

Time: 11:10

Email: likedew@physics.ucf.edu

Session: Modeling of Nanosctructures

Contributors: Altaf Karim, Talat Rahman

Occupation: Postdoc

Contact: Talat S. Rahman

Type: Oral

Title: Enhanced Reactivity and Selectivity of an Oxide Nanostructure

Abstract: RuO₂ (110) is a promising nanostructured surface consisting of linear arrays of under-coordinated Ru (Ru-cus) and O (O-bridge) atoms. Experiments find Ru-cus to be particularly reactive sites for a number of reactions. And in the case of ammonia oxidation, 100% selectivity towards NO or N₂ formation is obtained by controlling the O₂ pressure in the system. We have performed first principles electronic structure calculations on the selective oxidation of ammonia on RuO₂(110) based on the density functional theory (DFT) and the pseudopotential method to calculate the activation energy for the associated reaction processes, and used the DFT results in kinetic Monte Carlo (KMC) simulations of the reaction rates. We find that hydrogen bonding plays decisive role in the selective oxidation of ammonia on RuO₂(110) such that H abstraction reaction $\text{NH} + \text{OH}_x \text{ (} x=0,1 \text{)} \rightarrow \text{N} + \text{OH}_{x+1}$ are spontaneous and rapid reactions, and that intermediate products such as NH to be short-lived in agreement with experiment. We also find that the overall energy barrier for $\text{NH}_3 + \text{O} \rightarrow \text{NH} + \text{H}_2\text{O}$ is 0.55 eV with the reverse barrier of 0.26 eV, while that for $\text{N} + \text{N} \rightarrow \text{N}_2$, and $\text{N} + \text{O} \rightarrow \text{NO}$ to be 0.27 and 0.14 eV, respectively. For a simple model of the surface dominated by the two end reactions above, our KMC simulations show indeed almost 80% selectivity toward NO, in reasonable agreement with experimental findings. For more realistic simulation, in which we include several intermediates and their reactions (18 processes), we find NO desorption and N diffusion to be a rate-limiting process and about 95% selectivity toward NO, in excellent agreement with experiment, within the experimental temperature and O₂ pressure range.

Affiliation: University of Central Florida, Department of Physics

Name: Volodymyr Turkowski **Time:** 13:30
Email: vturkows@mail.ucf.edu **Session:** Modeling of Nanosstructures
Contributors: D. Le, S. Seal, S. Krishna, S. Mallik, M.K. Haldar, A. Gesquiere **Occupation:** Postdoc
Contact: Michael N. Leuenberger, Talat S. Rahman **Type:** Oral
Title: **Linker-induced increase of the visible photoluminescence of folic acid-conjugated titania nanoparticles**
Abstract: Our photoluminescence experiments on folic acid(FA)-conjugated TiO₂ nanoparticles demonstrate a dramatic increase of the photoemission intensity in the visible range (wavelengths between 500 to 700 nm) when the nanoparticles are coated with the 3-aminopropyltrimethoxylane (APTMS) linker/spacer molecule. This phenomenon can have a broad area of applications: from photovoltaic devices to nanomedicine. We demonstrate by using time-dependent density-functional theory approach that the large increase of the photoemission is due to enhanced optical transitions between the FA/APTMS and titania surface oxygen vacancy states. We present details of the geometric and electronic structure and excited states of our nanosystems and their dependence on the characteristics of the nanoparticle. This work demonstrates how molecular linkers can be used to manipulate the electronic and optical properties of nanosystems. We discuss possible optoelectronic applications for this effect.
Affiliation: University of Central Florida, Department of Physics, Nanoscience Technology Center

Name: Ivan Mikhaylov **Time:** 14:00
Email: ivan.mikhaylov@gmail.com **Session:** Modeling of Nanosstructures
Contributors: **Occupation:** Postdoc
Contact: Artëm E. Masunov **Type:** Oral
Title: **Computational design of two-photon absorbing materials**
Abstract: One- and two-photon absorption (2PA) properties of a new fluorene derivative with diphenylamino and 2-(2'-hydroxyphenyl)benzothiazole substituents were investigated theoretically using the TDDFT approach with different types of functionals. An effect of the Hartree-Fock exchange fraction in hybrid functionals on the 2PA spectrum was analyzed. The best agreement between theoretical and experimental data was obtained with a user defined derivative of the standard M05 functional where fraction of Hartree-Fock exchange was increased in 1.25 times. This functional was used for analysis of Kohn-Sham orbitals of the studied compound and prediction of 2PA spectra for some chemical modifications which were suggested to increase the 2PA cross section.
Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Giridhar Nandipati **Time:** 14:20
Email: giri_nani@hotmail.com **Session:** Modeling of Nanosstructures
Contributors: Yunsic Shim, Jacques G Amar, Altaf Karim, Abdelkader Kara, Talat S.Rahman and Oleg. Trushin **Occupation:** Postdoc
Contact: Talat S. Rahman **Type:** Oral
Title: **Parallel kinetic Monte Carlo simulations of Ag(111) island coarsening using a large database**

Abstract: The results of parallel kinetic Monte Carlo (KMC) simulations of the room-temperature coarsening of Ag(111) islands carried out using a very large database obtained via self-learning KMC simulations are presented. Our results indicate that, while cluster diffusion and coalescence play an important role for small clusters and at very early times, at late time the coarsening proceeds via Ostwald ripening, i.e. large clusters grow while small clusters evaporate. In addition, an asymptotic analysis of our results for the average island size $S(t)$ as a function of time t leads to a coarsening exponent $n = 1/3$ in good agreement with theoretical predictions. However, by comparing with simulations without concerted (multi-atom) moves, we also find that the inclusion of such moves in our database significantly increases the average island size. Somewhat surprisingly we also find that, while the average island size increases significantly during coarsening, the scaled island-size distribution does not change significantly. Our simulations were carried out both as a test of, and as an application of, a variety of different algorithms for parallel kinetic Monte Carlo including the recently developed optimistic synchronous relaxation (OSR) algorithm as well as the semi-rigorous synchronous sublattice (SL) algorithm. A variation of the OSR algorithm corresponding to optimistic synchronous relaxation with pseudo-rollback (OSRPR) is also proposed along with a method for improving the parallel efficiency and reducing the number of boundary events via dynamic boundary allocation (DBA). A variety of other methods for enhancing the efficiency of our simulations are also discussed. We note that, because of the relatively high temperature of our simulations, as well as the large range of relevant energy barriers present in the database (ranging from 0.05 to 0.8 eV), developing an efficient algorithm for parallel KMC and/or SLKMC simulations is particularly challenging. However, by using DBA to minimize the number of boundary events, we have achieved significantly improved parallel efficiencies for the OSRPR and SL algorithms. Finally, we note that, among the three parallel algorithms which we have tested here, the semi-rigorous SL algorithm with DBA led to the highest parallel efficiencies. As a result, we have obtained reasonable parallel efficiencies in our simulations of room-temperature Ag(111) island coarsening for a small number of processors (e.g. $N_p = 2$ and 4). Since the SL algorithm scales with system size for fixed processor size, we expect that comparable and/or even larger parallel efficiencies should be possible for parallel KMC and/or SLKMC simulations of larger systems with larger numbers of processors.

Affiliation: University of Central Florida

Name:	Syed Islamuddin Shah	Time:	14:40
Email:	islamuddinn@yahoo.com	Session:	Modeling of Nanostructures
Contributors:	Oleg Trushin, Abdelkader Kara, and Talat S. Rahman	Occupation:	Graduate Student
Contact:	Talat S. Rahman	Type:	Oral

Title: Crossover from concerted motion to periphery diffusion for Cu clusters on Cu(111): application of an Off Lattice SLKMC*

Abstract: The "off-Lattice" Self-Learning Kinetic Monte Carlo (SLKMC) technique combines the ideas embedded in the SLKMC method with a new pattern recognition scheme fitted to an Off-Lattice model in which relative atomic positions is used to characterize and store configurations. Application of a combination of the "drag" and the Repulsive Bias Potential (RBP) methods for saddle point searches allows the treatment of concerted, multiple atoms and single atom motions on equal footing. This tandem approach has helped us reveal several new atomic mechanisms, involving multiple atoms, which contribute to cluster migration. We present applications of this Off-Lattice SLKMC to the diffusion of 2D islands of Cu on Cu(111), using interatomic potential from the Embedded Atom Method. Results for the diffusion on Cu(111) of Cu clusters containing 3 to 16 atoms, at three different temperatures 300, 500 and 700K, will be presented. Long time simulations (10 million KMC steps) show a trend in crossover from concerted motion to periphery diffusion for clusters containing more than 12 atoms. We compare this result and those for calculated effective energy barriers and diffusion constants with those obtained by the SLKMC method[1]. [1] A. Karim et al. Phys. Rev. B 73, 165411 (2006) *This work was supported in part by NSF-ITR grant 0840389

Affiliation: University of Central Florida, Department of Physics

Name:	Scott Perry	Time:	14:00
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Email: ssp@mse.ufl.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Joelle M. Payne, F. T. Limpoco, Natalia V. Dolgova, Benjamin G. Keselowsky, W. Gregory Sawyer **Occupation:** Faculty
Contact: Scott S. Perry **Type:** Oral
Title: **Nanomechanical Probes of Single Corneal Epithelial Cells: Shear Stress and Elastic Modulus**
Abstract: Living human corneal epithelial cells have been probed in vitro via atomic force microscopy, revealing the frictional characteristics of single cells. Under cell media, measured shear stresses of 0.40 kPa demonstrate the high lubricity of epithelial cell surfaces in contact with a microsphere probe. The mechanical properties of individual epithelial cells have been further probed through nanometer scale indentation measurements. A simple elastic foundation model, based on experimentally verifiable parameters, is used to fit the indentation data, producing an effective elastic modulus of 16.5 kPa and highlighting the highly compliant nature of the cell surface. The elastic foundation model is found to more accurately fit the experimental data, to avoid unverifiable assumptions, and to produce a modulus significantly higher than that of the widely used Hertz-Sneddon model.

Affiliation: University of Florida

Name: Brian Schanen **Time:** 14:30
Email: bschanen@mail.ucf.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Ajay S. Karakoti, Don Drake III, Sudipta Seal, William Self **Occupation:** Graduate Student
Contact: Brian Schanen **Type:** Oral
Title: **Titanium Dioxide Nanomaterials Exposure Provokes Inflammation of an in Vitro Human Immune Construct**
Abstract: Nanoparticle technology is undergoing significant expansion largely because of the potential of nanoparticles as biomaterials, drug delivery vehicles, cancer therapeutics, and vaccine adjuvants. Incorporation of nanoparticle technologies for in vivo applications increases the urgency to characterize nanomaterial immunogenicity. Here, we have synthesized titanium dioxide, one of the most widely manufactured nanomaterials, into its three most common nanoarchitectures: anatase (7-10 nm), rutile (15-20 nm), and nanotube (10-15 nm diameters, 70-150 nm length). The fully human autologous MIMIC immunological construct has been utilized as a predictive, non-animal alternative to diagnose nanoparticle immunogenicity. Cumulatively, treatment with titanium dioxide nanoparticles in the MIMIC system led to elevated levels of proinflammatory cytokines and increased maturation and expression of costimulatory molecules on dendritic cells. Additionally, these treatments effectively primed activation and proliferation of naive CD4-T cells in comparison to dendritic cells treated with micrometer-sized (>1 μ m) titanium dioxide, characteristic of an in vivo inflammatory response. Future directions for this study include characterization of nanoparticle features that may contribute to activation of the inflammasome pathway. Defining these features may allow for the development of smart adjuvants capable of inducing protective immunity without instigating inflammation.

Affiliation: University of Central Florida

Name: Nadia Silvestry Rodriguez **Time:** 14:50
Email: nadia.silvestry-rodriguez-1@nasa.gov **Session:** Nanobiotechnology/Nanomedicine
Contributors: Michael S. Roberts **Occupation:** Postdoc
Contact: Nadia Silvestry Rodriguez **Type:** Oral
Title: **Disinfection of MS2-Bacteriophage in Water with UV-Led Enhanced by TiO₂ and Nanosilver**

Abstract: Ultraviolet lamps that generate UV light through the vaporization of elemental mercury are an effective, if inefficient, means to disinfect water. However, these lamps cannot be used in a closed environment due to the potential release of mercury in the event of bulb breakage. The recent development of semiconductor-based, solid-state lighting systems (light emitting diodes or LEDs) to generate UV light eliminates the need for mercury arc lamps, and promises to increase thermal, power, and lighting efficiency. The objective of this research is to verify the disinfection efficiency of UVA-LEDs in combination with TiO₂ and nanosilver to maintain water quality for earth and space applications. A drip flow reactor (BioSurface Technologies Corp., Bozeman, MT USA) design was modified to operate as a re-circulating potable water system with UV-A LEDs (250mW, $\lambda_{max}=365nm$) mounted in UV-resistant, polyethylene attached to cord-printed, circuit board heat sinks. A titania catalyst (TiO₂, Sigma Aldrich) was immobilized on borosilicate glass slides and mounted at the base of the reactor channel. Nanosilver particles, average particle size <100 μm , were purchased from Sigma-Aldrich and added to the test reactor at a concentration of 100 ppb. Sterile, type 2 reagent-grade water was inoculated with bacteriophage MS-2 (ATCC# 15597-B1) and re-circulated through the reactor at a constant flow rate in an environmental control chamber with set points of 25°C, 300 ppm CO₂, and constant dark cycle for disinfection challenge testing. Control treatments received no UV-A LED irradiation while all photocatalytic treatments received constant UV-A LED irradiation. Two additional photocatalytic treatments contained approx. 100 ppb of nanosilver. Replicate experiments were conducted over a period of 3 hours with microbiological sampling of the water at multiple time points to quantify bacteriophage viability in response to contact time with UV-A, photocatalyst, and/or nanosilver. Each treatment and control sample was processed for quantitative detection of MS-2 using the double agar overlay assay method with multiple dilutions and duplicate assay plates for each individual dilution. Negative viral controls contained the host bacterium without addition of bacteriophage MS-2 and positive viral controls were inoculated with the MS-2 viral suspension used to inoculate the reactor test chambers at the start of testing. The reduction equivalent dose of bacteriophage MS-2 upon exposure to UV-A LED, UV-A LED and TiO₂, UV-A LED and nanosilver, UV-A LED in combination with TiO₂ and nanosilver each resulted in several log units of viral reduction >5 log. The log reduction was sufficient to meet US EPA standards as a secondary disinfectant for maintaining water quality control. Based on the preliminary results reported here, there is no synergistic disinfection effect of UVA-LED irradiation, TiO₂, and nanosilver at the conditions tested; where the UVA-LED is doing all the disinfection and no addition of other disinfectants is needed. Additional microorganisms, water turbidity and probably other concentrations of nanosilver will be tested in future experiments with optimized reactor designs to comply with international water quality standards.

Affiliation: ORAU/NASA

Name:	Charalambos Kaittanis	Time:	15:10
Email:	ckaittan@mail.ucf.edu	Session:	Nanobiotechnology/Nanomedicine
Contributors:	S. Nath, J. M. Perez	Occupation:	Graduate Student
Contact:	C. Kaittanis	Type:	Oral
Title:	Iron oxide nanoparticles monitoring metabolic activity and drug resistance		

Abstract: Development of antibiotic resistance by microorganisms has been on the rise in recent years. Therefore, identifying drug resistant strains and effective antibiotic agents is critical. Traditional microbiological methods assess antimicrobial susceptibility within 24 to 48 hours, whereas optical nanoparticle-based methods cannot be used in opaque media. Hence, we have developed a nanoparticlebased antimicrobial susceptibility assay, utilizing Concanavalin A-conjugated iron oxide nanoparticles. When the bacteria do not grow, the changes in the solution's T₂ relaxation times are proximal to those of the sterile medium. On the other hand, when the bacteria grow, the levels of free carbohydrates decrease, thus the changes in the T₂ times are significantly higher than those of the sterile medium. The iron-oxide-nanoparticle-based antimicrobial susceptibility assay (i) monitors bacterial metabolism, (ii) provides results within 2 hours, (iii) determines the minimum effective antibiotic concentration with sensitivity comparable to those of the gold standard methods, and (iv) determines antimicrobial susceptibility in biological fluids, such as blood.

Affiliation: University of Central Florida

Name: Qun Huo **Time:** 16:30
Email: qhuo@mail.ucf.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Qun Huo **Occupation:** Faculty
Contact: Qun Huo **Type:** Oral
Title: **NanoDLSay: A New Platform Technology for Biomolecular Detection and Analysis using Gold Nanoparticle Probes Coupled with Dynamic Light Scattering**

Abstract: Analytical tools for biomolecular detection and interaction study are critical for biomolecular research. An ideal analytical technique should meet a well known 4-S rule: have high Sensitivity, high Specificity, is Simple to use, and uses a Small volume of samples. However, techniques that meet all these criteria are very rare. Based on the unique optical property of gold nanoparticles, we recently developed a low cost, highly sensitive and extremely easy-to-use analytical technique, NanoDLSay, for biomolecular detection and analysis. Gold nanoparticles scatter light strongly at or near their surface plasmon resonance wavelength region, and can be detected by DLS with extremely high sensitivity. To conduct a biomolecular assay, a layer of "baiting" protein is conjugated to gold nanoparticles to form a light scattering probe. When target proteins bind to the nanoparticle surface through specific interactions, this will cause nanoparticle size increase or nanoparticle aggregation. Such a particle size increase or particle aggregation can be easily measured by dynamic light scattering (DLS), and correlated to analyte concentration. So far we have demonstrated that NanoDLSay can be used for numerous applications including: (1) Direct monitoring of gold nanoparticle bioconjugation process, characterizing the GNP bioconjugate quality and stability; (2) In situ monitoring and study of protein-protein interaction; (3) Immunoassay for protein biomarker detection; (4) DNA detection; (5) Monoclonal antibody isotyping, quality and affinity analysis. NanoDLSay offers several incomparable advantages over traditional immunoassay and other state-of-the-art bioanalytical techniques: NanoDLSay has the potential to replace traditional immunoassay technologies and Surface Plasmon Resonance (SPR) technique to become the next generation most powerful analytical techniques for biomolecular detection, analysis and interaction study.

Affiliation: University of Central Florida

Name: Ajoy Saha **Time:** 17:00
Email: aksaha@erc.ufl.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Parvesh Sharma, Scott Brown **Occupation:** Graduate Student
Contact: Brij Moudgil **Type:** Oral
Title: **Synthesis and Characterization of Visible-NIR Light Emitting Hydrothermal Quantum Dots with High Quantum Yield**

Abstract: Water dispersible alloyed CdTeS quantum dots have been synthesized by the hydrothermal technique with non-toxic NAC as the stabilizer. The quantum dots have fluorescence in the visible-NIR (530-750 nm) wavelength range and exhibit high photoluminescence quantum yield (47%). The size of the quantum dots vary within 3-5 nm. Due to their excellent water dispersability and NIR emission these quantum dots can be used for bioimaging and metal ion sensing. Synthesis and characterization of quantum dots with core-shell CdTeS/CdS structure and magnetic quantum dots with dopants Mn, Fe will be discussed.

Affiliation: University of Florida

Name: Sanjay Singh **Time:** 17:20
Email: sansingh@mail.ucf.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Amit Kumar, Ajay Karakoti, Suzanne Hirst, Christopher Reilly, Sudipta Seal, **Occupation:** Postdoc
William T. Self

Contact: Sanjay Singh **Type:** Oral
Title: Uptake and Sub-cellular Localization of Ceria Nanoparticles
Abstract: Ceria nanoparticles (CNPs) have been gaining attention and being studied for their intrinsic free radical scavenging properties in various cell lines and animal models. Several reports have shown that CNPs protect against radiation exposure, laser induced damage, spinal injury, cardiovascular and other inflammatory diseases. Recent findings invitro also have indicated CNPs have the potential to mimic the biological superoxide dismutase enzyme and exhibit peroxidase activity. Despite these exciting biological applications of CNPs, so far little is known regarding cellular uptake and further subcellular localization. In this study, we seek to understand the mechanism of cellular uptake of these nanoparticles and their subsequent subcellular localization using a keratinocyte cell model system (HaCat) in defined culture medium. To track CNPs at the sub cellular level, we conjugated these particles with a fluorescent molecule, carboxyfluorescein, having a sharp emission at 520 nm. The carboxyfluorescein coated CNPs (CCNPs) were found to be stable and biocompatible when used in cell culture. Based on selected inhibitors, it was found that the uptake of CCNPs is a complex process and controlled mainly by energy dependent, clathrin and caveolae mediated endocytic pathways. Further, subcellular localization studies revealed the presence of CCNPs in mitochondria, lysosomes and endoplasmic reticulum. Interestingly, nanoparticles were taken up rapidly (3h) and evenly distribute in cytoplasm and nucleus. Given their radical scavenging properties, the widespread and evenly cellular distribution of these particles suggest this nanomaterial could be a potential antioxidant for experimental studies or even clinical use in the future.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Parvesh Sharma **Time:** 17:40
Email: psharma@perc.ufl.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Scott C. Brown, Amit Singh, Iwakuma Nobutaka, Niclas Bengtsson, Georgios Pyrgiotakis, Vijay Krishna, Edward W. Scott, Glenn A. Walter, Stephen R. Grobmyer, Qizhi Zhang, Huabei Jiang, Swadeshmukul Santra and Brij M. Moudgil **Occupation:** Postdoc

Contact: Parvesh Sharma **Type:** Oral
Title: Multifunctional Gold Speckled Silica Nanoparticles for Theranostics
Abstract: Nanotechnology offers promise for the development of novel materials that can be readily employed in modest clinical settings to afford broad access to new highly effective, safe and less expensive detection and treatment paradigms. Herein we present the synthesis, characterization and functional evaluation of multimodal contrast agent for non-invasive imaging through magnetic resonance imaging (MRI), photo acoustic tomography (PAT), and near infrared (NIR) optical tomography. The multifunctional gold speckled silica nanoparticles, ranging from 50 to 200 nm have been prepared using microemulsions. While the MR contrast from these nanoparticles originates from the incorporation of paramagnetic Gd, the presence of irregular, discontinuous, gold nanoparticles speckled on the silica surface generate the PAT signal. Combination of NIR imaging and laser thermal ablation provides novel approach to track homing/therapeutic ability of engineered nanoparticulates in real time in in vivo systems. The imaging and therapeutic functional ability of these novel nano-constructs would be presented in in-vitro and in-vivo experiments.

Affiliation: University of Florida

Name: Christina Termini **Time:** 10:00
Email: christina.termini@gmail.com **Session:** NanoEducation
Contributors: Angela Camp **Occupation:** Undergraduate Student
Contact: Kurt Winkelmann **Type:** Oral
Title: Application-Centered Nanotechnology Experiments for First-Year Students

Abstract: Two new experiments are being developed for an introductory nanotechnology laboratory. (1) Nanocomposites are both lightweight and strong materials that are used in many structural applications. Students prepare polymethylmethacrylate containing aluminum oxide nanoparticles and measure the nanocomposite's flexural stress-strain properties. Results indicate that low concentrations of nanoparticles in the polymer provide the greatest mechanical improvement while higher concentrations are not as beneficial. Students learn why this occurs and are asked to consider the possible advantages and disadvantages of nanocomposites compared to the pure polymer or other structural materials. (2) Silver nanoparticles are known to be effective antibacterial agents and are used in a variety of commercial products. Students prepare silver nanoparticles using various chemical synthetic methods and add them to bacteria cultures. Optical absorbance measurements show which silver nanoparticles are most effective at preventing bacteria growth, based on the cloudiness of the solution. Students learn the various theories that attempt to explain the antibacterial effectiveness of silver nanoparticles.

Affiliation: Florida Institute of Technology

Name:	Qi Zhang	Time:	10:30
Email:	qizhang@mail.ucf.edu	Session:	NanoEducation
Contributors:	Kirk Scammon, Mikhail Klimov and Karen Glidewell	Occupation:	Faculty
Contact:	Qi Zhang	Type:	Oral

Title: Structural and Spectroscopic Characterization of Nanoscale Feature

Abstract: Synthesis, properties, characterization and applications are becoming indispensable processes in materials science and engineering. Materials Characterization Facility (MCF) at Advanced Materials Processing and Characterization Center (AMPEC), University of Central Florida, provides full capacity to characterize nanoscale feature for nanomaterials and nanodevices structurally and spectroscopically. Scanning electron microscopy (SEM) with secondary electron detector, backscattered electron detector and scanning transmission electron microscopy (STEM) detector, and with attached X-ray energy dispersive spectroscopy (EDS), characterizes the morphology, surface structure, crystallographic structure and chemical composition. By applying different techniques, such as diffraction contrast imaging, mass-thickness contrast imaging, phase contrast imaging, selected area electron diffraction (SAED), nanobeam electron diffraction (NBD) and convergent beam electron diffraction (CBED), and combining with electron energy-loss spectroscopy (EELS) and EDS, transmission electron microscopy (TEM) with STEM yields full understanding on morphology, microstructure, surface structure, crystallography, atomic configuration, sample thickness, chemical composition and electronic structure from nanoscales to subnanoscales. Moreover, in-situ TEM observation interprets the characterization dynamically and comprehensively. Meanwhile, scanning probe microscopy (SPM), including atomic force microscopy (AFM) and scanning tunneling microscopy (STM), features electronic structure and surface configuration in atomic level non-destructively. With different sources, analytical spectroscopic techniques, consisting of X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), Rutherford Backscattering spectroscopy (RBS), secondary ion mass spectrometry (SIMS), X-ray powder diffraction (XRD) and Raman spectroscopy, identify the crystal structure, texture, surface structure, electronic structure, elements depth profile, chemical composition qualitative and quantitatively.

Affiliation: University of Central Florida, MCF/AMPAC

Name:	Ruey-Hung Chen	Time:	10:05
Email:	chenrh@mail.ucf.edu	Session:	Nanomaterials for Energy
Contributors:	Phuoc X. Tran, Donald Martello	Occupation:	Faculty
Contact:	Ruey-Hung Chen	Type:	Oral

Title: Effects of Nanoparticles on Nanofluid Droplet Evaporation

Abstract: Nanoparticles of laponite, Fe₂O₃ and Ag added to deionized water (DW) are shown to change the evaporate rate of the prepared nanofluids. While laponite and Fe₂O₃ are commercially available, the Ag-nanofluid was prepared using pulsed laser ablation on the metal target submerged in the liquid (laser ablation in liquid, or LAL). The results show that these nanofluid droplets evaporate at different rates (as indicated by the evaporation rate constant K in the well known d² law $d^2 \propto t$ the slope of the d² vs. time plot) from the base fluid. In the case of laponite, the K value is slightly smaller than that of the base fluid. For a given droplet as the evaporation proceeds, the particle concentration increases, accompanied by a decreases in the value of K. During the droplet lifetime, the K values of Ag□DW, Ag□(DW+1%PVP) and Fe₂O₃□(DW+1%PVP) nanofluids goes through a transition from one value to another, further demonstrating the effect of increasing nanoparticle concentration on slowing down droplet evaporation. Since the K value is closely related to the latent heat of vaporization (h_{fg}), the decrease/increase in K/h_{fg} can help conserve the needed liquid quantity in phase change applications.

Affiliation: University of Central Florida, MMAE Department

Name: Jianhua Liu **Time:** 10:40
Email: jialiu@mail.ucf.edu **Session:** Nanomaterials for Energy
Contributors: Jianhua Liu, Mohammad Arif, Jianhua Zou, Saiful I. Khondaker **Occupation:** Postdoc
Contact: Lei Zhai **Type:** Oral
Title: **Understanding Reigoregular Poly(3-hexylthiophene) Crystallization Using Flexible Semicrystalline Polymer Crystallization Theory**

Abstract: P3HT crystallization is systematically investigated guided by traditional semicrystalline polymer crystallization theory through a solution crystal method. Molecular weight dependence of chain folding and temperature determined fold length, which are typical behavior presented in flexible polymer crystals, are observed in P3HT one-dimensional (1D) nanowhiskers formed in dilute solutions. 1D nanowhiskers with fully extended polymer chains can further grow into two-dimensional (2D) nanoribbon with increased P3HT concentration. Nanowhiskers with folded chains can not form 2D nanoribbons because the poorly-defined surfaces that inhibit the further growth. Such solution method provides a simple way to understand the crystallization nature of P3HT as well as other conductive polymers.

Affiliation: University of Central Florida

Name: Yan Hong **Time:** 11:05
Email: yahong@mail.ucf.edu **Session:** Nanomaterials for Energy
Contributors: Shujiang Ding, Ming Su **Occupation:** Graduate Student
Contact: Yan Hong **Type:** Oral
Title: **High Performance Nanofluids with Encapsulated Phase Change Nanoparticles as Thermally Functional Additives**

Abstract: Silica encapsulated metallic phase change nanoparticles are added in single phase poly- α -olefin (PAO) fluid to make nanofluid with enhanced dielectric and thermophysical properties. During the solid-liquid phase transitions, nanoparticles absorb heat energy, and silica shell enhances the dielectric property of the nanofluid. In the case of 9% silica encapsulated indium nanoparticles, the heat transfer coefficient is 26% higher than that of PAO at the flow rate of 210 ml/min and temperature of 152 °C; and the dielectric constant measured at 1 kHz is 32% higher (from 1.45 to 1.92) after encapsulation. The high heat capacity and excellent dielectric property, combined with the high thermal conductivity as a result of adding nanoparticles, allow direct immersion cooling of high temperature electronic devices.

Affiliation: University of Central Florida

Name: David Wei **Time:** 14:10

Email: wei@chem.ufl.edu

Contributors:

Contact: David Wei

Title: Energy Transfer on Multisegmented Nanowires

Abstract: Energy transfer has been observed from a gold nanodisk pair to a silver nanowire across a 120 nm gap via surface plasmon resonance (SPR) excitation. The enhanced electromagnetic (EM) fields generated by the Au SPR excitation induce the oscillation of conduction electrons from the Ag segment and transfer energy to it, even though the Ag SPR is not in resonance with the incident electromagnetic radiation. The induced Ag SPR couples with the SPR from the Au disk pair to produce strong EM fields at their junction, and leads to a Raman signal 15 times greater than with the Ag alone. The nonlinear power dependence of the Raman intensity suggests that stimulated Raman scattering and multiple plasmon resonance excitations can be important for this gold/silver energy transfer.

Affiliation: University of Florida, Department of Chemistry

Session: Nanomaterials for Energy

Occupation: Faculty

Type: Oral

Name: Justin Hill

Email: jhill@che.ufl.edu

Contributors: Kelly Haller, Nick Banks

Contact: Kirk J. Ziegler

Title: Dye Sensitized Solar Cells with Core/Shell Nanowire Array Based Photoanodes: Modeling, Fabrication & Performance.

Abstract: Dye sensitized solar cells (DSCs) are one of the most actively researched and promising devices for photoelectrochemical energy conversion. Already boasting relatively high efficiencies, low cost materials and fabrication, DSCs still hold the potential for further improvement. With the aim of maintaining low material and fabrication costs, a great deal of effort is focused toward materials and device design to improve charge generation, interfacial transfer and transport, as well as increased overall power output. Traditional DSCs, based on nanocrystalline photoanodes, provide excellent high surface area scaffolding to maximize photon collection and charge generation, but do not utilize electric field induced migration of charge transport. Solely relying on diffusive transport to carry charge, traditional DSCs must employ an electrolyte that minimizes interfacial electron back reactions, limiting the electrolyte choice and subsequent output voltage. Furthermore, the diffusive transport limits the photoanode thickness due to the fixed electron lifetime within the semiconductor. Here we present a method of fabricating semiconductive shell and conductive core nanowire array photoanodes designed to enhance charge transport within the semiconductor and electrolyte. The approach decouples the dependence between photoanode thickness and charge transport distance to the charge collector allowing photoanode surface area to be increased beyond traditional DSC limits. While multiple models describe interfacial charge transfer dynamics of DSCs, none adequately describe charge transport and potential distributions in these new DSC devices. As a means to optimize experimental parameters and better understand interfacial charge transfer and bulk charge transport dynamics, a new model was developed to account for new kinetic and electrostatic driving forces. Experimental and theoretical results will be presented to elucidate the specific photoanode parameters that optimize device performance.

Affiliation: University of Florida, Department of Chemical Engineering

Time: 14:40

Session: Nanomaterials for Energy

Occupation: Graduate Student

Type: Oral

Name: Edward McCumiskey

Email: e.mccumiskey@ufl.edu

Contributors: Edward J. McCumiskey, Natarajan Chandrasekhar

Contact: Curtis R. Taylor

Title: Mechanical Characterization of CdSe Quantum Dot / MEH-PPV Polymer Nanocomposite Thin Films using Nanoindentation

Time: 10:10

Session: Nanophotonics and Nanoelectronics

Occupation: Graduate Student

Type: Oral

Abstract: We present the mechanical characterization of nanocomposite thin films containing CdSe quantum dots (QDs) and the electroluminescent polymer MEH-PPV. There has been an increasing interest in the development of organic electronics made with MEH-PPV and similar polymers, for products such as low cost rollable solar cells and high efficiency light emitting diodes. When blended with nanocrystal QDs, MEH-PPV devices have demonstrated enhanced functionality due to increased photoconversion efficiencies and improved charge separation and transport. QDs are semiconducting nanostructures whose band gaps depend on their size and shape, thereby giving them tunable electrical and optical properties. There have been numerous theoretical and experimental studies of QD-polymer electrical and optical properties. However, very little is known about the mechanical properties of QD-polymer nanocomposites and devices. In this presentation, we take a first step toward investigating the mechanical properties of CdSe QD / MEH-PPV polymer thin films as a function of QD loading. QD-polymer films are prepared via spin-coating mixtures onto glass slides. QD dispersion and film uniformity are critical for accurate mechanical measurements. These are verified using transmission electron microscopy (TEM) and atomic force microscopy (AFM), respectively. Nanoindentation is used to characterize the elastic modulus, hardness, and viscoelastic creep of the nanocomposite films. The incorporation of QDs in MEH-PPV increases the modulus and hardness by factors up to four and five, respectively, while suppressing the material's viscoelastic response.

Affiliation: University of Florida

Name:	Mohammad Arif	Time:	10:30
Email:	maarif@mail.ucf.edu	Session:	Nanophotonics and Nanoelectronics
Contributors:	Mohammad Arif , Jianhua Liu, Lei Zhai	Occupation:	Postdoc
Contact:	Saiful I. Khondaker	Type:	Oral
Title:	Low molecular weight poly (3-hexylthiophene) crystalline nanoribbons for high performance organic field effect transistors		

Abstract: In order to fabricate high performance devices with enhanced morphology for improved charge carrier transport, one (1D) and two dimensional (2D) crystalline nanostructures based on self organized P3HT in the form of nanowires, and nanofibres are creating significant interest for next generation optoelectronic devices. In this work we report on the fabrication of organic field effect transistors (FETs) using low molecular weight poly (3-hexylthiophene) (P3HT) crystalline nanoribbons with different surface treatments. Selective area electron diffraction pattern of P3HT indicates 2D crystalline nature of the nanoribbon. Device fabricated from a network of nanoribbon using drop cast method in bottom contact geometry with different surface treatment show p-type behavior with a maximum saturation mobility of 0.012 cm²/Vs and current on/off ratios of 6.5x10⁴. The mobility of single nanoribbon FETs show as high as 0.1 cm²/Vs. The charge carrier mobility and current on/off ratios show little effect on surface treatment indicates the presence of unique two dimensional crystalline nanoribbon at the dielectric interface. In contrast, our controlled experiment with the same molecular weight P3HT thin film FET, but not in nanoribbon format, show two orders of magnitude variations on charge carrier mobility with similar surface treatments. This study demonstrates the potential application of P3HT nanoribbon for organic nanoelectronics.

Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Physics

Name:	Patrick Mickel	Time:	10:50
Email:	mickel@phys.ufl.edu	Session:	Nanophotonics and Nanoelectronics
Contributors:	Patrick Mickel, Guneeta Singh-Bhalla, Sefaatin Tongay, Amlan Biswas, and A. F. Hebard	Occupation:	Graduate Student
Contact:	Patrick Mickel	Type:	Oral
Title:	Distinguishing the competing dielectric phases in thin film manganites		

Abstract: Mixed-valence manganites exhibit a rich variety of crystallographic, electronic, and magnetic phases that compete in phase-separated ground states. In thin films ($d < 100\text{nm}$), the strain/stress induced from a mismatched substrate has been shown to suppress/stabilize these phases, erasing their signature from standard characterization techniques. We report a new dielectric analysis that detects the suppressed charge-ordered-insulating phase in thin films of $\text{La}_{1-y}\text{Pr}_y\text{Ca}_{0.33}\text{MnO}_3$. Analyzing the dielectric response in terms of a parallel component model enables the simultaneous determination of the individual time-scales, broadenings, and relative amplitudes of the paramagnetic-insulating and charge-ordered-insulating phases. The model is applied over a broad temperature range, extracting activation energies, and revealing the individual phase-transition temperatures of each phase.

Affiliation: University of Florida

Name:	Kenneth Knappenberger	Time:	11:10
Email:	klk@chem.fsu.edu	Session:	Nanophotonics and Nanoelectronics
Contributors:		Occupation:	Faculty
Contact:	Kenneth L. Knappenberger, Jr.	Type:	Oral
Title:	Achieving Electronic Coupling Enhancement with Tunable Plasmon-Supporting Hollow Gold Nanoparticles: Insights from Femtosecond Transient Absorption and FDTD simulations.		

Abstract: Electronic relaxation and interparticle electromagnetic coupling processes in hollow gold nanoparticles (HGNs) and HGN arrays will be described. These plasmon-tunable HGNs exhibit an unexpected, but systematic, blue shift of the surface plasmon resonance spectral position when the particles are assembled in arrays. Femtosecond transient absorption measurements and Finite-Difference Time-Domain Calculations will be used to demonstrate that this blue shift is the result of delocalization of the Fermi-gas over multiple particles, an effect not observed with solid spherical particles. The ultrafast electron-phonon coupling lifetimes for the thin-shelled HGNs increase for an array, indicating significant enhancement in interparticle electromagnetic coupling. For instance, a 35-nm HGN with a shell thickness of 5-nm shows ultrafast electron-phonon coupling with a lifetime of 300 - 100 fs, and upon aggregation, this lifetime increases to 730 - 100 fs. It will be shown that interparticle coupling efficiency can be tailored by controlling the aspect ratio of HGNs. The experimental data strongly suggest that confinement effects in HGNs allow for enhanced energy transport over nanometer distances and this effect can be applied to developing more efficient devices, including photovoltaics.

Affiliation: Florida State University, Department of Chemistry

Name:	Paul Stokes	Time:	13:40
Email:	pstokes26@gmail.com	Session:	Nanophotonics and Nanoelectronics
Contributors:		Occupation:	Graduate Student
Contact:	Saiful I. Khondaker	Type:	Oral
Title:	Evaluation of surfactant free commercial carbon nanotube solution for directed assembly of nanoelectronic devices		

Abstract: Solution processing of carbon nanotubes (CNTs) for nanoelectronic devices is becoming an increasingly important class of technology due to the ease of processing, the ability to cover large areas, cost efficiency, and compatibility with a variety of different substrates. It is generally believed that solution processing techniques can degrade the intrinsic electrical properties of CNTs and could limit their application in nanoelectronic devices. However, the degree of degradation can depend heavily on the aggressiveness of the purification process. Here, we report on the electrical characterization and improved device quality of individual solution processed CNTs assembled by AC dielectrophoresis (DEP) from a commercial surfactant free solution. By controlling the concentration of CNTs in the solution we are able to reproducibly tune the number of CNTs between palladium source and drain electrodes from dense arrays mimicking the electric field lines to individual CNTs. The room temperature electronic measurements on individual CNT devices show contact resistances as low as 33 k Ω , transconductance and field effect mobilities as high as 1.8 μS and 1000 cm^2/Vs respectively for semiconducting CNTs, and saturation currents up to ~ 15 μA for metallic CNTs. Raman spectroscopy done on individual CNT devices show the absence of D-band. At low temperatures the electronic transport measurements reveal periodic Coulomb Blockade oscillations as a function of gate voltage indicating single quantum dot behavior. We present single electron transport spectroscopy where we observe well defined Coulomb diamonds and modeled the observed behavior using a single electron transistor simulator. These results indicate that there may be fewer defects in solution processed CNTs than expected and shows promise for them to be effective for the large scale fabrication of high quality CNT devices.

Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Physics

Name: Denis Kitenge **Time:** 14:00
Email: dkitenge@mail.usf.edu **Session:** Nanophotonics and Nanoelectronics
Contributors: Denis Kitenge, Rakesh K. Joshi, Makoto Hirai and Ashok Kumar **Occupation:** Graduate Student
Contact: Denis Kitenge **Type:** Oral
Title: **Nanostructured Silver Films for Surface Plasmon Resonance**
Abstract: We report the room temperature detection of carbon monoxide (CO) and hydrogen (H₂) by nanostructured silver films via surface plasmon resonance (SPR) phenomena. Thin films of Ag and yttrium stabilized zirconia (YSZ): Ag were prepared by Pulsed Laser Deposition (PLD) method. Films were characterized by XRD and atomic force microscopy. CO and H₂ are selected as the target gases for the YSZ: Ag films and the sensor characteristics are compared. Sensitivity was estimated by percent change in wavelength for SPR band peak. The nanostructured films were tested for different concentration of CO (100 to 1000 ppm) and hydrogen (1 to 10%). The sensors were also tested for the cross selectivity of the gases. The sensors have a detection limit of 100 ppm for CO and also show a noticeable signal for hydrogen in the concentration range as low as 1 %.

Affiliation: University of South Florida

Name: Amit Kumar **Time:** 14:20
Email: amit@mail.ucf.edu **Session:** Nanophotonics and Nanoelectronics
Contributors: Ajay S. Karakoti, S. Babu, S. Seal **Occupation:** Graduate Student
Contact: S. Seal **Type:** Oral
Title: **Elucidating the Role of Vacancy and Trivalent Cerium Concentration on the Fluorescence Properties of Europium Doped Cerium Oxide Solid Solution**

Abstract: Enhancing the optical emission of cerium oxide nanoparticle is essential for potential biomedical applications as cerium oxide exhibits a weak emission. In the present work, we report a simple chemical precipitation technique to synthesize europium doped cerium oxide nanostructures to enhance the emission properties of cerium oxide. Structural and optical properties showed an acute dependence on the concentration of oxygen-ion vacancy and trivalent cerium which in turn could be modified by dopant concentration and the annealing temperature. Results from X-ray photoelectron spectroscopy (XPS) showed an increase in tetravalent cerium concentration up to 85% on annealing at 900 C. The oxygen-ion vacancy increased from $1.7 \times 10^{20} \text{ cm}^{-3}$ to $4.1 \times 10^{20} \text{ cm}^{-3}$ with increase in dopant concentration. The maximum emission at room temperature was obtained for 15 mol% Eu doped ceria which improved with annealing at 900C. The oxygen ion vacancies were inversely related to emission while the concentration of trivalent cerium augmented the emission intensity. The emission behavior with temperature of the doped sample is governed in opposite manner by the concentration of oxygen-ion vacancy and Ce^{3+} both of which are modulated by dopant concentration and the heat treatment. The contrary role of oxygen-ion vacancies and trivalent cerium in modifying the emission properties of Eu doped ceria were evaluated quantitatively with respect to the dopant concentration and annealing temperature.

Affiliation: University of Central Florida

Name:	Peng Zhang	Time:	14:40
Email:	pengz@mail.ucf.edu	Session:	Nanophotonics and Nanoelectronics
Contributers:	Abhilash Vincent, Amit Kumar, Sudipta Seal and Hyoung J. Cho	Occupation:	Postdoc
Contact:	Hyoung J. Cho	Type:	Oral
Title:	The Effect of Schottky Barriers at the Electrode/Sensing Material Interfaces on Hydrogen Sensing		

Abstract: In this work, we present a hydrogen nanosensor integrating Au interdigitated electrodes (IDEs) with a 100 nm gap and Indium oxide (In_2O_3) doped Tin dioxide (SnO_2) nanoparticles. The existence of Schottky barriers at Au/ In_2O_3 doped SnO_2 interfaces enhanced the sensitivity and response time of the hydrogen nanosensor. A simplified model based on the Schottky barrier assumption was proposed to interpret the influence of the Schottky Barriers on the hydrogen sensing performance of the sensor. We fabricated the sensor platforms with Au IDEs by E-beam photolithography. Hydrogen sensing material, In_2O_3 doped SnO_2 nanoparticles with the size of less than 20 nm, was deposited on the IDEs by dip-coating. Due to the different work functions of Au and In_2O_3 doped SnO_2 , Schottky barrier contacts might exist at the electrode/sensing material interfaces. This was indirectly observed in the non-linear I/V curve of the sensor obtained in air atmosphere. With the introduction of hydrogen gas (H_2), the linear I/V response of the sensor was observed implying the vanishing of the Schottky barriers. To simplify the analysis, the equivalent circuitry of the sensor is modeled as two Schottky diodes which are connected back-to-back with a series resistance (In_2O_3 -doped SnO_2 material) in between, separating the diodes. At a low applied voltage of 0.4 volt with which the breakdown of the diode did not happen, the current of the sensors was constrained by the reverse biased diode and the sensor showed a huge resistance in air. With the presence of H_2 (0.09 vol %), the dissociated hydrogen atoms could accumulate at the electrode/sensing material interfaces and can be polarized, causing the formation of a dipolar layer. The excess of charge states at the interfaces could effectively reduce the Schottky barrier height and the resistance of the sensor. High sensitivity ($R_{\text{air}}/R_{\text{hydrogen}} = \sim 7224$, R_{air} and R_{hydrogen} are the measured resistances in air and in hydrogen gas, respectively) and fast response (~ 7 s, the time frame when R_{air} drops by one order of magnitude) were recorded indicating that the existence of Schottky barriers could improve the hydrogen sensing performance of our nano hydrogen sensor.

Affiliation: University of Central Florida

Name:	Anindarupa Chunder	Time:	18:00
Email:	anindarupa@gmail.com	Session:	Designer Nanostructures
Contributers:	Anindarupa Chunder, Jianhua Liu	Occupation:	Graduate Student

Contact: Lei Zhai **Type:** Poster

Title: Poly(3-hexylthiophene) Supramolecular Structures on Reduced Graphene Oxide

Abstract: Single layer of graphite or "graphene" and poly(3-hexylthiophene)(P3HT) have received significant attention in fabricating organic electronics due to their unique and intriguing properties such as superior charge mobility. The applications includes field effect transistors and organic photovoltaics. Integrating P3HT and graphene nanosheets in a single composite material will open new prospects in aligning and forming molecular devices and generating nanoscale architectures. Here, we report the self-assembled supramolecular P3HT structures on reduced graphene oxide (RGO) nanosheets with a possibility of achieving enhanced electrical performance. Poly(3-hexylthiophene)(P3HT) supramolecular structures were fabricated on graphene nanosheets through a bottom-up graphene induced crystallization process. The crystallization process monitored by in-situ UV-Vis spectroscopy clearly indicated that graphenes could greatly enhance the P3HT crystallization. Reduced graphene oxides have ordered pristine graphene structures separated by disordered domains. The P3HT nanowires formed on the graphene surface could connect the ordered pristine "graphene-domains" of many individual graphene sheets, forming bridges to bypass the insulating disordered domains. The P3HT supramolecular structures were characterized by TEM and AFM. The nanowires on graphene surface had uniform width (7-12 nm) and height (1.5-2 nm). The nanowire structures were controlled by P3HT concentration and P3HT/RGO ratio. Such supramolecular structures will have potential applications in organic electronics such as thin film transistors and organic photovoltaics.

Affiliation: University of Central Florida

Name: Janet Dowding

Time: 18:00

Email: jdowding@mail.ucf.edu

Session: Designer Nanostructures

Contributors: Sarah Lubitz, Wenjun Song, Ajay Karakoti, Kimberly Bossy, Andrew Kim, Sudipta Seal, Mark Ellisman, Guy Perkins, Ella Bossy-Wetzel, William T. Self

Occupation: Graduate Student

Contact: Janet M. Dowding

Type: Poster

Title: Radical Scavenging Properties of Cerium Oxide Nanoparticles

Abstract: Peroxynitrite (ONOO⁻), one of several reactive nitrogen species (RNS), has been implicated in inflammation and neurodegenerative diseases. Peroxynitrite is a powerful oxidant and can be more reactive than its precursors nitric oxide or superoxide (O₂⁻;). In this study we investigated the ONOO⁻ scavenging potential of cerium oxide nanoparticles (CeO₂ NPs) using various in vitro assays including UV-Vis spectroscopy and XPS. The catalytic properties of CeO₂ NPs have generated increased interest due to its ability alternate between the +3 and +4 states via redox reactions at the particle surface. CeO₂ NPs have similar chemical and physical properties to bulk cerium but due to the increased surface area to volume ratio, along with oxygen vacancies or "defects" in the lattice structure, CeO₂ NPs have the potential to act as a unique catalyst. Our lab has previously demonstrated nanoparticles with a high +3/+4 ratio are capable of scavenging O₂⁻;). Redox-cycling manganese-salen complexes that are effective SOD mimetics have also been shown to react with ONOO⁻. RNS role in many age related diseases is now just being appreciated. Mitochondria are dynamic and sensitive organelles that undergo fission in response to stress. Protecting cortical neuronal mitochondria from RNS stress may help delineate the role that RNS may play in mitochondrial dysfunction. For in vitro cell culture studies, we used primary cortical neuronal cultures and subjected cultures to exogenous or endogenous produced RNS. The in vitro assays demonstrate the ability of CeO₂ NPs to interact with ONOO⁻. When cells were pre-treated with CeO₂ NPs, the cultures showed protection from nitrate stress. Since we have shown the CeO₂ NPs react with ONOO⁻ in vitro, these results point to an in vivo scavenging of ONOO⁻ by CeO₂ NPs. Furthermore, we show that the CeO₂ NPs indeed entered the neurons and were often found in association with mitochondria using EM microscopy. The results of these and future studies focused on the radical scavenging properties of this material may have important implications for developing therapeutics in medicine.

Affiliation: University of Central Florida

Name: Anurudha Dutta **Time:** 18:00
Email: aniruddha@knights.ucf.edu **Session:** Designer Nanostructures
Contributors: Aniruddha Dutta, Biao Yuan, Helge Heinrich, Christopher N. Grabill, Henry E. Williams, Stephen M. Kuebler, Aniket Bhattacharya **Occupation:** Graduate Student
Contact: Helge Heinrich **Type:** Poster
Title: **Transmission Electron Microscopy Study of Silver and Gold Nanoparticles on Polymeric Surfaces (*)**
Abstract: In the Electroless Metallization process of silver on gold-catalyzed polymeric surfaces (SU8) Au nanoparticles act as nucleation sites for Ag. Transmission Electron Microscopy (TEM) is used to study the polymeric surface for a series of silver deposition times. Sample cross sections are studied in TEM to obtain correlations between the original gold nanoparticles and the silver nanoparticles. The silver and gold composition on the surface is measured with energy dispersive X-ray analysis, while high-resolution TEM yields information on the distribution and sizes of the nanoparticles on the surface. Scanning TEM with a high-angle annular dark field detector is used to obtain atomic number contrast. The thickness of the silver layer is recorded as a function of time. The height fluctuations of the Ag layer are determined and a statistical analysis of the growth process is conducted. This information is used as feedback for understanding and improvements in the processing steps, as well as for process simulations. (*) Supported by grant #0809821 from the National Science Foundation, Chemistry Division.
Affiliation: University of Central Florida

Name: Humberto Gomez **Time:** 18:00
Email: hagomez2@mail.usf.edu **Session:** Designer Nanostructures
Contributors: Rakesh Joshi, Farah Alvi, Ashok Kumar **Occupation:** Graduate Student
Contact: Ashok Kumar **Type:** Poster
Title: **Graphene as Fast Response Gas Sensors**
Abstract: We report the gas sensor performance of few layer graphene grown on Ni coated Si substrates. The graphene layers for gas sensor application were grown using microwave plasma enhanced chemical vapor deposition method. Hydrogen and methane in a ratio of 8:1 were used as gaseous mixture in presence of 2 kW microwave plasma to grow graphene on the Ni coated substrates at 700°C. Graphene layers were characterized by scanning electron microscopy, transmission electron microscopy, Raman spectroscopy and X-ray diffraction. Electric resistance as function of temperature has been studied in the range 50 to 200°C. Gas sensing properties of the few layer graphene structures were studied at room temperature for 100 to 500 ppm of CO and NO₂ in synthetic air mixture. The gas sensor mechanism is consistent with charge carrier donation to conducting graphene surfaces in presence of the target gases.
Affiliation: University of South Florida

Name: Duy Le **Time:** 18:00
Email: dle@physics.ucf.edu **Session:** Designer Nanostructures
Contributors: Sergey Stolbov **Occupation:** Graduate Student
Contact: Talat Rahman **Type:** Poster
Title: **Hydrogen adsorption on Co bilayers grown on Cu(111) from ab-initio studies***

Abstract: Through first principles electronic calculations, based on the spin-polarized density functional theory using the generalized gradient approximation and the ultrasoft pseudopotential method in the plane wave representation, we studied the adsorption and the dissociation of H₂ on Co bilayers grown on Cu(111). As H₂ approaches the surface with the H-H bond parallel to that surface, it dissociates at a distance of about 1.7Å from the Co layer, and constituent H atoms proceed to occupy neighboring fcc and hcp sites. The “adsorption” energy barrier for H₂ is 0.14 eV and the “adsorption” energy is about 0.80eV. On the Co surface, H diffuses from an fcc site to an hcp site, or vice versa, with diffusion barriers of 0.17eV and 0.12eV respectively. We find no evidence of subsurface H. By analyzing the local electronic density of state, we establish, in agreement with suggestion from experiments [1], that the surface electronic states and magnetic moment of Co atoms depend very much on the H coverage. [1] M. Sicot et al, Phys. Rev. B 77, 035417 (2008) * Work supported in part by DOE under Grant No DE-FG02-07ER46354.

Affiliation: University of Central Florida, Department of Physics

Name:	Tamre Parsons	Time:	18:00
Email:	tamreparsons@gmail.com	Session:	Designer Nanostructures
Contributors:	Tamre Parsons*, Padmavathy Tallury, Rajendra Narayan Mitra	Occupation:	Undergraduate Student
Contact:	Swadeshmukul Santra	Type:	Poster

Title: Nanoformulation for the treatment of mold

Abstract: Molds are microscopic fungi that grow in moist environments and use spores for reproduction. Molds can easily attack house/building materials such as dry walls, wood, grouts, carpet backing etc. Moreover, airborne mold spores can seriously compromise in-door air quality and can cause severe allergy, asthma and other immunological problems. Application of bleach has been very effective for the treatment of mold world-wide. However, the action of bleach does not last for long, requiring multiple applications. In our daily life we all experience how molds grow back in wet areas within a couple of weeks specifically in the bathroom and kitchen. In this poster, we examine the use of a silica based antibacterial/antifungal nanoformulation for preventing the spread of mold. The efficacy is tested using two methods on *Aspergillus niger*, a popular strain of mold used in industry testing. In the first procedure, the formulations are applied with a sterile swab directly to the agar surface, and the fungal matter is added to the plate. The second method used is the disc diffusion method. Again the *A. niger* is added after the plate has been treated with the test formulas. Our results show that a nanoparticle based formulation has an effect in the inhibition of the spread of mold colonies in agar.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name:	Andrew Teblum	Time:	18:00
Email:	ateblum@mail.ucf.edu	Session:	Designer Nanostructures
Contributors:	Soumitra Kar	Occupation:	Undergraduate Student
Contact:	Swadeshmukul Santra	Type:	Poster

Title: Effects of Alloying and Doping in Semiconductor Nanowires: CdxZn1-xS:Mn, a Case Study

Abstract: Synthesis of semiconductor nanowires requires special synthesis condition to guide growth in one-dimension. Making alloy semiconductor introduces additional constraints in the growth environment. The success of the experiments depends on several parameters such as suitable choices of the elementary components, response of these elements to the growth environment, lattice strain etc. Most of the semiconductor materials tend to oppose to the impurity doping during their crystal growth due to self-purification phenomena. Thus in order to achieve desired doping, the growth condition needs to be tuned to enhance impurity doping. In the present work we have successfully fabricated ternary alloy semiconductor $Cd_xZn_{1-x}S$ nanowires by a simple synthesis routes. Moreover we have successfully tailored the growth environment to incorporate the transition metal ion Mn^{2+} into these alloy nanowires. We have observed development of various new morphological and optical phenomena related to alloying and doping. Alloying leads to the formation of self-assembled three dimensional urchins which consisted of nanowires. Detail investigation shows that strain induced in the crystal due to ionic radii mismatch of the two cations produced structural defects in the nanowires. These defect sites served as the secondary nucleation sites for the formation of three dimensional assemblies of nanowires. It was observed that Mn doped samples could exhibit yellow emission at room temperature for $x \leq 0.65$.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name:	Chaoming Wang	Time:	18:00
Email:	chaowang@mail.ucf.edu	Session:	Designer Nanostructures
Contributors:	Chaoming Wang, Minghui Zhang, Ming Su	Occupation:	Graduate Student
Contact:	Ming Su	Type:	Poster
Title:	Sub-nano-gram Temperature-programmed Thermal Analysis based on Ultrasensitive Mass Measurements of Plasmonic Nanoparticles		
Abstract:	Ultrasensitive thermo-gravimetric analysis of adsorbed organic molecules has been achieved on an ordered array of gold nanoparticles used as a novel plasmonic nano-balance. The extinction peaks of the resonating surface plasmon of nanoparticle array shift upon loading molecules, and return to original position after a linear temperature rise process. A good correlation exists between the film thickness and magnitude of peak shifts. The mass detection sensitivity of plasmonic nano-balance is 2 ng/mm^2 , much lower than those of available weight-measuring devices. Such high sensitivity, combined with remote detection capability of plasmonic sensors, allows in-situ detections of the masses of loaded material and thermally desorbed molecules.		

Affiliation: University of Central Florida, Nanoscience Technology Center

Name:	Handan Yildirim	Time:	18:00
Email:	handan@physics.ucf.edu	Session:	Designer Nanostructures
Contributors:		Occupation:	Graduate Student
Contact:	Abdelkader Kara, Talat S. Rahman	Type:	Poster
Title:	Structural, Electronic, Vibrational and Thermodynamical Properties of Ag_nCu_{34-n} bi-metallic Nanoparticles		

Abstract: We report results of a systematic study of structural, vibrational and thermodynamical properties of 34-atom bimetallic nanoparticles from the Ag_nCu_{34-n} family using model interaction potentials (as derived from the embedded atom method) density functional theory. Systematic trends in the bond length and dynamical properties can be explained largely from arguments based on local coordination and elemental environment. Thus an increase in the number of silver atoms in a given neighborhood introduces a monotonic increase in bond length, while an increase of the copper content does the reverse. For the entire set, we find vibrational modes above the bulk bands of copper/silver. We trace a blue shift in the high-frequency end of the spectrum that occurs as the number of copper atoms increases in the nanoparticles, leading to shrinkage of the bond lengths from those in the bulk. The vibrational densities of states at the low-frequency end of the spectrum scale linearly with frequency as for single-element nanoparticles, with a more pronounced effect for these nanoalloys. The Debye temperature is found to be about one-third of that of the bulk for pure copper and silver nanoparticles, with a non-linear increase as copper atoms increase in the nanoalloy. From the first principles electronic structure calculations, we find the HOMO-LUMO gaps to range from 0.19 eV to 0.88 eV. The highest (lowest) gap is found for Ag₁₇Cu₁₇ (Ag₂₉Cu₅) nanoparticles. The analysis of the local DOS give further insights in to the coordination effect, bond length differences and the existence of the dissimilar atoms in the bonding. Charge density contour plots and the charge density differences of particular atoms relative to the substrate provide further understanding about the bond and binding strengths. Analysis of the total electronic densities of states of each nanoparticle shade light on alloying effect.

Affiliation: University of Central Florida, Department of Physics

Name:	Sebastian Zuluaga	Time:	18:00
Email:	sebastian.z.b@knights.ucf.edu	Session:	Designer Nanostructures
Contributors:		Occupation:	Graduate Student
Contact:	Sergey Stolbov	Type:	Poster
Title:	First principles studies of the oxygen redaction reaction on the Pd-Co surfaces		

Abstract: Fuel cells (FC) are a promising means to obtain clean energy, but currently used in FC Pt catalysts are too expensive for practical application. Since Pd-Co nanostructures are found to show promising catalytic properties for the oxygen reduction reaction (ORR) on FC's cathode catalysts, we focus on these materials. We carry out density functional theory calculations using the Vienna AB initio Simulation Package (VASP) in order to investigate ORR characteristics of the Pd_x-Co_{1-x} (x=0.75 & 0.5) surfaces. We have calculated the absorption energies of O and OH for different sites in the surface and use them to build a free energy diagram, which helps us to estimate the ORR rate. We also trace these properties to calculated densities of electronic states of the materials.

Affiliation: University of Central Florida, Department of Physics

Name:	Workalemahu Berhanu	Time:	18:00
Email:	work_mikre@yahoo.com	Session:	Modeling of Nanosctructures
Contributors:		Occupation:	Graduate Student
Contact:	Artëm E. Masunov	Type:	Poster
Title:	Molecular dynamic simulation of the inhibition of aggregation of amyloid with beta breakers		

Abstract: Alzheimer disease (AD) is characterized pathologically by extracellular amyloid deposits composed of A beta peptide. Presently, only symptomatic therapies are available for the treatment of AD and these therapies have a limited time frame of utility. Amyloid disorders (which include Alzheimer disease, other neurodegenerative disease and glaucoma) represent the effect of chronic A-beta production and therefore targeting A beta is a viable pursuit. The beta amyloids aggregate into oligomer, pro-fibril, fibril and eventually to plaques which is the hallow mark of Alzheimer's disease. Various small molecules anti-aggregation inhibitors has been reported in the literature, yet, a detailed description of their interaction with the A beta peptides oligomers and fibrils is missing. We are implementing a molecular dynamic simulation of the inhibition of aggregation of these peptides using a molecular dynamic software package (Amber9). Our simulation shed light at atomic level on the interactions between our small organic molecules and the A beta oligomers, providing useful insight for the design of small molecule inhibitors of aggregation with therapeutic potential for Alzheimer's disease, other neurodegenerative disease and glaucoma.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name:	Craig Finch	Time:	18:00
Email:	cfinch@ieee.org	Session:	Modeling of Nanosctructures
Contributers:		Occupation:	Graduate Student
Contact:	James J. Hickman, Thomas Clarke	Type:	Poster
Title:	Multiscale simulation of colloidal near-surface diffusion		

Abstract: Diffusion is an important process in microscale and nanoscale fluids. At small dimensions, flows are almost perfectly laminar, and diffusion is the only significant mixing mechanism. Diffusion is an important transport process within cells, and affects the kinetics of protein adsorption, nanoparticle synthesis, and particle deposition on surfaces. The diffusion equation is a well-known partial differential equation that can be used to describe diffusive transport. However, the diffusion equation assumes a continuous medium, so it cannot account for effects due to discrete particles. Brownian dynamics simulation is becoming a popular method for simulating the transport of discrete particles. In a Brownian dynamics simulation, colloidal particles are approximated as simple geometric solids, such as spheres, within a simulation volume. At each time step, each particle is subjected to a random displacement, which approximates the effects of many random collisions with solvent molecules. Displacements resulting in overlapping particles are rejected. Through the process of displacements and collisions, particles diffuse throughout the simulation volume. We constructed a Brownian dynamics simulation of hard-sphere particles near a surface. We ran two limiting test cases: the surface adsorbs no particles, and the surface adsorbs any particle that touches it. For the first case, we verified that the average concentration throughout the simulation box remains uniform. For the second case, we verified that the kinetics of particle adsorption matches the prediction from the diffusion equation with a perfect adsorbing boundary. We also verified that the results agree with the solution from a commercial computational fluid dynamics (CFD) solver. Validating the results of the Brownian dynamics simulation is an important step towards creating a practical tool that can be used to simulate a wide variety of nanoscale systems.

Affiliation: University of Central Florida

Name:	Alamgir Kabir	Time:	18:00
Email:	alam_215@yahoo.com	Session:	Modeling of Nanosctructures
Contributers:	A. Kabir, T. S. Rahman, V.Turkowski	Occupation:	Graduate Student
Contact:	Talat S. Rahman	Type:	Poster
Title:	Nanoscale Dynamical Mean-Field Theory study of electron correlation effects in small iron clusters		

Abstract: We study the magnetic properties of small iron clusters Fe_n ($n=2-5$) by using the Nanoscale Dynamical Mean-Field Theory (NDMFT) approach. The lowest energy isomers are obtained within the GGA approximation, and the dependence of the cluster magnetization on the Coulomb repulsion energy is analyzed within the NDMFT approach. In addition, we study the magnetic properties of the systems for different cluster geometries and demonstrate that the effect of the Jahn-Teller-like distortion on the magnetic properties of the systems is reduced when the correlation effects are taken into account. We compare our results with other approaches which take into account the electron correlation effects and demonstrate that the NDMFT approximation becomes better when the number of atoms in the cluster increases.

Affiliation: University of Central Florida, Department of Physics

Name: Nathan Miller
Email: nmiller@fit.edu

Time: 18:00
Session: Modeling of Nanostructures

Contributors:
Contact: Nathan Miller

Occupation: Graduate Student
Type: Poster

Title: **Computational Modeling for Self-Assembly of Functionalized Carbon Nanotubes**

Abstract: It is desired to determine a way to computationally predict a method to functionalize carbon nanotubes (CNTs) for solubility and/or drug delivery for possible biomedical applications. Ab initio self-consistent field (SCF) molecular orbital calculations will be performed for polynuclear aromatics and carbon nanotube structures, employing various basis sets. Functionalization, including the addition of solubilizing agents with polar terminating groups, will be studied in detail through computational analysis using Restricted Hartree-Fock calculations. The structure and formation energy of functionalized nanotubes will be predicted via theoretical calculations. CNTs of various diameters will be tested to determine where a transition from a nonwrapping to a wrapping approach will occur as a function of CNT diameter. Whether additional phenyl- or T-stacking interactions, if applicable, will impose additional constraints on desired self-assembly is also to be evaluated.

Affiliation: Florida Institute of Technology

Name: Neha Nayyar
Email: nehanayyar85@gmail.com

Time: 18:00
Session: Modeling of Nanostructures

Contributors: N. Nayyar, T. S. Rahman, V. Turkowski
Contact: Talat S. Rahman

Occupation: Graduate Student
Type: Poster

Title: **Dynamical Mean-Field Theory approach to examine magnetic properties of nanosystems: the case of cobalt clusters**

Abstract: We develop the Nanoscale Dynamical Mean-Field Theory (NDMFT) approach [1] to study the magnetic properties of small metallic clusters. It is shown that the NDMFT solution approaches the exact solution when the number of atoms in the cluster and their coordination number increase. The method is tested by studying the magnetic properties of small cobalt clusters Co_n ($n < 6$). We examine the dependence of the magnetization in the systems on the geometry, temperature and Coulomb repulsion energy and demonstrate that the experimental results on cobalt nanoclusters can be reproduced with the proper choice of the Coulomb repulsion energy parameters. We compare our results with the GGA+U solution and show that in some cases this particular approximation overestimates the role of the correlation effects. [1] S. Florens, Phys. Rev. Lett. 99, 046402 (2007)

Affiliation: University of Central Florida, Department of Physics

Name: Iffat Nayyar
Email: iffatnayyar@gmail.com

Time: 18:00
Session: Modeling of Nanostructures

Contributors: Ivan A. Mikhyalov

Occupation: Graduate Student

Contact: Artëm E. Masunov **Type:** Poster

Title: Comparison of different formalisms for prediction of two-photon absorption profiles

Abstract: The two-photon absorption (TPA) is an electronic excitation process involving simultaneous absorption of two photons. Designing and synthesizing materials exhibiting large TPA cross sections allows one to reduce the intensity of the excitation source hence ameliorating the conditions with regard to optical damage. Organic molecules are promising candidates for efficient two photon absorbers because their material properties can be tailored through molecular engineering. Computer modeling of TPA spectra facilitates understanding of structure/activity relationships of these molecules. Thus, accurate predictions of TPA cross sections of organic chromophores are crucial as a potential alternative to time-consuming synthesis and non linear optical measurements. In this study, we compared various time-dependent density-functional theory (TDDFT) formalisms to calculate one- and two-photon absorption spectra in a series of large donor-acceptor substituted conjugated molecules. We also studied the influence of different optimization levels and exchange correlation (xc) functionals on excitation energies and cross sections. We conclude that the TDDFT is a predictive and trustworthy method for evaluation of TPA cross sections. Various DFT xc-functionals allow for a fine tuning in excitation energy and dipole moments.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Vaibhav Thakore

Time: 18:00

Email: thakore@mail.ucf.edu

Session: Modeling of Nanosctructures

Contributers: Peter Molnar, Aman Behal, Del C. Leistriz

Occupation: Graduate Student

Contact: James J. Hickman

Type: Poster

Title: Modeling of the neuron-electrode interface: From equivalent circuit models to development of advanced simulation methods

Abstract: Traditionally neuron electrode interface has been modeled using point or area contact linear equivalent circuit models. We shall present results obtained from modeling of the shape of neuronal action potentials recorded in two different ways by employing extracellular on-cell patch electrode and a planar metal microelectrode. The ion-channel parameters of the neuron, to be used with the equivalent circuit models of the neuron-electrode interface, were obtained by fitting the experimentally obtained action potentials to a Hodgkin-Huxley type mathematical model of the NG108-15 cells based on a thermodynamic rate constant approach. The ion-channel parameters thus obtained were then employed for the optimization and fitting of the parameters of the two compartment equivalent circuit model of the neuron-patch electrode interface and a reasonable fit was obtained. An attempt to optimize circuit parameters and fit the signal shapes recorded from the extracellular microelectrode by employing the same equivalent circuit did not yield a good fit. However, a significantly improved fit was obtained when additional circuit elements accounting for the electric double layer capacitances and resistances and the increased area of contact between the neuron and the microelectrode were included in the circuit model for the neuron-microelectrode interface. But, while trying to fit a variety of extracellular signal shapes we found that it is not always possible to obtain a reasonable fit using the equivalent circuit models. This is so because a linear equivalent circuit model ignores the physics of nonlinear electrodiffusion of ions and the complex relaxation of the highly dispersive dielectric medium in the neuron-electrode cleft. Also, having to deal with a large number of unwieldy parameters involved in the fitting of the extracellular shapes is a drawback. In view of the above reasons, we have developed a non-parametric "data-true" model of the neuron-electrode interface using nonlinear dynamic Volterra-Wiener characterization that allows us to predict the extracellular shapes recorded on the microelectrode using the first and second order Volterra-Wiener kernels. We are also developing a Lattice-Boltzmann model for the simulation of the nonlinear electrodiffusion of ions in the neuron-microelectrode cleft to explore strategies for engineering the neuron-electrode interface using surface chemical modification of the microelectrodes.

Affiliation: University of Central Florida, Department of Physics, Nanoscience Technology Center

Name: Atul Asati

Time: 18:00

Email: aasati@mail.ucf.edu
Contributors: Swadeshmukul Santra, Charalambos Kaittanis
Contact: J Mnauel Perez
Title: pH modulated enzymatic behavior of cerium oxide nanoparticles and its potential application in cellular ELISA

Session: Nanobiotechnology/Nanomedicine
Occupation: Graduate Student
Type: Poster

Abstract: It has been found that cerium oxide nanoparticles (nanoceria) possess antioxidant activity at physiological pH values, and has been used potentially in protection against radiation damage, oxidative stress, and inflammation. The ability of these nanoparticles to act as an antioxidant resides on their ability to reversibly switch from Ce³⁺ to Ce⁴⁺. Herein, we report that nanoceria has an intrinsic oxidase like activity at acidic pH values, as it can quickly oxidize a series of organic substrates without any oxidizing agent (e.g. hydrogen peroxide). The observed activity is not only pH-dependent but is also dependent on the size of the cerium oxide nanoparticles as well as the thickness of the polymer coating. Based on these findings, we have designed an immunoassay in which folate-conjugated cerium oxide nanoparticles provide dual functionality by binding to folate expressing cancer cells and facilitating detection by catalytic oxidation of sensitive colorimetric substrates. Hence, nanoceria can be used as a robust and single reagent in cellular immunoassays, eliminating the need of enzyme conjugated secondary antibodies and hydrogen peroxide that are typically used in common ELISAs, resulting in cheaper and more durable detection modalities.

Affiliation: University of Central Florida

Name: Peter Bedocs
Email: peter.bedocs@gmail.com
Contributors: Rolf Bunger, Janos Szebeni
Contact: Peter Bedocs

Time: 18:00
Session: Nanobiotechnology/Nanomedicine
Occupation: Postdoc
Type: Poster

Title: Complement Activating Properties of Liposome Encapsulated Hemoglobin

Abstract: Creation of a blood group-free universal, long-lasting and safe oxygen carrier blood substitute, i.e., an artificial blood, has been a generic research topic for a long time and will remain to be one in the future for many reasons, including real medicinal need as well as unmet intellectual challenge. Our project focuses on the development of a long-circulating, biocompatible blood substitute based on liposome-encapsulated hemoglobin (LEH). Long circulation is achieved by attaching polyethylene glycol (PEG). Goals: In this part of the study we examined the immunogenic properties of LEH, particularly its complement activating potentials that could prevent its application in trauma, hemorrhagic shock or other conditions of severe blood loss. Methods: In our swine model of complement activation related pseudoanaphylaxis (CARPA) we injected various doses of pegylated and non-pegylated forms of LEH while monitoring and recording physiological parameters (systemic arterial and pulmonary arterial blood pressure, ECG, oxygen saturation, expired CO₂) and collecting blood samples for further analysis. Results: The non-pegylated LEH vesicles did not cause any immediate hypersensitivity reactions. The first injections of pegylated LEH provoked severe anaphylactic reactions, but the hypersensitivity substantially diminished or completely disappeared upon subsequent administration of pegylated LEH. Conclusions: Non-pegylated liposomes and LEH did not induce hypersensitivity reactions. LEH is nonreactogenic even in relatively high bolus dose. Upon first exposure to pegylated liposomes potentially lethal physiologic reactions occur. PEGylation lends reactivity to these vesicles that can be prevented by tolerization with empty pegylated liposomes. If PEG is used in LEH, tolerization with placebo might be necessary for safe application as the pegylated liposomes seem to have tachyphylactic properties. This hypothesis needs to be investigated in details before proceeding to application of LEH as a blood substitute.

Affiliation: Semmelweis University, Hungary/USUHS

Name: Farzad Behafarid
Email: behafarid@physics.ucf.edu
Contributors: F. Behafarid, A. Naitabdi

Time: 18:00
Session: Nanobiotechnology/Nanomedicine
Occupation: Graduate Student

Contact: Beatriz Roldan **Type:** Poster

Title: **Enhanced Thermal Stability and Nanoparticle-mediated Surface Patterning: Pt/TiO₂(110)**

Abstract: Size-selected Pt nanoparticles were synthesized by inverse micelle encapsulation on PS-PVP diblock copolymers. The thermal stability of these Pt nanoparticles deposited on TiO₂(110) has been investigated by scanning tunneling microscopy. Our micelle-based nanoparticles were found to be very stable against agglomeration and they preserved their initial size (~3.2 nm) and hexagonal arrangement up to an annealing temperature of at least 1000°C [1]. Furthermore, the original spherical shape of these particles was found to change upon annealing above 1000°C, leading to the formation of 3D faceted particles. Atomic desorption and cluster coarsening was observed at 1060°C. Our study also revealed that strong nanoparticle/support interactions are present in this system, resulting in the formation of TiO₂ nanostripes at high temperature with widths and a 2D spatial arrangement pre-determined by the presence and distribution of the Pt nanoparticles on the substrate. Further insight into the mechanisms underlying the enhanced thermal stability of our micellar nanoparticles was obtained via a comparative study with UHV-evaporated Pt nanoparticles supported on pristine and polymer-coated TiO₂(110) surfaces.

Affiliation: University of Central Florida

Name: Jacob Billings

Time: 18:00

Email: billings.jacob@gmail.com

Session: Nanobiotechnology/Nanomedicine

Contributors: Jacob Billings

Occupation: Undergraduate Student

Contact: Ray O'Neal

Type: Poster

Title: **Position Sensitive Bio-Electrical Photodetection Array**

Abstract: Our laboratory is undertaking the development of a nanoscale device which employs the photoactive protein, bacteriorhodopsin, towards the low power, high efficiency detection of light. Compared to avalanche photodiodes and photomultiplier tubes which require high voltages to operate, a bacteriorhodopsin detector is able to operate under its own power due to an elegant quaternary structure. Also, since bacteriorhodopsin has a higher quantum efficiency than electronic photodectors, we expect our device to show increased sensitivity. The detector's fabrication begins with an array of pyramidal wells etched into a silicon substrate. Etching stops at the last 20 microns to form a set of diaphragms through which 1 micron diameter holes are bored. An array of Ag/AgCl electrodes is deposited onto the device to connect intra-well space to the device's electronic packaging. The entire wafer, save for the inter-well contacts, is passivated to reduce capacitive and inductive noise. An opposite terminal, also composed of Ag/AgCl atop a silicon wafer, is situated on the non-well side of the substrate. This two-tiered device is sealed together about a polydimethylsiloxane gasket and is filled with a dilute HCL solution. Negatively charged giant liposomes, peppered with bacteriorhodopsin, will be mixed with the same HCL electrolyte and pipetted into the wells. Application of a potential will then promote the electrophoretic migration of the liposomes towards the holes. With the aid of a positively charged coating over the diaphragm, the liposomes are expected to flatten out and form giga-ohm seals. The change in potential upon exposure to light will then be calibrated for inter pixel particularities. Monitoring of the potential of each pixel is expected to allow for the spatial and temporal resolutions of photonic events. It is our hope that our device will successfully illustrate the viability of this particular integration of biological materials into electronic devices.

Affiliation: Florida A&M University

Name: Logan Byrne

Time: 18:00

Email: byrne.logan@gmail.com

Session: Nanobiotechnology/Nanomedicine

Contributors: Logan Byrne, Padmavathy Tallury, Swadeshmukul Santra

Occupation: Undergraduate Student

Contact: Swadeshmukul Santra

Type: Poster

Title: **Ultra-Small Fluorescent Chitosan Nanoparticles: Synthesis, Characterization and Specific Targeting**

Abstract: Fluorescent nanoparticle (NP) based probes such as quantum dots (Qdots) and dye-doped silica based NPs are popular imaging probes being developed for various bioimaging applications such as diagnostic imaging of cancer cells, labeling of stem cells and imaging of pathogenic cells. These NP probes have the advantages of being photostable and even allow real-time imaging of intracellular components but the cytotoxicity of Qdots due to the presence of heavy metals and silica NPs not being biodegradable limits their biomedical applications. Thus, it would be desirable to develop NP based probe that is biocompatible and biodegradable. Also size of the NP plays an important role in bioimaging in particular for drug based imaging and therapy of tumors. In this aspect, ultra-small size (< 30 nm) of NPs would be preferred. We present here a method of synthesizing ultra small size water dispersible fluorescein isothiocyanate (FITC) labeled fluorescent NPs of biocompatible and biodegradable chitosan polymer. The NPs have been characterized for its particle size, surface charge and fluorescence properties. These NPs have been demonstrated for specific targeting to human leukemia cells via aptamer recognition.

Affiliation: University of Central Florida

Name: Yan Chen

Time: 18:00

Email: yanchen@ufl.edu

Session: Nanobiotechnology/Nanomedicine

Contributors: Meghan O'Donoghue, Yu-Fen Huang, Huaizhi Kang

Occupation: Graduate Student

Contact: Weihong Tan

Type: Poster

Title: Using Nanoparticles as a Molecular Ruler for Measuring Binding Site Distances on Live Cell Surfaces

Abstract: Measuring distances at molecular length scales in living systems is a significant challenge. Methods like Forster Resonance Energy Transfer (FRET) and Surface Plasmon Resonance (SPR) can be used as molecular rulers, but when applied to live cell systems, these methods suffer from drawbacks of small detection distance ranges (<10nm), high orientation requirements (for FRET), and high scattering background from cells (for SPR). Recently, a novel dipole-surface energy transfer (SET) phenomenon between a dye molecule and the surface of a metal particle has been reported in bulk systems. This fluorescent technique is capable of continuous monitoring of separations up to ~25 nm and has been employed to overcome the limitations of dipole-dipole interactions in FRET. For the first time, we report here the application of SET to monitor the distance between two binding sites in a membrane receptor on the surface of a live cell. By using a range of gold nanoparticle-aptamer conjugates with different diameters was used as a SET nanoruler, the distance between two binding sites on a membrane receptor on a live cell surface was measured as (13.43 \pm .40) nm, a distance that is beyond the detection limit of FRET. The SET nanoruler system has simple construction, fast detection, low fluorescence background and can be applied to large complex systems that have longer interaction distances, especially live cell systems.

Affiliation: University of Florida

Name: Lisa Cole

Time: 18:00

Email: lcole@my.fit.edu

Session: Nanobiotechnology/Nanomedicine

Contributors: Benjamin J. Burnett,

Occupation: Graduate Student

Contact: Samuel Durrance, Shaohua XU

Type: Poster

Title: Understanding the Self-Organizing Mechanism in Amyloid Fiber Formation

Abstract: The self-assembly process that drives the linear formation of amyloid fibers is complex and involves a number of different species with unique morphologies. By using separation techniques and analysis methods such as dielectric spectroscopy, AFM, TEM, confocal microscopy, and other biochemical means, the aggregation of proteins at each step in the formation process was analyzed. We approach amyloid fiber formation using the colloidal model proposed by Dr. Xu, Florida Institute of Technology. This model suggests that the fibers initially aggregate into uniformly sized nano-spheres, driven by surface energy minimization. The uniform spheres then begin to behave like a mono-dispersed colloidal suspension. Once the spheres have reached their critical diameter of approximately 20nm it is observed from microscopy that the colloidal growth stops. At this point the attractive forces that favor agglomeration are balanced by the barrier potential forces that retard agglomeration. The fully developed nucleation units then assemble in a linear fashion before finally evolving into mature amyloid fibers. The model postulates that the linear assembly arises from dipole-dipole interaction between nano-spheres. We analyze this assembly process in vitro using lysozyme from chicken egg whites in an acidic environment. In vivo, lysozyme has a propensity to form amyloid fibers in systemic amyloidosis diseases. The dipole moment, thought to attribute to the linear assembly of proteins, is analyzed using dielectric spectroscopy with an initial calculated average dipole moment of 350D. These experiments were carried out with an Agilent 4294 impedance analyzer and an Agilent 16452 liquid test fixture over a frequency range of 100Hz to 30MHz. In addition, AFM, TEM, and confocal microscopy are used to monitor the time dependent morphologies of the different species involved.

Affiliation: Florida Institute of Technology

Name:	Janet Dowding	Time:	18:00
Email:	jdowding@mail.ucf.edu	Session:	Nanobiotechnology/Nanomedicine
Contributors:	Wenjun Song, Ajay Karakoti, Sudipta Seal, Ella Bossy-Wetzel, William Self	Occupation:	Graduate Student
Contact:	Janet M. Dowding	Type:	Poster
Title:	Reactive Nitrogen Species Scavenging Properties of Cerium Oxide Nanoparticles		

Abstract: Peroxynitrite (ONOO⁻), one of several reactive nitrogen species (RNS), has been implicated in inflammation and neurodegenerative diseases. Peroxynitrite is a powerful oxidant and can be more reactive than its precursors nitric oxide or superoxide (O₂⁻). In this study we investigated the ONOO⁻ scavenging potential of cerium oxide nanoparticles (CeO₂ NPs) using various in vitro assays including UV-Vis spectroscopy and XPS. The catalytic properties of CeO₂ NPs have generated increased interest due to its ability alternate between the +3 and +4 states via redox reactions at the particle surface. CeO₂ NPs have similar chemical and physical properties to bulk cerium but due to the increased surface area to volume ratio, along with oxygen vacancies or □defects□ in the lattice structure, CeO₂ NPs have the potential to act as a unique catalyst. Our lab has previously demonstrated nanoparticles with a high +3/+4 ratio are capable of scavenging O₂⁻. Redox-cycling manganese-salen complexes that are effective SOD mimetics have also been shown to react with ONOO⁻. RNS role in many age related diseases is now just being appreciated. Mitochondria are dynamic and sensitive organelles that undergo fission in response to stress. Protecting cortical neuronal mitochondria from RNS stress may help delineate the role that RNS may play in mitochondrial dysfunction. For in vitro cell culture studies, we used primary cortical neuronal cultures and subjected cultures to exogenous or endogenous produced RNS. The in vitro assays demonstrate the ability of CeO₂ NPs to interact with ONOO⁻. When cells were pre-treated with CeO₂ NPs, the cultures showed protection from nitritative stress. Since we have shown the CeO₂ NPs react with ONOO⁻ in vitro, these results point to an in vivo scavenging of ONOO⁻ by CeO₂ NPs. The results of these and future studies focused on the radical scavenging properties of this material may have important implications for developing therapeutics in medicine.

Affiliation: University of Central Florida

Name:	Mariam Ilyas	Time:	18:00
Email:	m.ilyas@ufl.edu	Session:	Nanobiotechnology/Nanomedicine

Contributors: Ajoy K. Saha, Parvesh Sharma

Contact: Brij M. Moudgil

Title: Variation in Chemical Composition and Particle Size of CdTeS Hydrothermal Quantum Dots

Abstract: This poster will show the synthesis and characterization of CdTeS quantum dots via hydrothermal route as well as how the amount of sulfur and tellurium varies with the size of the quantum dots. It has been noted that the CdTeS quantum dots prepared via hydrothermal route reveal changes in amount of sulfur and tellurium depending on the size of the particles. As the size of the particles increase the sulfur content increase and tellurium content decreases. The quantum dots were prepared from a precursor solution with pH 8.1. This pH has been shown to produce particles with the highest quantum yield.

Affiliation: University of Florida, Department of Chemical Engineering

Name: Nidhi Joshi

Email: njoshi3@mail.usf.edu

Contributors: Rakesh K. Joshi, Seyhan Boyoglu, Shree R. Singh

Contact: Ashok Kumar

Title: Shape selective Gold Nanoparticles: synthesis and Application for the detection of Respiratory Syncytial Virus

Abstract: We present the applicability of Au nanoparticles of different shapes and sizes as the carrier agent for the respiratory syncytial virus (RSV) to the target cell. Gold nanoparticles have potential to be applicable for the prevention of many lethal diseases. RSV is known to be the main cause of Pneumonia and other severe respiratory disorders causing serious illness to the children. We synthesized gold nanoparticles in the size range from 3 to 30 nm by reducing HAuCl₄ with sodium citrate in the presence of polyvinyl pyrrolidone (PVP). The nanoparticles were grown in different shapes such as, nanorods, nanocubes, nanotriangles, nanooctagons and nanohexagons. High resolution Transmission electron microscopy, scanning electron microscopy atomic force microscopy and absorption spectroscopy was used to characterize the nanoparticles. Variation in surface plasmon resonance band peak position in wavelength scale from 525 nm to 975 nm was observed on changing the nanoparticle shape from spherical to cubic. Surface-Enhanced Raman Scattering properties of gold nanoparticles were studied. The nanostructures were used for studying inhibition of RSV viral infection in cell culture protocol. The gold nanoparticle conjugates were mixed with RSV and subsequently introduced into the HEp-2 cells. Role of Au nanoparticle size and shape on the prevention of RSV infection and toxicity for HEp-2 cells has been studied. It has been seen that the gold nanoparticle coated with biomolecules can penetrate the cell deep without harming cell membrane.

Affiliation: University of South Florida

Name: Huaizhi Kang

Email: hkang@chem.ufl.edu

Contributors: Haipeng Liu, Xiaoling Zhang, Jilin Yan, Zhi Zhu, Huanghao Yang, Youngmi Kim and Weihong Tan

Contact: Weihong Tan

Title: DNA crosslinked hydrogels for photocontrollable encapsulation and release

Occupation: K12 Student

Type: Poster

Time: 18:00

Session: Nanobiotechnology/Nanomedicine

Occupation: Graduate Student

Type: Poster

Time: 18:00

Session: Nanobiotechnology/Nanomedicine

Occupation: Graduate Student

Type: Poster

Abstract: Hydrogels are hydrophilic materials composed with polymer skeleton and crosslinkers. They are able to encapsulate and release pharmaceuticals for delivery. However, localized delivery using easily controllable means is difficult. Here we have created DNA crosslinked hydrogels that display photocontrollable and reversible sol-gel conversion. Photosensitive azobenzene moieties are incorporated into DNA bases responding to different light sources, so that azobenzene isomerization induced by visible and UV light can either destabilize or stabilize the duplex structure in a sol or gel state. In this way, the sol-gel transition in the hydrogel can be achieved optically. Three different materials, fluorescein, horseradish peroxidase and gold nanoparticle, can be encapsulated inside the gel by one wavelength of light, and released by photons with a different wavelength. Utilization of clean and localized light for controllable encapsulation and release of multiple loads provides a promising stimuli-sensitive biomaterial for drug delivery in targeted therapy and in biotechnological applications.

Affiliation: University of Florida, Department of Chemistry

Name: Talib Pirmohamed

Time: 18:00

Email: talibpir@hotmail.com

Session: Nanobiotechnology/Nanomedicine

Contributors: Janet M. Dowding, William T. Self

Occupation: Undergraduate Student

Contact: Talib M. Pirmohamed

Type: Poster

Title: **Nanoceria exhibit redox-state dependent catalase mimetic activity**

Abstract: Intracellular accumulation of reactive oxygen species (ROS) such as superoxide (O₂⁻) and hydrogen peroxide (H₂O₂) may lead to oxidative stress. ROS have been implicated in various degenerative diseases and disorders as well as aging. Enzymes such as catalase and superoxide dismutase (SOD) serve as antioxidants by neutralizing or breaking down ROS. Cerium oxide nanoparticles (nanoceria) have also been shown to scavenge ROS in both cell culture and animal models, and specifically shown to react with superoxide. Additionally, the redox state of cerium at the surface of the particle, which may be +4 (oxidized) or +3 (reduced), has been shown to influence its superoxide scavenging activity. This study attempted to establish nanoceria as a catalase mimetic by showing that this material can effectively convert hydrogen peroxide to oxygen. Hydrogen peroxide was quantified using UV-Vis spectrophotometry and fluorophotometry-coupled enzyme assays, and the production of oxygen from the reaction was measured using a dissolved oxygen probe. With these methods, nanoceria were shown to exhibit catalase mimetic activity. Moreover, this activity was shown to be dependent on nanoceria surface chemistry, as samples with low +3/+4 redox-state ratios, with respect to surface cerium atoms, were observed to be more catalytically efficient. While nanoceria have been shown to have ROS-scavenging properties, this study specifically affirms nanoceria as redox-state dependent catalase mimetics. Furthermore, these findings have implications in the ongoing search for, and study of, potent catalytic antioxidant materials.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Anchal Shrivastava

Time: 18:00

Email: anchalbhu@gmail.com

Session: Nanobiotechnology/Nanomedicine

Contributors: Santosh K. Yadav, Tanmay Bera, Preeti S.Saxena, Ashok K.Maurya, Rajendra S.Garbyal, Robert Vajtai, P. Ramachandrarao

Occupation: Faculty

Contact: Anchal Shrivastava

Type: Poster

Title: **Biocompatibility of MWCNTs reinforced Hap-Gel nano-composite for artificial bone grafting**

Abstract: Artificial bone grafting is essential to treat the bone loss due to trauma, cancer and other medical conditions. There has been a lot of effort in making an artificial bone graft that resemble natural bone both in microstructure and strength. Our previous study shows the development of the Hydroxyapatite-Gelatin (Hap-Gel based) artificial bone graft. Though it had commendable bio-compatibility and osteo-regeneration in animal models but its strength did not match that of natural bone. In this study, we explored if MWCNTs can be used as reinforcing agents to strengthen Hap-Gel nanocomposites for artificial bone grafting applications without significantly compromising their biocompatibility. Hap-Gelatin composites, reinforced with various proportions of MWCNTs, were synthesized to optimize the MWCNT content in the composites which yield commendable improvement in the strength. The morphological studies reveal that the MWCNTs act as templates for nucleation of Hap crystals. The biocompatibility of MWCNT reinforced Hap-Gelatin composites were evaluated in animal model through the histopathological investigation of tissues from skin, kidney and liver. On histopathological examination, no noticeable alteration due to toxicity was found for lower concentration of MWCNTs. But mild reversible changes in the liver and tubular damage in kidney have been observed for higher concentration (4 %wt. of MWCNTs). It can be inferred from the findings that MWCNTs, in proportions less than 4 %, can successfully be used to reinforce the Hap-Gel nanocomposite to improve its mechanical properties. However, how safe would these CNT reinforced bone implants would be when used for prolonged period in actual physiological conditions needs to be investigated further.

Affiliation: Banaras Hindu University, Department of Physics

Name:	Milan Srivastava	Time:	18:00
Email:	msrivast@mail.ucf.edu	Session:	Nanobiotechnology/Nanomedicine
Contributors:	Sanjay Singh, Amit Kumar, Sudipta Seal and William T. Self	Occupation:	Faculty
Contact:	Milan Srivastava	Type:	Poster
Title:	Anti-biofilm Efficacy of Hydrophobic Silver Nanoparticles Against Vancomycin-resistant Enterococci.		

Abstract: The antimicrobial activity of hydrophobic silver nanoparticles against vancomycin resistant pathogen *Enterococcus faecalis* V583 was investigated. *E. faecalis* is a natural habitant of the urinary tract of insects, humans and accounts for approximately 80% of all infections by Enterococci, including urinary tract infections, bacteremia, intra-abdominal infections, and endocarditis. *E. faecalis*, recognized as opportunistic pathogen, also adhere and produce copious amounts of biofilm on a variety of medical devices. Moreover, this pathogen has been found to have intrinsic antibiotic resistance coupled with genetically mobile antibiotic resistance elements, which presents a serious threat to the treatment of enterococcal infections. Treatment of escalating vancomycin resistance of this enterococci in particular, poses a major therapeutic challenge. Silver has long been known to exhibit a strong toxicity to a wide range of microorganisms. The main goal of this study was to develop a potential antibacterial/antibiofilm coating in a single step at ambient conditions using Ag NPs from hydrophobic suspensions using octa-decyl amine (ODA) instead of water based Ag NPs. Hydrophobised Ag NPs for coating over solid substrates is advantageous, as this would not lead to rapid solubilization of Ag NPs in the aqueous environment of the cell and will lead to controlled Ag⁺ ion release. Cell viability experiments demonstrated significant antimicrobial properties of AgNPs against *E. faecalis* ($p < 0.05$). Biofilm formation by *E. faecalis* triggered by hydrogen peroxide was also significantly inhibited in the cells cultured in the presence of AgNPs coated substrate ($p < 0.05$). Controlled experiments with ODA did not result in antibacterial and anti-biofilm formation, indicating that the antibiofilm activity was solely. This study demonstrates the promise of employing hydrophobic AgNPs films as better antibiofilm agent and could lead to better antimicrobial materials for medical applications.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name:	Marston Stryker	Time:	18:00
Email:	marstonstryker@gmail.com	Session:	Nanobiotechnology/Nanomedicine
Contributors:	Ajoy K. Saha, Parvesh Sharma	Occupation:	Undergraduate Student

Contact: Brij M. Moudgil **Type:** Poster
Title: **Effect of pH on the Fluorescence Quantum Yield of CdTeS Quantum Dots**
Abstract: The fluorescent property of quantum dots (QDs) is of great value and has application in many fields, including that of bioimaging. We have synthesized highly fluorescent and water dispersible CdTeS QDs by the hydrothermal technique. During the hydrothermal synthesis of these QDs, it was observed that fluorescence efficiency depended greatly on the pH of the precursor solution. One purpose of this study is to explore the relationship between pH and the quantum yield of the CdTeS QDs. In this poster we examine the variation of the quantum yield of the particles with solution pH.
Affiliation: University of Florida

Name: Abhilash Vincent **Time:** 18:00
Email: abhivin@gmail.com **Session:** Nanobiotechnology/Nanomedicine
Contributors: Suresh Babu, Eric Heckert, Janet Dowding, Suzanne M. Hirst, Talgat M. Inerbaev, William T. Self, Christopher M. Reilly, Artëm E. Masunov, Talat S. Rahman **Occupation:** Graduate Student

Contact: Sudipta Seal **Type:** Poster
Title: **Protonated nanoparticle surface governing ligand tethering and cellular targeting**
Abstract: Nanoparticles have shown tremendous potential for effective drug delivery due to their tiny size and cell membrane penetration capabilities. Cellular targeting with nanoparticles is often achieved by surface modifications followed by ligand conjugation. However, the efficiency of the nanoparticles reaching the target cells and getting internalized depends on the stability of targeting ligands and the chemical nature of the ligand nanoparticle binding. Recent advancements in nanobiomaterials research have proven the superoxide dismutase (SOD) mimetic activity of cerium oxide nanoparticles (CNPs) in protecting cells against oxidative stress. Due to their excellent biocompatibility, CNPs can be used as a potential drug carrier that can transport and release drugs to the malignant sites. Atomic Force Microscopy (AFM) based Single Molecule Force Spectroscopy (SMFS) measurements supported by density functional theory (DFT) simulations are employed to understand the interaction between transferrin, a ligand protein overexpressed in cancer cells, and CNPs. SMFS studies demonstrate an increase in the transferrin adhesion to the nanoparticles' surface with an increase in positive zeta potential of CNPs. Binding energy values obtained from DFT calculations predict an increase in bond strength between the transferrin and CNPs upon surface protonation and charge modification. Transferrin-conjugated CNPs were tested for their binding stability and preferential cellular uptake efficiency by incubating them with human lung cancer cells (A549) and normal embryo lung cells (WI-38). The results demonstrate the importance of tuning the surface properties of nanoparticles for better ligand adsorption and cellular uptake.
Affiliation: University of Central Florida, AMPAC

Name: Hui Wang **Time:** 18:00
Email: wanghui@ufl.edu **Session:** Nanobiotechnology/Nanomedicine
Contributors: Hui Wang, Youngmi Kim, Haipeng Liu, Zhi Zhu, Suwussa Bamrungsap and Weihong Tan **Occupation:** Graduate Student
Contact: Hui Wang **Type:** Poster
Title: **Engineering a unimolecular DNA-catalytic probe for single lead ion monitoring**

Abstract: The binding of proteins and small molecules by DNA is well established, but, more recently, DNA molecules have been selected to catalyze biochemical reactions. These catalytic DNAs, or DNAzymes, can be activated by metal ions. In this paper, we take advantage of DNA molecular engineering to improve the properties of DNAzymes by designing a unimolecular probe for lead ion (Pb²⁺) catalyzed reaction, achieving, in turn, the ability to monitor a single Pb²⁺ in solution by fluorescence microscopy. Specifically, by applying a unimolecular design, a leaving substrate DNA strand labeled with a fluorophore is linked to a hairpin 8-17 DNAzyme sequence labeled with a quencher. The hairpin structure and the substrate are connected using poly T, which brings the quencher into close proximity with the fluorophore in the inactive state. The intramolecular linkage of the two strands assures efficient quenching of the fluorescence, generating almost zero background. In the presence of Pb²⁺, however, the leaving substrate fragment is cleaved at the RNA site by the enzyme, releasing a fluorescent fragment for detection with repetitive cycling for signal amplification. The resulting high sensitivity with a quantifiable detection range from 2 nM to 20 μM was achieved with a high selectivity in excess of 80-fold for Pb²⁺ over other metal ions. The limit of detection is about 167 times better than the previously reported similar probes¹ and 1600 times better compared to the Pb²⁺ detection limit obtained from atomic spectroscopy. Thus, this probe could provide a simple, yet rapid and sensitive measurement for Pb²⁺. Furthermore, we used this probe to monitor single Pb²⁺ reaction kinetics. Given this degree of sensitivity and selectivity, our new probe design may prove useful in the development of other nucleic acid-based probes for intracellular, toxicological and environmental monitoring. Key words: DNAzyme; probe design; intramolecular probe; single ion; lead ion

Affiliation: University of Florida, Department of Chemical Engineering

Name:	Jessica Weber	Time:	18:00
Email:	jess@mail.usf.edu	Session:	Nanobiotechnology/Nanomedicine
Contributors:	Shreekumar Pillai, Shree R. Singh, Ashok Kumar	Occupation:	Graduate Student
Contact:	Jessica Weber	Type:	Poster
Title:	Electrochemical Impedance-Based DNA Sensor Using a Modified Carbon Nanotube Electrode		

Abstract: A nanoscale molecular sensing device has been designed and developed for the detection of Salmonella enterica serovar Typhimurium. Our device has been fabricated to detect very low levels of Salmonella by attaching single stranded DNA (ssDNA) specific to carbon nanotubes (CNTs), which are attached to a polished glassy carbon electrode. The carbon nanotubes have been modified with carboxylic acid functional groups (-COOH) and aminated ssDNA probes were linked onto the CNT matrix by chemical methods. This paper presents a novel electrochemical impedance-based DNA biosensor by using a modified CNT □ COOH/glassy carbon electrode. Hybridization with the complimentary ssDNA results in a shift in the impedance, based on the electron transfer resistance of the double-stranded DNA versus the ssDNA. It was found that ssDNA attached to the CNT □ COOH/GC electrodes resulted in a change in impedance, which was attributed to a higher charge transfer electron resistance of ssDNA versus the attachment of the complimentary double-strand DNA on the modified electrode surface. The genosensor was also demonstrated to have excellent specificity for the appropriate target DNA strand. This method of electrode preparation and functionalization is a new way to construct DNA hybridization sensors.

Affiliation: University of South Florida

Name:	Lisa Morin	Time:	18:00
Email:	lmorin@ufl.edu	Session:	NanoEducation
Contributors:	James Oliviero, Lisa Morin	Occupation:	Undergraduate Student
Contact:	Curtis Taylor	Type:	Poster
Title:	Touch-Based Virtual Exploration of the Nano-World		

Abstract: The haptic nanotechnology education model uses touch-based and visual computer environments to educate students about the abstract concepts of atomic-scale physics and nanotechnology. This project seeks to increase learning of abstract concepts by utilizing hands-on lessons while stimulating student interest through use of touch and virtual reality. This model uses a spherical controller, the Novint Falcon, to provide tactile feedback for visual images. Using this method, students can feel physical properties ranging from atomic forces to the surface tension of water. The program also utilizes a zoom function that illustrates the relationship between macro, micro, molecular, and atomic features.

Affiliation: University of Florida

Name: Farah Alvi **Time:** 18:00
Email: falvi@mail.usf.edu **Session:** Nanomaterials for Energy
Contributors: Rakesh K.Joshi, Ashok Kumar **Occupation:** Graduate Student
Contact: Farah Alvi **Type:** Poster
Title: Study of Acid treatment for Single crystalline TiO₂ nanowires grown hydrothermally to enhance the Performance of dye sensitized solar cell

Abstract: Here we report the influence of acid pretreatment on single crystalline TiO₂ nanorods grown hydro thermally. The influence of acid treatment of TiO₂ electrode with different kinds and concentrations on the photoelectric performance of DSSC has been explored prior to dye sensitization on the performance of dye-sensitized solar cells based on the dye called N719. It has been observed that DSSC had better photoelectric performance when the TiO₂ electrode was treated by nitric and hydrochloric acid than that by sulfuric and phosphoric acid. The increase in power conversion efficiency of DSSC based on nitric acid treatment for the photo-electrode is mainly contribute to increase in photo current. A comparative photovoltaic investigation of DSSCs using HCl-treated TiO₂ photo-electrode reveals that the HNO₃-treated photo-electrode reduces back electron transfer at the electrolyte interface and increases the amount of dye loading. The acid treatment of TiO₂ electrode provides useful information on the mechanism of energy conversion of DSSC. Open circuit voltage (Voc), short circuit current density (Jsc) and Fill factor (FF) was calculated after the solar cell illumination of simulated AM1.5 solar light (100 mW cm⁻²). Transmission Electron microscopy (TEM), SEM, PL and UV-Vis spectroscopy was used to analyze and characterize the crystallinity and quality of TiO₂ nanowires.

Affiliation: University of South Florida

Name: Maxwell Bonner **Time:** 18:00
Email: maxwellbonner@gmail.com **Session:** Nanomaterials for Energy
Contributors: Andre J. Gesquiere **Occupation:** Graduate Student
Contact: Maxwell S. Bonner **Type:** Poster
Title: Photophysical Characterization of Broad-Band Light Absorbing Composite Nanoparticles

Abstract: Herein, we report the fabrication of quasi-spherical broad-band absorbing nanoparticles consisting of Poly[(o-phenylenevinylene)-alt-(2-methoxy-5-(2-ethylhexyloxy)-p-phenylenevinylene)] (BPPV) and Poly[2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] (MEH-PPV) via the reprecipitation method. The broader light absorption of these nanomaterials is expected to address issues with efficient light absorption in Organic Photovoltaic Devices (OPV). Bulk spectroscopy on these nanoparticles suspended in solution reveals a primary energy transfer mechanism between the donor and acceptor molecules that deviates from a linear Stern-Volmer relationship at high MEH-PPV doping concentrations. In addition, photophysical features that remained hidden in bulk spectroscopy were elucidated by Single Particle Spectroscopy. A key observation is that there is a broad distribution of spectral shapes and energy transfer efficiencies when comparing the spectra of individual nanoparticles in a sample of a given composition of MEH-PPV and BPPV. These data show that for a given bulk sample composition the individual nanoparticles show very different properties from one particle to the next, signifying (i) nanoscale disruptions in inter- and intrachain interactions and (ii) a heterogeneous distribution of the constituent polymers in composite materials at the nanoscale. These data clearly illustrate the complex heterogeneous nanoscale morphology within densely packed composite nanoparticles and bulk materials in general that affects optical and photophysical properties such as energy transfer mechanisms and kinetics. From a broader perspective, even though this type of nanoparticles allows for extensive tunability of emission colors in bulk solution, it is clear that these are poor labels for bioimaging due to the broad distribution of spectral properties.

Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Chemistry, CREOL College of Optics and Photonics

Name:	Jason Croy	Time:	18:00
Email:	jcroy@physics.ucf.edu	Session:	Nanomaterials for Energy
Contributors:	S. Mostafa, L. Hickman, H. Heinrich, B. Roldan Cuenya	Occupation:	Graduate Student
Contact:	Jason R. Croy	Type:	Poster
Title:	Bimetallic Pt-Metal Catalysts for the Decomposition of Methanol: Effect of Secondary Metal on Oxidation State, Activity, and Selectivity		
Abstract:	Bimetallic Pt-Metal (Pt-M) catalysts are important in a wide range of applications including the direct methanol fuel cell (DMFC). In order to take full advantage of Pt-M systems in the design of new and efficient nanocatalysts, we must understand the structural, chemical, and electronic modifications brought about by the addition of the secondary metal M. We present here an investigation of the influence that the addition of secondary metals (M=Au, Pd, Ru, and Fe) has on the oxidation state, activity, and selectivity of ZrO ₂ -supported Pt nanoparticles. We use as a probe reaction the decomposition of MeOH. Size-selected bimetallic Pt nanoparticles were obtained by diblock-copolymer encapsulation and deposited on nanocrystalline ZrO ₂ powder. The chemical composition of the particles was studied by X-ray photoelectron spectroscopy and structural characterization was done by atomic force microscopy and transmission electron microscopy. The reactivity of the bimetallic systems for MeOH decomposition was monitored in a packed-bed mass flow reactor by mass spectrometry. Distinct atomic segregation trends were observed upon annealing these nanoparticles in an oxygen-rich environment. The affect these trends have on the oxidation state of Pt and how this state influences reactivity is presented.		

Affiliation: University of Central Florida

Name:	Jason Croy	Time:	18:00
Email:	jcroy@physics.ucf.edu	Session:	Nanomaterials for Energy
Contributors:		Occupation:	Graduate Student
Contact:	Jason R. Croy	Type:	Poster
Title:	Properties of Pt Nanoparticles Synthesized by Reverse Micelle Encapsulation: Oxidation, Reduction, and Reactivity		

Abstract: The oxidation of Pt and the reactivity of Pt oxides are of fundamental importance in catalysis, and although much research has been conducted on the interaction of oxygen with Pt surfaces, most of the work is confined to UHV with bulk materials such as Pt(111). In this work we will explore the size dependent-oxidation and reduction properties of Pt nanoparticles (NPs) synthesized by reverse micelle encapsulation. We use in-situ oxygen plasma treatments in conjunction with e-beam heating and X-ray photoelectron spectroscopy (XPS) to monitor the temperature-dependent reduction of Pt-oxide species in NPs with distinct size distributions. In addition temperature programmed desorption (TPD) was conducted to monitor the oxygen phases developed on our NP samples. These results are compared with the same experiments conducted on a Pt(111) crystal. In parallel to UHV studies, the activity of preoxidized Pt NPs, supported on nanocrystalline ZrO₂, was tested for methanol (MeOH) decomposition and oxidation reactions at atmospheric pressure using a packed-bed reactor coupled to a quadrupole mass spectrometer (QMS). Transmission electron microscopy (TEM) was conducted for morphological information and XPS was used to characterize samples both before and after interaction with MeOH.

Affiliation: University of Central Florida

Name:	Justin Hill	Time:	18:00
Email:	jhill@che.ufl.edu	Session:	Nanomaterials for Energy
Contributors:	Kelly Haller	Occupation:	Graduate Student
Contact:	Kirk J. Ziegler	Type:	Poster
Title:	Template-Based Fabrication of Core/Shell Nanowire Arrays Directly on Transparent Conducting Oxides.		

Abstract: Core/shell nanowire arrays can be fabricated under vacuum in a variety of ways. These nanowire arrays have important applications in dye-sensitized solar cells (DSCs). However, nanowire fabrication should ideally be through wet chemical or electrochemical methods to maintain the attractive low manufacturing cost that is found with traditional nanoparticle-based DSCs. Directed growth of materials in porous templates, such as anodic aluminum oxide (AAO), on transparent conductive oxides can yield the desired nanowire arrays. While these transparent substrates may be ideal for photoanode applications, the formation of the AAO as well as the treatment of the resulting nanowire array is non-trivial. Complete delamination of the AAO film can occur without a metal adhesion layer or if the incorrect adhesion layer is chosen. Additionally, explosion of the adhesion layer can occur as the film becomes completely anodized-destroying portions of the templated substrate or the entire template. Furthermore, upon depositing material in the pores and subsequent selective removal of the AAO with a liquid etchant, the nanowires typically aggregate upon drying of the substrate. This is due to the surface tension of the etching solution. Here we present a method of fabricating semiconductive shell and conductive core nanowire array photoanodes designed to enhance charge transport within the semiconductor and electrolyte of DSCs. This poster presents our recent advances made in preparing AAO directly on transparent conducting oxides, such as indium-doped tin oxide (ITO), and a simple method to prevent the surface tension induced aggregation of conductive nanowire arrays.

Affiliation: University of Florida, Department of Chemical Engineering

Name:	Zhongjian Hu	Time:	18:00
Email:	zjhu05@gmail.com	Session:	Nanomaterials for Energy
Contributors:	Andre J. Gesquiere	Occupation:	Graduate Student
Contact:	Zhongjian Hu	Type:	Poster
Title:	Correlation between Spectroscopic and Morphological Properties of Composite P3HT/PCBM Nanoparticles Revealed by Single Particle Spectroscopy		

Abstract: Composite nanoparticles consisting of poly-3-hexylthiophene (P3HT) doped with varying amounts of [6,6]-phenyl C61-butyric acid methyl ester (PCBM), a material blend that has been applied in some of the highest efficiency Bulk-Heterojunction Organic Photovoltaic Devices (BH-OPVs), were prepared and characterized. The optical properties of these nanoparticles were studied one particle at a time by Single Particle Spectroscopy (SPS). The resulting data reveal that these nanoparticles have spectroscopic characteristics consistent with the existence of two types of crystalline nanodomains, one with a higher energy emission at 660 nm and one with a lower energy emission at 720 nm. Our data also reveal a PCBM concentration dependent formation of two these two types of P3HT crystalline nanodomains in P3HT/PCBM composite nanoparticles, where the lower energy nanodomain becomes more favored with increasing PCBM concentration. This work provides a molecular scale insight in the correlation between morphology of conjugated polymer materials and weight percentages of fullerene dopants.

Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Chemistry, CREOL College of Optics and Photonics

Name: YoungWoo Joh

Time: 18:00

Email: itsthewoo@gmail.com

Session: Nanomaterials for Energy

Contributors:

Occupation: Undergraduate Student

Contact: Beatriz Roldan

Type: Poster

Title: Structure-Sensitive Reactivity of Mono and Bimetallic Pd Nanocatalysts for NO_x Reduction Reactions

Abstract: Selective catalytic reduction (SCR) is a method of reducing NO_x emissions within a highly oxidative environment (O₂). It has steadily garnered more attention within the past couple decades due to the passing of more stringent emission controls enacted worldwide. Though much is already understood about SCR, there is much more to be discovered, such as the structure-sensitivity and selectivity of catalysts, particularly nanocatalysts deposited on substrates. Here we seek to reveal various structure effects with SCR, such as size and inter-particle distance of mono and bimetallic Pd-based nanoparticles. Nanoparticles are prepared via diblock-copolymer encapsulation on various substrates and samples are characterized by atomic force microscopy, tunneling electron microscopy, and x-ray photoelectron spectroscopy. Propene, helium, oxygen, and nitric oxide gas are flowed through a packed-bed mass flow reactor. Conversion rates are analyzed using data from the mass spectrometer.

Affiliation: University of Central Florida

Name: Zeyu Ma

Time: 18:00

Email: zma@mail.ucf.edu

Session: Nanomaterials for Energy

Contributors: Yan Hong, Chaoming Wang, Shujing Ding, Liyuan Ma, Ming Su

Occupation: Graduate Student

Contact: Ming Su

Type: Poster

Title: Superhydrophobic Membrane Distillation for Water Desalination

Abstract: Membrane distillation can desalinate seawater using low grade heat or solar heat, but it has low mass flux and membrane fouling issue. Glass membrane with integrated microspikes and microchannels has been made by assembling fibrous building blocks, dissolving template material from microchannels, and differential etching of glasses. After surface modification, the superhydrophobic membrane is produced with water contact angle more than 160° due to the existence of ordered microspikes. Such membrane has shown mass flux 100% higher than that of existing polymer membranes, owing to its large pore size, narrow pore size distribution, straight pores, low heat conduction through membrane, high chemical and thermal stability, as well as good foul-resistance ability.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Simon Mostafa

Time: 18:00

Email: gringo_simon@hotmail.com

Contributors:

Contact: Simon Mostafa

Title: **Catalytic Decomposition of Alcohols over Size-Selected Pt Nanoparticles Supported on ZrO₂: A study of activity, selectivity, and stability**

Session: Nanomaterials for Energy

Occupation: Graduate Student

Type: Poster

Abstract: This article discusses the performance of ZrO₂-supported size-selected Pt nanoparticles for the decomposition of methanol, ethanol, 2-propanol, and 2-butanol. The potential of each alcohol for the production of H₂ and other relevant products in the presence of a catalyst is studied in a packed-bed mass flow reactor operating at atmospheric pressure. All the alcohols studied show some decomposition activity below 200°C which increased with increasing temperature. In all cases, high selectivity towards H₂ formation is observed. With the exception of methanol, all alcohol conversion reactions lead to catalyst deactivation at high temperatures (T >250°C for 2-propanol and 2-butanol, T >325°C for ethanol) due to carbon poisoning. However, long-term catalyst deactivation can be avoided by optimizing reaction conditions such as operating temperature.

Affiliation: University of Central Florida

Name: Jose Carballo

Email: jcarball@mai.usf.edu

Contributors: Alex Volinsky

Contact: Jose Carballo

Title: **Applying total variation regularization to extract the change of curvature of round substrates upon deposition of thin films**

Abstract: Several techniques are used to measure residual stress of thin films. The curvature method consists of using the Stoney equation in order to relate the change of curvature of the substrate with amount of internal stress that the film possesses. Curvature information can be extracted from a film height profile. In order to find the most appropriate method of fitting a function to data, several techniques are being used and compared for data de-noising, and analysis. Total variation regularization is useful for preventing the propagation of noise upon differentiation, thus it will be applied for the calculation of substrate curvature.

Affiliation: University of South Florida

Time: 18:00

Session: Nanophotonics and Nanoelectronics

Occupation: Graduate Student

Type: Poster

Name: Gregory Freihofer

Email: freihofer_greg@yahoo.com

Contributors: Adonay Jimenez, Seetha Raghavan and David Gosztola

Contact: Gregory Freihofer

Title: **Temperature and Laser Excitation Effects on the Raman Spectra of Carbon Nanotube Engineered Paper**

Time: 18:00

Session: Nanophotonics and Nanoelectronics

Occupation: Undergraduate Student

Type: Poster

Abstract: There is a need for a consistent measurement process for CNT engineered paper stress and strain; these characteristics are necessary in order for them to be utilized in structural applications. Spectroscopy has shown promise for accurately measuring these characteristics in the form of different peak shapes representing the phonon frequencies of the nanotubes. In this work, a large temperature range was used to induce thermal stresses on the sample and effects on the spectral peaks were studied. Varying laser excitation wavelengths can also affect the phonon frequency. Hence, variations of both temperature and excitation wavelength were the focus areas of the experiments conducted in this work. The G-band peaks, G1 and G2 were selected for study since these are known to exhibit shifts under stress. To study the laser excitation wavelength effects at 514nm, 633nm, and 442nm; two extreme temperatures were chosen (88K and 298K) for data collection. A clear temperature dependency is noticed in the G-bands for peak characteristics, particularly intensity. The intensity difference in the spectra of CNT's as the laser excitation reaches near-IR shows an increase in signal intensity with a reversal in peak intensity in the G-band. As the wavelength excitation increases the G1 peak intensity exceeds that of G2. The second study simulated a temperature variation of the lunar surface; which changes drastically from 100K at night to 400K during the day. A temperature stage (Linkam (Copyright)) varied the temperature from 88K to 388K and 31 acquisitions were taken for every 10K. Characteristics of the peaks such as full width half max (FWHM), peak position, and intensity showed signs of thermal influences. The results show a FWHM increase in G2, while G1's FWHM seems unaffected. Similarly, The peak position of G2 decreases on the PLS, while remaining constant for G1. From these characteristics it seems G2 is more sensitive to temperature, however Intensity behaves differently. G2's intensity remains constant as G1's intensity increases with respect to temperature. Optical spectroscopy of CNTs shows promise as a method of stress measurement. The method of deconvoluting the collected data from CNT stress experiments was successful in finding and analyzing the peak characteristics of the G-bands. The research has shown that temperature affects the tangential vibrational mode known as the Raman G-band of CNT engineered nanopaper. Thermal and mechanical stress measurements on engineered carbon nanopaper will provide calibrated stress-optic relations that can be used for in-situ measurements of structures using spectroscopic techniques.

Affiliation: University of Central Florida

Name:	Qiang Hu	Time:	18:00
Email:	qhu@mail.usf.edu	Session:	Nanophotonics and Nanoelectronics
Contributors:	Qiang Hu and Ashok Kumar	Occupation:	Graduate Student
Contact:	Qiang Hu	Type:	Poster

Title: Growth and I-V Characteristics of Nanocrystalline Diamond Films/Wires

Abstract: Nitrogen doped nanocrystalline diamond (NNCD) films were grown using Microwave plasma enhanced chemical vapor deposition method. Silicon nanowires were grown by vapor-liquid-solid(VLS) in thermal furnace at 1100 °C on silicon substrate with Au catalytic layer. Nitrogen doped diamond nanowires were then synthesized in the same recipe of diamond film by CVD method. Films were characterized by Raman spectroscopy, X-ray diffraction and scanning electron microscopy (SEM). Perfectly ohmic contacts for the N-doped NCD film and p-type Si substrate were obtained using Silver (Ag). Silver deposited at temperature of 250 °C with a pulsed laser deposition (PLD) method was found to show the ohmic behavior with high degree of reproducibility. Current voltage (I-V) characteristics are presented for various Ag/ N-NCD, and Ag-Si. Rectifying I-V behavior for the interface NNCD/p-Si suggests that the majority carriers for NNCD are electrons.

Affiliation: University of South Florida

Name:	Daeha Joung	Time:	18:00
Email:	djoung@gmail.com	Session:	Nanophotonics and Nanoelectronics
Contributors:	Anindarupa Chunder, Lei Zhai	Occupation:	Graduate Student
Contact:	Saiful I. Khondaker	Type:	Poster

Title: Large scale assembly of reduced graphene oxide field effect transistors via ac dielectrophoresis

Abstract: We will present directed assembly of reduced graphene oxide sheets dispersed in water with high yield using ac dielectrophoresis (DEP) between prefabricated gold source and drain electrodes. Room temperature electrical transport measurement of as- assembled devices show ambipolar field effect transistor (FET) behavior with a maximum hole and electron motilities up to 0.45 cm²/Vs and 0.007 cm²/Vs respectively. Upon annealing the devices in Argon and Hydrogen environment, the mobilities as high as 1.96 cm²/Vs for hole and 0.34 cm²/Vs for electron. This is the first report on directed assembly of RGO sheets and the fabrication of FET using such technique. DEP assembly of RGO FET will facilitate large scale fabrication of graphene based integrated circuits and other nanoelectronic devices.

Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Physics

Name: Kristy Kormondy

Email: kristykorm@gmail.com

Contributors: Eliot Silbar, Paul Stokes

Contact: Kristy Kormondy

Title: High yield solution processed carbon nanotube field effect transistors assembled via AC dielectrophoresis

Abstract: Ac-dielectrophoresis (DEP) typically yields a low percentage of semiconducting single-walled nanotube (SWNT) devices due to the greater force SWNTs feel during the trapping process. However, by applying DEP to a commercially available semiconducting enriched solution, we demonstrate the ability to fabricate SWNT-field effect transistors with high yield, up to 87%. The as assembled devices showed high contact resistance and low current on-off ratios due to the large contact barriers. However, after annealing in Ar/H₂ gas we were able to restore the device properties and observed mobilities up to 463 cm²/Vs and on-off ratios as large as 47,590. We will present scanning electron micrographs, full electronic characteristics, and statistics on the FET devices. This technique combined with the semiconducting enriched solution may pave the way to solve one of the most challenging problems in nanoelectronics – assembly of only semiconducting SWNTs from solution.

Affiliation: University of Central Florida

Name: Elizaveta Oleynik

Email: eoleynik@ufl.edu

Contributors: Elizaveta Oleynik

Contact: Curtis Taylor

Title: Nanomechanical Characterization of Ultrathin Films

Abstract: As the size of devices continues to decrease, measurement of thin film properties is becoming more important. Emerging applications such as low cost flexible organic solar cells and thin highly durable nanocomposite structures consist of components or films that are less than 100 nm in size. Consequently, the small scale increases difficulty of mechanical property characterization and thin film thickness measurement. The most widely used methods of thickness measurement include profilometry, X-Ray diffraction (XRD), and ellipsometry. However, these methods have several limitations including high cost, complex analysis procedures, or require knowledge of thin film optical properties. Currently, few methods can accurately measure thickness of an ultrathin (< 50 nm) film . A new nanomechanical method using a nanoindenter has the potential to measure thickness of films less than 10 nm with high accuracy. The advantages of nanoindentation over current methods are that it is a relatively straightforward technique, fast, and compatible with a wide range of substrates (soft and hard). Poly(methyl methacrylate) (PMMA) films were fabricated via spin coating to produce films 100-5 nm thick. The film roughness and morphology were characterized by atomic force microscopy as a function of spin coating parameters. Nanoindentation is performed on the films and a load-depth curve analysis based on the Oliver and Pharr method is used to determine the film thickness.

Time: 18:00

Session: Nanophotonics and Nanoelectronics

Occupation: Undergraduate Student

Type: Poster

Time: 18:00

Session: Nanophotonics and Nanoelectronics

Occupation: Undergraduate Student

Type: Poster

Affiliation: University of Florida

Name: Tanusri Pal **Time:** 18:00
Email: tanusri_p@yahoo.com **Session:** Nanophotonics and Nanoelectronics
Contributors: Tanusri Pal, M. Arif, Soumitra Kar, S. Santra **Occupation:** Postdoc
Contact: Saiful I. Khondaker **Type:** Poster
Title: **Photoresponse study in poly (3-hexylthiophence)/CdZnS nanocomposite field effect transistors**
Abstract: Organic field effect transistors (OFETs) were fabricated from poly(3-hexylthiophene)(P3HT) and CdZnS nanowire composite with different CdZnS concentration. The photoresponse behavior of the devices was studied under white light illumination with different intensity of the incident light. We found that the photosensitivity of the device is due to the charge separation of excitons at the interface of P3HT and CdZnS which depends on concentration of CdZnS nanowires. We also observed that under dark condition the field effect mobility decreases with the increase in CdZnS concentration, which can be attributed to the CdZnS nanowires that impede the transport of charge carriers. In addition the threshold voltage shifts towards the positive gate bias with the increase of CdZnS concentration indicates charge carrier trapping due to the higher concentration of CdZnS.

Affiliation: University of Central Florida, Nanoscience Technology Center, Department of Physics

Name: Biddut Sarker **Time:** 18:00
Email: bsarker@mail.ucf.edu **Session:** Nanophotonics and Nanoelectronics
Contributors: Bidduk K. Sarker, M. Arif, Lei Zhai **Occupation:** Graduate Student
Contact: Saiful I Khondaker **Type:** Poster
Title: **Near-infrared photoresponse in single walled carbon nanotube /polymer composite films**
Abstract: We present a near-infrared photoresponse study of single-walled carbon nanotube/poly (3-hexylthiophene)-block-polystyrene polymer (SWCNT/P3HT-b- PS) composite films for different loading ratios of SWCNT in the polymer matrix. Compared to the pure SWCNT film, the photoresponse [(light current - dark current)/dark current] is much larger in the SWCNT/polymer composite films. The photoresponse is up to 157% when SWCNT is embedded into P3HT-b-PS while for pure SWCNT film it is only 40%. We also show that the photocurrent strongly depends on the position of the laser spot, with maximum photocurrent occurring at the metal-film interface. We explain the photoresponse due to excitation dissociations and charge carrier separation caused by a Schottky barrier at the metallic electrode -SWCNT interface.

Affiliation: University of Central Florida, Department of Physics, Nanoscience Technology Center

Name: Todd Schumann **Time:** 18:00
Email: fhghfjk@ufl.edu **Session:** Nanophotonics and Nanoelectronics
Contributors: T. Schumann **Occupation:** Undergraduate Student
Contact: S. Tongay/A. F. Hebard **Type:** Poster
Title: **Graphite based Schottky diodes formed on Si, GaAs and 4H-SiC substrates**
Abstract: We demonstrate the formation of semimetal graphite/semiconductor Schottky barriers where the semiconductor is either silicon (Si), gallium arsenide (GaAs) or 4H-silicon carbide (4H-SiC). Near room temperature, the forward-bias diode characteristics are well described by thermionic emission, and the extracted barrier heights, which are confirmed by capacitance voltage measurements, roughly follow the Schottky-Mott relation. Since the outermost layer of the graphite electrode is a single graphene sheet, we expect that graphene/semiconductor barriers will manifest similar behavior.

Affiliation: University of Florida

Name: Shashank Shekhar **Time:** 18:00
Email: sshekhar@mail.ucf.edu **Session:** Nanophotonics and Nanoelectronics
Contributors: **Occupation:** Postdoc
Contact: Saiful I Khondaker **Type:** Poster
Title: **Macroscopic Level Alignment of Carbon Nanotube Devices at Pre-Defined coordinates**
Abstract: The SWCNTs have been aligned on designated arrays of (equidistant) electrodes of various channel length (L) and width (W). The alignment has been achieved by AC dielectrophoresis (DEP) of water soluble SWCNTs of different concentration and dielectrophoresis time. By this method the nanotubes are precisely located at given set of predefined coordinates. The packing density of nanotubes are varied from 0.25/micron to 1/micron on various combination of L and W. This method provides an easy, efficient and inexpensive way to align the CNT at macroscopic level at any possible substrate and designated location which may not be possible with other methods such as CVD. One of the worthy advantages of this method is that the dimension of the device depends on the geometry of the electrodes and not on the size of CNTs. The appropriate nanotubes are selected by the electrodes and hence we do not need a solution of precise size distribution. From technological point of view alignment of CNTs are essential for a large current output and to make statistically homogeneous devices which are the major drawbacks with single CNT devices. With alignment of commercially available semiconducting SWCNT it is possible to integrate the pre-located aligned nanotubes into an integrated circuit. The precisely located CNT array devices have shown promising field effect characteristic. Both wafer scale device and integration of individual nanotube devices to wafer scale are possible to fabricate from this kind of assembly. In this presentation I will be discussing the different controlling parameter for directed and positioned assembly such as concentration of initial solution, DEP time, and electrodes shape and size which alters the DEP force significantly. We will also show a comparative study of directed aligned and self aligned nanotubes by DEP method. Some of the challenges in alignment, and technological advancement will also be highlighted.

Affiliation: University of Central Florida, Nanoscience Technology Center

Name: Carlos Solano **Time:** 18:00
Email: cabeto.ortiz@gmail.com **Session:** Nanophotonics and Nanoelectronics
Contributors: **Occupation:** Undergraduate Student
Contact: Carlos A. Solano **Type:** Poster
Title: **Atomic Force Microscopy Study of Colossal Magnetoresistive Oxide Film Morphology**
Abstract: The morphology of the colossal magnetoresistive (CMR) oxide lanthanum strontium manganite (LSMO, La_{0.65}Sr_{0.35}MnO₃) has been studied using atomic force microscopy (AFM). The principles of the AFM itself have been learned and applied. A basic understanding of thin film growth was required in order to correlate surface morphology to epitaxial growth modes. The basics of the synthesis equipment, off-axis radio frequency (RF) magnetron sputtering, were learned. Thin film growth was optimized by observing the quality of the films obtained under different growth conditions. Two samples showed a difference in roughness at different locations. Substrate-induced strain was studied by growing the LSMO on different substrates; namely, strontium titanate (STO, SrTiO₃) and lanthanum aluminate (LAO, LaAlO₃). Scanning at different degrees did not demonstrate significant differences in measurements. A graph of roughness vs. film thickness shows a similar relation with both substrates, with LAO having a larger average roughness. This work was conducted under the guidance of Professor Charles Ahn and his graduate student Jason Hoffman at the Center for Research on Interface Structure and Phenomena (CRISP) at Yale University. Summer '09.

Affiliation: University of Central Florida

Name: Qiong Song **Time:** 18:00

Email: qsong@creol.ucf.edu

Contributors: Jianhua Liu, Lei Zhai

Contact: Shin Tson Wu

Title: Palladium nano particles doped liquid crystal display

Abstract: Recently, the merging of nanomaterials and nanotechnology into the fabrication of electro-optic device such as LCDs attracts much attention of researchers. The interesting optical, magnetic, and biological properties of metal nanoparticles are attributed to the size and structure of metal nanoparticles as well as the surfactants that stabilize nanoparticles. [1] Liquid crystal display devices, composed of nematic liquid crystal doped with palladium nanoparticles stabilized by the same NLC molecules of 5CB (Merck, K-15), show electrooptic characteristics that are featured by a frequency modulation effect [2]. In this paper, we report that the frequency range in the homogeneous cell spreading from 10Hz to 100Hz, correlates with that of the dielectric dispersion of the sample cell. Such correlation is expressed analytically by the Maxwell-Wagner theory on the heterogeneous dielectric medium, where the dielectric relaxation frequency and thus the dielectric relaxation time are primarily governed by the electrical conductivity of the doped nanoparticles of Pd and their concentrations. To synthesize the Pd nano particles, a solution of 2.49 mg $(C_2H_3O_2)_2Pd$ and 126.1 mg 5CB in 1.455g ethanol was illuminated with a UV irradiation of 60mw/cm² at 60 degree C for 15 mins under the stirring of a magnetic bar with 500 rpm/min. After the reduction of palladium acetate to palladium, the absorption peak of the suspension was observed at 395nm [1]. TEM images of the suspension show that most of the nanoparticles sizes are from 3 to 10 nm while small amount of nanoparticle aggregation with size around 20 to 30 nm are also observed. In order to put Pd nanoparticles into liquid crystals, chlorobenzene was used to form a stable Pd nanoparticle/5CB suspension after sonication. The solvents were vacuum evaporated obtain a palladium nanoparticle doped liquid crystal suspension with a nanoparticle concentration of 0.09 percent. Upon heating the 5CB to isotropic phase, a transparent dark brown solution was obtained, suggesting a uniform dispersion of nanoparticles in the liquid crystal. The Pd nanoparticle doped liquid crystal was loaded into an 8 μ m homogeneous cell and the dielectric relaxation of this sample was measured. The real part of the dielectric constant is fitted with Debye equation. The dielectric constant at 0 Hz and infinity Hz are 135 and 11.0, respectively with the crossover frequency being only 24Hz. The transmission vs voltage curves at difference frequencies were also examined. The threshold voltage shift from 0.55V to 1.1V at 10Hz, which is much larger than the shift in a pure 5CB sample. At 50Hz, the threshold voltage shift from 0.55V to 0.65V. Above 50Hz, no obvious frequency modulation effect was observed for this sample with concentration 0.09 percent. In the future work, various concentrations of palladium nano particles in 5CB will be fabricated to study the effect on the concentration on the physical property of nanoparticles doped liquid crystal suspension. The Maxwell-Wagner theory will be applied to fit the dielectric relaxation and loss. [1] Gunter Schmid, Nanoparticles: from Theory to Application, WILEY-VCH Verlag GmbH & Co.KG&A, Weinheim, 2004. [2] S. Kobayashi, T. Miyama, J. Display Technology 2, 121 (2006)

Affiliation: University of Central Florida, College of Optics and Photonics, Nanoscience Technology Center

Session: Nanophotonics and Nanoelectronics

Occupation: Graduate Student

Type: Poster