Fall 2012 Meeting of the APS Ohio-Region Section
Detroit, Michigan
http://www.aps.org/meetings/meeting.cfm?name=OSF12
In the past 50 years it was believed that during cell secretion, membrane-bound secretory vesicles completely merge at the cell plasma membrane resulting in the diffusion of intra-vesicular contents to the cell exterior and the compensatory retrieval of the excess membrane by endocytosis. This explanation made no sense or logic, since following cell secretion partially empty vesicles accumulate as demonstrated in electron micrographs. Furthermore, with the “all or none” mechanism of cell secretion by complete merger of secretory vesicle membrane at the cell plasma membrane, the cell is left with little regulation and control of the amount of content release. Moreover, it makes no sense for mammalian cells to possess such ‘all or none’ mechanism of cell secretion, when even single-cell organisms have developed specialized and sophisticated secretory machinery, such as the secretion apparatus of Toxoplasma gondii, the contractile vacuoles in paramecium, or the various types of secretory structures in bacteria. Therefore, in 1993 in a News and Views article in Nature, E. Neher wrote “It seems terribly wasteful that, during the release of hormones and neurotransmitters from a cell, the membrane of a vesicle should merge with the plasma membrane to be retrieved for recycling only seconds or minutes later.” This conundrum in the molecular mechanism of cell secretion was finally resolved in 1997 following discovery of the “Porosome,” the universal secretory machinery in cells. Porosomes are supramolecular lipoprotein structures at the cell plasma membrane, where membrane-bound secretory vesicles transiently dock and fuse to release intravesicular contents to the outside during cell secretion. In the past decade, the composition of the porosome, its structure and dynamics at nm resolution and in real time, and its functional reconstitution into artificial lipid membrane, have all been elucidated. Since porosomes in exocrine and neuroendocrine cells measure 100-180 nm, and only 20-45% increase in porosome diameter is demonstrated following the docking and fusion of 0.2-1.2 µm in diameter secretory vesicles, it is concluded that secretory vesicles “transiently” dock and fuse, rather than completely merge at the base of the porosome complex to release their contents to the outside. In agreement, it has been demonstrated that “secretory granules are recaptured largely intact after stimulated exocytosis in cultured endocrine cells”, that “single synaptic vesicles fuse transiently and successively without loss of identity”; and that “zymogen granule (the secretory vesicle in exocrine pancreas) exocytosis is characterized by long fusion pore openings and preservation of vesicle lipid identity.” In this presentation, the discovery of the porosome, resulting in a paradigm shift in our understanding of cell secretion will be briefly discussed.

Friday, October 5, 2012 3:00PM - 4:00PM –
Session BA Energy Conversion McGregor Conference Center BC - Sean Gavin, Wayne State University

3:00PM BA.00001 Energy for the 21st Century World Economy: Problems and Opportunities, WOLFGANG BAUER, Michigan State University — Humans currently use approximately 16 TW of power. More than 80% of this power is generated from fossil fuels, which is unsustainable. But there are alternatives (solar, wind, hydro, biomass, geothermal, and nuclear). In this presentation I will review their costs and benefits.

4:00PM - 4:00PM –
Session CA Poster Session (4:00-6:00 PM) McGregor Conference Center J - Gavin Lawes, Wayne State University

CA.00001 Stability of the Euler integration method in coupled two-domain diffusive systems, STEFFAN PUWAL1, BRADLEY ROTH, Oakland University — Owing to its simplicity, the Euler integration method is widely used for modeling diffusive systems. The method involves approximating the derivative with a finite difference. The size of the space and time steps used cannot be considered independently. For the solution to converge, the time step can be no larger than a quantity proportional to the square of the space step; this is the well-known stability condition of the parabolic differential (heat) equation. In cardiac electrodynamics, the action potential reaction diffuses and one must separately consider the diffusive characteristics of the intracellular and extracellular spaces (a bidomain model). We derive the stability relation for this coupled two-domain diffusive system in the case of anisotropic, homogeneous electrical conductivity. We find that stability is uniquely determined only if the electrical conductivity tensors of the two spaces are symmetric (a condition related to the nature of the derivative) and are positive definite (a condition related to entropy).

1Primary author.

CA.00002 Hyperfine Structure Measurement in the 8p2P 3/2 Level of Cesium by Quantum Beat Spectroscopy1, BURCIN BAYRAM, OLEG POPOV, STEPHEN KELLY, ANDREW SALSMAN, Miami University — Using the delayed- detection method in conjunction with pump-stimulated emission probe excitation, we have measured atomic polarization quantum beats in the 8p2P 3/2 level of atomic cesium. According to the observed evolution of hyperfine structure dependent parameters, e.g. alignment and atomic polarization, by delaying the arrival time of the probe laser, the magnetic dipole A and electric quadrupole B coefficients are obtained. We will present our unique method, applied the first time to the 8p2P 3/2 level of atomic cesium, and the results which are in good agreement with the previous determination within the error limits.

1The authors acknowledge financial support from Research Corporation and Miami University.

CA.00003 Comparison of mechanism of break up and cycle length in defibrillation success, NATALYA MELKUS1, STEFFAN PUWAL, Oakland University — Heart fibrillation is an often fatal condition which can be modeled by chaotic electrical activity; spiral waves of electrical activity rotate, break-up, and meander on tissue. As they do, they produce a chaotic distribution of electrical activity, negatively affecting physical contraction (blood pumping). Fenton et al. studied several mechanisms of this wave breakup, including “far from tip” and “Doppler shift.” We used Fenton et al.’s mathematical model and the different modes of breakup proposed by Fenton to simulate fibrillation and to determine if the cycle length of the activity or the type of mechanism was more significant in defibrillation. Our data supports the conclusion that the cycle length is the more important factor in defibrillation.

1Primary author.
CA.00004 Bone strength and athletic ability in hominids: *Ardipithecus ramidus* to *Homo sapiens*. SCOTT LEE, University of Toledo — A methodology for the evaluation of the athletic ability of animals based on the strength of their femur and their body mass is developed. The ability of the femur to resist bending stresses is determined by its midlength cross-sectional geometry, its length and the elastic properties of the mineral part of the bone. The animal’s athletic ability, determined by a “bone strength index,” is limited by this femoral bending strength in relation to the loads on the femur. This analysis is applied to the fossil record for *Homo sapiens*, *Homo neanderthalensis*, *Homo erectus*, *Homo habilis*, *Australopithecus afarensis* and *Ardipithecus ramidus*. Evidence that the femoral bone strength index of modern *Homo sapiens* has weakened over the last 50,000 years is found.

CA.00005 A Raman Scattering Study of the Interactions of DNA with its Water of Hydration. SCOTT LEE, University of Toledo, NONG-JIAN TAO, Arizona State University, ALLAN RUPPRECHT, University of Stockholm — Raman spectroscopy is used to probe the nature of the hydrogen bonds which hold the water of hydration to DNA. The ~ 3450 cm$^{-1}$ molecular O-H stretching mode shows that the first 6 water molecules per base pair of the primary hydration shell are very strongly bound to the DNA. The observed shift in the peak position of this mode permits a determination of the length of the hydrogen bonds for these water molecules. These hydrogen bonds appear to be about 0.3 A shorter than the hydrogen bonds in bulk water. The linewidth of this mode shows no significant changes above water contents of about 15 water molecules per base pair. This technique of using a vibrational spectroscopy to obtain structural information about the hydration shells of DNA could be used to study the hydration shells of other biomolecules.

CA.00006 The Dip in the Anodal Strength-Interval Curve in Cardiac Tissue. SUNIL KANDEL, BRADLEY J. ROTH, Oakland University — Heart disease – specifically ventricular fibrillation – is the leading cause of death in the United States. The most common treatment for this lethal arrhythmia is defibrillation: application of a strong electrical shock that resets the heart rhythm. In this project, we use the bidomain model of cardiac tissue to calculate the time it takes for the wave of depolarization to get to the heart by using numerical simulations. To accomplish this goal, we will test four hypotheses to find the time delay of refractory tissue to an anodal shock. We will use bidomain model; the state-of-the-art mathematical description of how cardiac tissue responds to an electric shock. The innovative feature of this proposal is to integrate the bidomain model with an ion channel model (Luo-Rudy model, 1994) that includes intracellular calcium dynamics to get a detailed calculation of the mechanism of the excitation and to understand the electrical behavior of the heart, which is important for pacing and defibrillation.

CA.00007 The application of time-gated fluorescence spectroscopy to the real-time monitoring of biological metabolism. ZACHARY LONG, PAUL URAYAMA, Miami University — A time-gated fluorecence spectroscopy system capable of nanosecond gating and picosecond control of gate delays is presented. Used in conjunction with pulsed excitation, the system is capable of tracking the temporal evolution of the fluorescence spectrum from solution samples. The system uses a nitrogen discharge laser as the excitation source and a time-gated intensified CCD detector coupled to a spectrograph. Precise synchronization between the laser pulse and ICCD gate is achieved using a constant-fraction optical discriminator. System characterizations are presented, for example, the ability to both spectrally and temporally resolve the content of fluorophore mixtures is confirmed. Biotechnological applications are highlighted, including gated spectroscopy for the real time monitoring of metabolic activity via measurement of endogenous cellular fluorescence.

1 This material is based upon work supported by the National Science Foundation under Grant No. 0957675.

CA.00008 Cell Adhesion Modification of Streptococcus viridians in the Presence of Xylitol. JASON ESMACHER, Wayne State University, BLAIR VIDAKOVICH, Oakland University, MICHAEL GIANGRANDE, Oakland Community College, PETER HOFFMANN, Wayne State University — There is scientific documentation that those who chew gum sweetened by the sugar alcohol xylitol report a dramatically lower incident of both dental caries and otitis media compared to those who chew conventional gum sweetened by sucrose. An explanation contends that xylitol interferes with the ability of Streptococcus viridians (SV) to form biofilms which is a necessary precursor to the bacteria’s ability to damage human tissues. We have used atomic force microscopy to study the cell wall/fimbria properties at the nanonewton level in both the presence and absence of xylitol. The first set of measurements used varying concentrations of xylitol incorporated within the incubation medium. The second used non-xylitol grown bacteria, the xylitol was added externally at various concentrations. Our study suggests that growing SV with xylitol reduces their ability to adhere together. Additionally, externally added xylitol showed grouping of cell adhesion to a relatively narrow nanonewton spread that is concentration dependent. Measurement of the adhesion properties of the bacterial cell wall have found that there is a dramatic increase in the cell wall’s firmness which simultaneously accompanied a decrease in its ability to support adhesion, even at very low concentrations of xylitol.

CA.00009 Viscosity characterization of polymer and polymer-nanocomposite materials with the AFM. EDWARD KRAMKOWSKI, DAVID WILSON, ASHIS MUKHOPADHYAY, PETER HOFFMANN, Wayne State University — Traditional methods for characterizing the viscosity of solutions, while accurate, require the use of a few grams of the material being investigated. As the production methods of these materials becomes more costly, devising techniques that can accurately measure their physical properties with a much smaller mass of material would prove useful in streamlining the development process. To this end, we aim to design a quick, reliable, and cost-effective method of measuring viscosity through the use of an atomic force microscope, which requires less than a gram of the sample being tested. Here we will introduce preliminary results, comparing the AFM-determined viscosity with values attained through the use of other commonly used measurement devices.

CA.00010 Phase Transitions and Helix Formation of a Fused Square-Well-Sphere Chain. MICHAEL MROZ, MARK TAYLOR, Dept. of Physics, Hiram College — This study involves observing phase transitions of a flexible polymer chain made of $N = 20$ square-well-sphere monomers, with the hard-core diameter $\sigma$ and square-well diameter $\lambda\sigma$, connected by bonds of fixed length $L < \sigma$. The density of states of the polymer is calculated using the Wang-Landau simulation technique. The density of states was then utilized to compute thermodynamic and average structural properties of the chain. A temperature-interaction range $T$-$\lambda$ phase diagram was constructed for a chain of bond length $L = 0.625\sigma$. With decreasing temperature this chain undergoes a coil-globule (i.e., collapse) transition followed by one or more low temperature transitions to an ordered ground-state structure. For $\lambda > 1.25$ this ground state is a simple helix while for smaller $\lambda$ the ground state is a wrapped structure, in which one end of the chain forms a linear core about which the rest of the chain is helically wound. The low temperature transition takes on a first-order character for $\lambda < 1.1$.

1 Funded by NSF (DMR-1204747)
CA.00011 Thermodynamics of cellulose solvation in novel solvent mixtures, RITANKAR DAS, JHIH-WEI CHU, Department of Chemical and Biomolecular Engineering, University of California, Berkeley — Biomass contains abundant amounts of cellulose as crystalline microfibrils. A limiting step to using cellulose as an alternative energy source, however, is the hydrolysis of the biomass and subsequent transformation into fuels. Cellulose is insoluble in most solvents including organic solvents and water, but it is soluble in some ionic liquids like BMIM-Cl. This project aims to find alternative solvents that are less expensive and are more environmentally benign than the ionic liquids. All-atom molecular dynamics simulations were performed on dissociated glucan chains separated by multiple (4-5) solvation shells, in the presence of several novel solvents and solvent mixtures. The solubility of the chains in each solvent was indicated by contact calculations after the equilibration of the molecular dynamics. It was discovered that pyridine and imidazole acted as the best solvents because their aromatic electronic structure was able to effectively disrupt the inter-sheet interactions among the glucan chains in the axial direction, and because perturbation of the solvent interactions in the presence of glucan chains was minimal.

CA.00012 Low temperature glassy relaxation in rare earth doped Fe₃O₄ nanoparticles, SUVRA LAHA, GAVIN LAWES, Wayne State University — Magnetic nanoparticles typically exhibit glassy relaxation at low temperature, which can be affected by doping. Gadolinium and Lanthanum doped Fe₃O₄ nanoparticles were synthesized using a chemical co-precipitation method. The structural and optical properties of these nanoparticles were characterized by using Transmission Electron Microscope (TEM) and the Raman spectroscopy. The TEM images show the formation of nanoparticles of size ranging between 12-14 nm and Raman spectra are consistent with the formation of Fe₃O₄. AC magnetic measurements were also conducted on these nanoparticles. From the ac out-of-phase susceptibility (χ′′) vs temperature (T) graphs, it is observed that the doped nanoparticles show larger amplitude relaxation peaks at low temperature as compared to the undoped samples. These magnetic relaxation features develop roughly between 25K to 35K and show frequency dependence. The increased magnetic relaxation at low temperatures can be attributed to structural defects which may arise due to the doping of lanthanides in Fe₃O₄ nanoparticles.

CA.00013 Diffusion of Nanoparticles in Semidilute Polymer Solutions: The Effect of Different Length Scales, INDERMEET KOHLI, ASHIS MUKHOPADHYAY, Wayne State University — Gold nanoparticles (Au NPs) were used to investigate the length-scale dependent dynamics in semidilute poly(ethylene glycol) (PEG)-water solutions. Fluctuation correlation spectroscopy was used to measure the diffusion coefficients (D) of the NPs as a function of their radius, R₀ (2.5-10 nm). PEG volume fraction, φ (0-0.37) and molecular weight, Mₘ (5 kg/mol and 35 kg/mol). Our results indicate that the radius of gyration, Rₒ, of the polymer chain is the crossover length scale for the NPs experiencing nanoviscosity or macroviscosity. The reduced diffusivity can be plotted on a single master curve as Dₒ/D= exp [(α(Rₒ/ζ)²)] for Rₒ > Rₐ and as Dₒ/d= exp [(α(Rₒ/δ)²)] for Rₒ < Rₐ, where Dₒ is diffusion coefficient in the neat solvent; ζ = the correlation length, α = 1.63 and δ = 0.89. In the intermediate size regime, ζ < Rₒ < α(φ), where ‘α(φ)’ is the tube diameter for entangled polymer liquid, we found that D ~ φ⁻¹.⁴ and independent of Mₘ. For Rₒ > α(φ), D~ φ⁻¹ was obtained. The results were compared with currently available theories.

CA.00014 Adsorption of Gold Nanoparticles from a Crowded Solution on Solid/Liquid Interface, SHARMINE ALAM, INDERMEET KOHLI, BHAVDEEP PATEL, ASHIS MUKHOPADHYAY, Wayne State University — Adsorption of nanoparticles at solid-liquid interface is of great importance in the field of colloidal science and biophysics. Protein adsorption is one of the most significant processes and can be mimicked by colloidal systems. We will present results of our studies of the kinetics of adsorption of gold nanoparticles from a crowded polyvinyl alcohol (PVA) polymer solution on a solid/liquid interface using phase-modulated ellipsometry and Fluctuation Correlation Spectroscopy (FCS). The experimental system mimics many biological processes, where the adsorption of particles or proteins takes place in the presence of other many components.

CA.00015 Effect of Surfactants on the Physical Properties and Electrochemical Performance of LiFePO₄ Cathode Material for Lithium Ion Batteries, K. BAZZI, R. NAJK, G.A. NAZRI, Wayne State University, M. NAZRI, Applied Sciences Inc., Cedarville, Ohio, V. NAJK, Department of Natural Sciences, University of Michigan-Dearborn, B.P. MANDAL, Wayne State University, P.P. VAISHNAVA, Department of Physics, Kettering University, Flint, Michigan — Use of lithium ion phosphate in lithium ion battery is hampered by the poor electronic conductivity and slow lithium ion diffusion. Several methods have been tried to improve the conductivity. Carbon coating is found to be very suitable way to enhance the electronic conductivity. Here, we report synthesis of carbon coated LiFePO₄ composite materials using lauric, myristic, and oleic acid as source of carbon. The phase purity of these three LiFePO₄/C composites was confirmed by X-Ray Diffraction. The quality of carbon coating has been investigated by Raman spectroscopy. In all the samples, the carbon content is found to be approximately 10%. SEM and TEM investigations reveal that the surfactants coat the LiFePO₄ particles uniformly with carbon and the coating reduces the particle size to approximately 30 nm. Due to high electrical conductivity, controlled particle size and suitable microstructure, among the three LiFePO₄ coated samples, the sample prepared in presence of lauric acid exhibited superior electrochemical performance in terms of specific capacity, the cycling stability and delivered high discharge capacity of ~140 mAhg⁻¹ at C/2 rate.

CA.00016 Approaching the Intrinsic Bandgap in Suspended High-Mobility Graphene Nanoribbons, MING-WEI LIN, CHENG LING, Wayne State University, LUIS AGAPITO, NICHOLAS KIOUSSIS, California State University, YIYANG ZHANG, MARK MING-CHENG CHENG, Wayne State University, WEILI WANG, EFTHIMIOS KAXIRAS, Harvard University, ZHIXIAN ZHOU, Wayne State University, WAYNE STATE UNIVERSITY COLLABORATION, CALIFORNIA STATE UNIVERSITY COLLABORATION, HARVARD UNIVERSITY COLLABORATION, WAYNE STATE UNIVERSITY COLLABORATION — We report electrical transport measurements on a suspended ultra-low-disorder graphene nanoribbon (GNR) with nearly atomically smooth edges that reveal a high mobility exceeding 3000 cm²V⁻¹s⁻¹ and an intrinsic bandgap. The experimentally derived bandgap is in quantitative agreement with the results of our electronic-structure calculations on chiral GNRs with comparable width taking into account the electron-electron interactions, indicating that the origin of the bandgap in non-armchair GNRs is partially due to the magnetic zigzag edges.

CA.00017 Mobility Enhancement and Highly Efficient Gating of Monolayer MoS₂ Transistors with Polymer Electrolyte, MING-WEI LIN, LEZHANG LIU, QING LAN, XUEBIN TAN, KULWINDER DHINDSA, PENG ZENG, Wayne State University, VAMAN NAJK, University of Michigan-Dearborn, MARK MING-CHENG CHENG, ZHIXIAN ZHOU, Wayne State University, WAYNE STATE UNIVERSITY COLLABORATION, UNIVERSITY OF MICHIGAN-DEARBORN COLLABORATION — We report electrical characterization of monolayer molybdenum disulfide (MoS₂) devices using a thin layer of polymer electrolyte consisting of poly(ethylene oxide) (PEO) and lithium perchlorate (LiClO₄) as both a contact-barrier (Parrier reducer and channel mobility booster. We find that bare MoS₂ devices (without polymer electrolyte) fabricated on Si/SiO₂ have low channel mobility and large contact resistance, both of which severely limit the field-effect mobility of the devices. A thin layer of PEO/ LiClO₄ deposited on top of the devices not only substantially reduces the contact resistance but also boosts the channel mobility, leading to dramatically enhancement of the field-effect mobility of the device. When the polymer electrolyte is used as a gate medium, the MoS₂ field-effect transistors exhibit excellent device characteristics such as a near ideal subthreshold swing and an on/off ratio of 10⁶ as a result of the strong gate-channel coupling.
CA.00018 The effect of select non-structural parameters upon the intensity of calculated LEED I(E) curves. NATHAN GRIESE, Ohio Northern University — The LEED investigation of the (5x5) structure formed by sulfur adsorbed on a clean Au(111) surface results in calculated I(E) curves which exhibit unexpectedly low intensity at high energies of the probing electrons. The present study investigates various parameters used in the dynamical LEED calculation these curves, which are predominantly responsible for the intensity of the curves. Parameters such as: the Debye temperature associated with the sulfur adsorbed layer, the imaginary part of the inner potential describing the inelastic energy losses of the probing electrons within the crystal, and the anisotropic vibrations of the sulfur layer (enhanced vibrations in a direction perpendicular to the surface) have been studied by monitoring their effect on the intensity of the calculated curves. Also, the phase shifts describing the scattering of the incoming electrons by the S and Au atoms have been calculated for different configurations of the sulfur atoms on the substrate, and their influence on the I(E) curves has been considered. It is concluded that even if a certain enhancement of the beams’ features is possible by choosing a particular combination of the above mentioned parameters, the process of comparing the experimental and theoretical beams by mainly matching the peak positions (as done by the Pendry R factor) imposes certain values of these parameters, not necessarily the ones which would produce high intensity peaks.

CA.00019 Live cell imaging and determination of protein-protein rupture force with AFM. ANWESA SARKAR, EDWARD KRAMKOWSKI, ELSA VARUGHESE, Wayne State University, ESSA MAYYAS, Wayne State University, PETER HOFFMANN, Wayne State University — Atomic Force Microscopy (AFM) provides superior imaging resolution and the ability to measure forces at the nanoscale. It is an important tool for studying a wide range of biomolecular samples from proteins, DNA to living cells. We are developing AFM measurement procedures to measure protein interactions on live cells at the single molecular level. To achieve this goal, a number of challenging problems need to be overcome. These include live cell imaging, lever functionalization, localizing single proteins on the cell surface, taking the effect of cell membrane deformation into account, developing data analysis methods to determine the protein-protein rupture force (subtracting out cell deformation) and determining bond characteristics and kinetic parameters for the protein interaction. This poster presents preliminary results obtained with AFM and addresses these various aspects.

CA.00020 Study of Quark Compositeness using the Dimuon Mass Distribution in a Helicity Non-Conserving Model in High Energy p-p Collisions. CHAMATH KOTTACHCHI KANKANAMGE DON, SOWJANYA GOLAPPINI, PRAMOD LAMICHHANE, PAUL KARCHIN, Wayne State University, LEONARD SPIEGEL, FNAL — The Standard Model (SM) of particle physics predicts and explains the nature of particle processes at very high accuracy, but it does not explain everything. The SM does not predict the mass spectra of quarks & leptons as well as the number of family members in each group. A possible explanation is the existence of more fundamental particles in nature. The 4-fermion contact interaction is used to understand the compositeness of quarks and leptons with more basic constituents called preons. Using contact interactions in the helicity non-conserving model of quark compositeness, the predicted dimuon mass distribution is studied at a center of mass energy of 8 TeV for proton-proton collisions with compositeness energy scales ranging from 3 TeV to 30 TeV. Dimuon events are generated using the Monte Carlo generator Pythia 6.4. We have shown that the mean dimuon mass in contact interactions decreases with increasing compositeness energy scale. The results are compared with the mean dimuon mass distribution of the Drell Yan process.

CA.00021 Enhanced electrochemical performance of graphene modified LiFePO$_4$ as a cathode material for lithium ion batteries. K.S. DHINDSA, B.P. MANDAL, M.W. LIN, M. NAZRI, G.A. NAZRI, Wayne State University, V.M. NAIK, University of Michigan-Dearborn, P. VAISHNAVA, Kettering University, R. NAIK, Z.X. ZHOU, Wayne State University — We have synthesized LiFePO$_4$/graphene nano-composites using a sol-gel method by adding water dispersed graphene oxide to the LiFePO$_4$ precursors during the synthesis. The graphene oxide was reduced by annealing the composite at 600°C for 5h in flowing forming gas (90% Ar and 10% H$_2$). The phase purity of the product was characterized by X-Ray diffraction and Raman spectroscopy. The reduction of graphene oxide was verified by Raman spectroscopy and X-ray Photoelectron spectroscopy. The electronic conductivity of LiFePO$_4$/graphene composite was found to be six orders of magnitude higher than that of pure LiFePO$_4$ synthesized following otherwise the same procedure except that no graphene oxide was used. SEM and TEM images show that LiFePO$_4$ particles are wrapped in uniformly distributed graphene sheets throughout the material forming a three dimensional conducting network. At low currents, the capacity of the composite cathode reaches 160 mAh/g, which is very close to the theoretical limit. More significantly, the graphene wrapped LiFePO$_4$ shows a dramatically improved rate capability and excellent charge-discharge cycle stability in comparison with the LiFePO$_4$ without graphene.

CA.00022 Ionic-Liquid Gated Bilayer MoS$_2$, Field-Effect Transistors. MEEGHAGE MADUSANKA PERERA, HSUN-JEN CHUANG, MING-WEI LIN, BHIM CHAMLAGAIN, XUEBIN TAN, MARK MING-CHENG CHENG, ZHIXIAN ZHOU, Wayne State University — We report the electrical characterization of ionic-liquid-gated bilayer MoS$_2$ field-effect transistors. An On-Off current ratio greater than 10$^5$ is achieved for hole transport, while that for electron transport exceeds 10$^8$. The subthreshold swing of our bilayer MoS$_2$ devices reaches as low as 47 mV/dec at 230 K, approaching the theoretical limit. We also demonstrate that 1) the extrinsic mobility of back-gated MoS$_2$ field-effect transistors is largely limited by the contact resistance; and 2) the extremely large electrical-double-layer capacitance of ionic liquid significantly reduces the Schottky contact barrier leading up to three orders of magnitude mobility increase for electron transport.

CA.00023 Few-layer MoSe$_2$, Ambipolar Field-Effect Transistors. BHIM CHAMLAGAIN, HSUN-JEN CHUANG, MEEGHAGE MADUSANKA PERERA, MING-WEI LIN, Wayne State University, JIAQIANG YAN, NIRMAL JEEVI GHIMIRE, WAYNE MANDRUS, The University of Tennessee, ZHIXIAN ZHOU, Wayne State University — Field-effect transistors were fabricated from few-layer MoSe$_2$ quasi-two dimensional flakes produced by mechanically exfoliating high quality MoSe$_2$ crystals synthesized using a vapor transport method. Electrical transport measurement on back-gated MoSe$_2$ devices shows that they are n-type and their extrinsic mobility is in the range of 0.1 - 10 cm$^2$/V·s, similar to few-layer MoS$_2$ field-effect transistors. Ambipolar behavior is observed in ionic-liquid-gated MoSe$_2$ devices, with the On/Off current ratio exceeding 10$^{10}$ for both electrons and holes. For the electron channel, the extrinsic mobility measured in the ionic-liquid-gate configuration increases by over an order of magnitude, which can be attributed to the reduction of Schottky barrier by the more efficient gating. In addition, the electron mobility increases with decreasing temperature above 250 K, suggesting that the phonon scattering is a significant contributor to the channel resistance. On the other hand, the hole mobility is substantially lower and does not show significant temperature dependence, which is likely due to the higher contact resistance for holes.

$^1$This work was supported by NSF (No. ECCS-1128297). Part of this research was conducted at the Center for Nanophase Materials Sciences under project # CNMS2011-066.

$^2$This work was supported by NSF (No. ECCS-1128297). Part of this research was conducted at the Center for Nanophase Materials Sciences under project # CNMS2011-066.
CA.00024 Tomographic Reconstruction of Breast Characteristics Using Transmitted Ultrasound Signals. GURSHARAN SANDHU, Wayne State University, CUIPING LI, NEB DURIC, Karmanos Cancer Institute, ZHI-FENG HUANG, Wayne State University — X-ray mammography has been the standard technique for the detection of breast cancer. However, it uses ionizing radiation, and can cause severe discomfort. It also has low spatial resolution, and can be prone to misdiagnosis. Techniques such as X-ray CT and MRI alleviate some of these issues but are costly. Researchers at Karmanos Cancer Institute developed a tomographic ultrasound device which is able to reconstruct the reflectivity, attenuation, and sound speed characteristics of the breast. A patient places her breast into a ring array of transducers immersed in a water bath and the device scans the breast yielding a 3D reconstruction. Our work focuses on improving algorithms for attenuation and sound speed imaging. Current time-of-flight tomography provides relatively low resolution images. Improvements are made by considering diffraction effects with the use of the low resolution image as a seed to the Born approximation. Ultimately, full waveform inversion will be used to obtain images with resolution comparable to MRI.

CA.00025 Nonspecific targeting of iron oxide nanoparticles to the liver, kidney and spleen: A novel approach to achieving specificity. MAHESHKA PALIHAWADANA ARACHCHIGE, AMANDA FLACK, XUEQUN CHEN, JING LI, DAVID OUPICKY, Y.-C. NORMAN CHENG, YIMIN SHEN, BHANU JENA, GAVIN LAWES, Wayne State University — Recently there has been significant interest in developing Fe$_3$O$_4$ nanoparticles for biomedical applications including targeted drug delivery and magnetic resonance imaging. One of the major problems in applying these nanoparticles clinically is to minimize the undesirable filtration of these materials by the mononuclear phagocyte system. Preliminary MRI and magnetization studies on hyaluronic acid coated nanoparticles injected intravenously into mice confirm that the nanoparticles accumulate in the liver, spleen, and kidneys. To identify whether this nanoparticle accumulation is due to some certain specific proteins, we exposed hyaluronic acid coated nanoparticles to proteins extracted from these organs, together with blood plasma proteins, then used gel electrophoresis together with mass spectroscopy to identify the proteins binding to the nanoparticles. We find that the accumulation of nanoparticles in these organs can be due to specific binding by a small number of proteins. By appropriately functionalizing the Fe$_3$O$_4$ nanoparticles, possibly by blocking the binding sites of these specific proteins, we expect that the nanoparticles uptake in the liver, spleen, and kidneys will be reduced, which, in turn, could increase the concentration of nanoparticles at tumor sites.

CA.00026 Assessment of Pulmonary Artery Stiffness of Repaired Congenital Heart Disease Patients. NAMHEON LEE, University of Cincinnati, RAJIT BANERJEE, Mason High School, MICHAEL TAYLOR, KAN HOR, Cincinnati Children’s Hospital Medical Center — Surgical correction or palliation of congenital heart disease (CHD) often requires augmenting the main pulmonary artery (MPA) with non-native material or placing a cylindrical graft. The degree to which this intervention affects PA compliance is largely unknown. In this study, the MPA stiffness characteristics were assessed by its compliance, distensibility, and pressure-strain modulus. Coregistered velocity encoded phase-contrast MRI and cardiac catheterization data were available for a cohort of repaired CHD patients (n=8) and controls (n=3). All patients were repaired with either an RV-PA conduit or a RV outflow tract patch. We measured the MPA area change by MRI and MPA pressure during the cath. The measurements were taken through or just distal to the conduit. The MPA compliance and distensibility for the patients were significantly lower than the controls: compliance (9.8±10.8 vs 28.3±7.7mm$^2$/mmHg, p<0.05), distensibility (2.2±1.5 vs 6.6±2.1%Area change/mmHg, p=0.05). The patients had a significantly higher pressure-strain modulus (152.3±116.4mmHg, p<0.05) than the controls (35.8±10.6mmHg). The abnormally elevated PA stiffness due to the rigidity of the conduit or patch material may cause a compliance mismatch resulting in high stress levels contributing to the observed progressive PA dilatation. This may be a factor in the progressive RV dilatation seen in this cohort of repaired CHD patients.

CA.00027 Development of a Laser Manipulation System for Dusty (Complex) Plasma Research$^1$, LISA SIMPSON, JEREMIAH WILLIAMS, Wittenberg University — A dusty (complex) plasma is a cloud of ionized gas containing small particles (i.e. dust). In the laboratory setting, the dust component typically consists of micron- to nanometer-sized dust grains which allows for the study of a wide range of physics at the kinetic level. Because of the relatively large size of the dust grains, it is possible to manipulate the dust component via the radiation pressure force. This poster presents work on the development of a laser manipulation system for use in dusty plasma research. Details of the laser manipulation system, as well as the studies that we plan to conduct in the future, will be discussed.

$^1$This work is supported by grant number PHY-0953595 from the National Science Foundation.

CA.00028 Numerical simulations of the particle image velocimetry technique applied to dusty plasmas$^1$, ANYA WEAVER, JEREMIAH WILLIAMS, Wittenberg University — A dusty plasma is a system composed of ions, electrons, neutral particles, and charged microparticles. The dust component in this cloud of ionized gas consists of micron- to nanometer-sized dust grains, which allows for the study of physics on the kinetic level. Recent developments in stereoscopic and tomographic particle image velocimetry (stereo-PIV) techniques have been used to map the underlying distribution functions of the microparticles. This poster describes the numerical study of the PIV measurement technique and its application to the measured three-dimensional velocity space distribution function.

$^1$This work is supported by grant number PHY-0953595 from the National Science Foundation.

CA.00029 Mixing evaluation using an entropic measure in Dean flow micromixers. PETRU FODOR, BRIAN VYHNALEK, MIRON KAUFMAN, Cleveland State University — Promoting mixing in fluid systems at low Reynolds number, remains one of the problems of interest in the development of microreactors. In the laminar flow regime characteristic to these type of systems the mixing between different species needed for chemical reactions relies on diffusion, which is relatively slow. In order to circumvent this problem various methodologies exploiting appropriately chosen geometries or relying on external forces such as magnetic, electrophoretic, ultrasonic ones are used to either increase the interface between the chemical components and/or induce chaotic advection within the fluid stream. In this work we investigate computationally the use of curved channels at Reynolds numbers from 25 to 900, in which the centrifugal forces, experienced by the fluid as it travels along a curved trajectory, induce counter-rotating flows (Dean Vortices). The presence of these transversal flows promotes the mixing of chemical species which are introduced in the system at different position across the cross section of the channel. The mixing efficiency is evaluated using the Shannon entropy. We have found this measure to be useful in understanding mixing in the staggered herringbone mixer [Petru S. Fodor and Miron Kaufman, Modern Physics Letters B 25, 1111 (2011)].
CA.00030 Light Scattering Study of Elongated Particles \textit{in situ}: From FeOOH Nanorice to Polypeptide Micelles. PHILIP DEE, KIRIL STRELETZKY, Cleveland State University — Utilizing the powerful experimental technique of Dynamic Light Scattering (DLS) for size characterization of anisotropic particles can be extremely misleading. Unfortunately, this point is often not realized by researchers who strive for particle sizing of nanoparticles in suspensions. The first goal of this study was to highlight the ambiguities of the DLS experiment on elongated particles. The second goal was to demonstrate the power of Depolarized Dynamic Light Scattering (DDLs) in probing the anisotropy of different types of nanoparticles. Both goals were realized by studying two very different systems: inorganic FeOOH nanorice and elastin like polypeptide (ELP) micelles. The difference between the two systems is fundamental as FeOOH particles are solid, contain no water, and, therefore, are easily imaged using SEM, TEM, and AFM. Polypeptide micelles are soft particles filled with water, and, therefore, not easily imaged by abovementioned techniques. Perfecting DDLs on a system like FeOOH would allow less ambiguous interpretation of light scattering experiments on ELP micelles. We present a consistent analysis of DDLs results on FeOOH nanorice and outline the potential difficulties and challenges of DDLs application for polypeptide micelles.

Friday, October 5, 2012 8:30PM - 9:30PM —
Session DA Planetarium Show Planetarium Theater - Claude Pruneau, Wayne State University

8:30PM DA.00001 IBEX: Interstellar Boundary Explorer, CLAUDE PRUNEAU, Wayne State University — The show features the recent IBEX NASA mission. IBEX is an orbiting probe designed to map the interstellar boundary between our solar system and the rest of the Milky Way galaxy using energetic neutral atoms (ENAs).

Saturday, October 6, 2012 8:00AM - 9:48AM —
Session EA High Energy and Nuclear Physics McGregor Conference Center BC - Gil Paz, Wayne State University

8:00AM EA.00001 Resonance Width Distribution for Open Chaotic Quantum Systems, GAVRIIL SHCHERDIN1, Michigan State University — Recent measurements of resonance widths, $\Gamma$, for low-energy neutron scattering off heavy nuclei claim significant deviations from the standard chi-square $\chi^2_1(\Gamma)$, or the Porter-Thomas, distribution. The unstable nucleus is an open quantum system, where the intrinsic dynamics has to be supplemented by the coupling of chaotic internal states through the continuum. We propose a new resonance width distribution based on the random matrix theory for an open quantum system. For a single open channel, the new distribution is $P(\Gamma) = C \chi^2_1(\Gamma) \sqrt{\sinh \kappa/\kappa}$ where $\kappa = \pi \Gamma/2D$ and $D$ is the mean energy level spacing. This result naturally recovers the Porter-Thomas distribution for small $\kappa$ and can be directly applied to a whole range of mesoscopic systems, and is invariant under $\Gamma \rightarrow \eta - \Gamma$, where $\eta$ is the total width. The realistic situation in nuclei is not that of a single neutron channel. Many photon channels are always opened which modifies the width distribution into $P(\Gamma, \eta) = C \chi^2_1(\Gamma - \eta) \sqrt{\sinh \kappa_\gamma/\kappa_\gamma}$ with $\kappa_\gamma = \pi (\Gamma - \eta)/2D$, and the whole distribution is shifted by $\eta$, an average radiation width.

1The work is done together with Prof. Vladimir Zelevinsky, Michigan State University.

8:12AM EA.00002 Soft Photons and Leptonic B Decays, KRISTOPHER HEALEY, ADITYA YECHAN GUNJA, ALEXEY PETROV, Wayne State University — The leptonic decay of the neutral B meson $B^0_s$ into a di-muon pair is an example of a flavor-changing neutral current (FCNC) process. Studies of such decay processes not only play an important role in probing the standard model (SM) of particle physics but also provide sensitive indirect searches for new physics (NP) which predict substantial increases over the suppressed SM branching ratio. We look at the possible contributions to the standard model prediction stemming from decays with an additional outgoing photon, thus lifting a suppression that is existent in the predominant decay. While technically a different process, these additional contributions may be included in experimental measurements thus inflating the reported branching ratio.

8:24AM EA.00003 Observation of $D^0 \rightarrow \eta \omega$, MACKENZIE SMITH, DAVID CINABRO, Wayne State University, CLEO COLLABORATION — Numerous singly-Cabibbo-suppressed charm meson decays are as yet unobserved. Here we report the updated observation of $D^0 \rightarrow \eta \omega$ in the CLEO data set. Besides the value of branching fraction of this decays in helping to measure $\eta - \eta'$ mixing, it is an important background in $D^0$ Dalitz decays, such as $D^0 \rightarrow K^0_s \pi^+ \pi^-$ which is where we first noticed it.

8:36AM EA.00004 Searching for super-WIMPs in leptonic heavy meson decays, ADITYA YECHAN GUNJA, KRISTOPHER HEALEY, ALEXEY PETROV, Wayne State University — We study constraints on the models of bosonic super-weakly interacting particle (super-WIMP) dark matter (DM) with DM masses $m_X \sim O(1 - 100)$ keV from leptonic decays $M \rightarrow \ell \nu + X$, where $M = B^\pm, D^0, D_s^\pm$ is a heavy meson state. We focus on two cases where $X$ denotes either a light pseudoscalar (axion-like), or a light vector state that couples to the standard model (SM) through kinetic mixing. We note that for a small DM mass these decays are separately sensitive to DM couplings to quarks, but not its mass.

8:48AM EA.00005 LUX Cryogenics and Circulation, ADAM BRADLEY, Case Western Reserve University, LUX COLLABORATION — LUX is a new dark matter direct detection experiment being carried out at the Sanford Underground Research Facility, at the renewed Homestake mine in Lead, SD. The detector’s large size supports effective internal shielding from natural radioactivity of the surrounding materials and environment. The LUX detector consists of a cylindrical vessel containing 350 kg of liquid xenon (LXe) cooled down and maintained at 175-K operating temperature using a novel cryogenic system. We report the efficiency of our thermosyphon-based cooling system, as well as the efficiency of a unique internal heat exchanger with standard gas phase purification using a heated getter, which allows for very high flow purification without requiring large cooling power. Such systems are required for multi-ton scale up.
9:00AM EA.00006 Scalar Dark Matter & Vacuum Stability, MATTHEW GONDERINGER, Wayne State University — The Standard Model of particle physics is a highly successful theory of fundamental particle interactions, especially in light of the recent discovery of a Higgs-like boson at the LHC. Nonetheless, the SM is known to be incomplete because it does not contain a suitable dark matter candidate. Scalar extensions of the SM are simple but nonetheless interesting and well-motivated models that provide a dark matter candidate particle. I present a vacuum stability analysis — which ensures the ground state of the theory has the correct properties — of two of these models. The analysis reveals that light dark matter (10 GeV) requires a moderate self-interaction strength and new physics at or below the 10^{9} GeV scale in the first model, and a light (order 10 to 100 GeV) Higgs-like particle with reduced couplings and additional new physics below 1000 TeV in the second model. Experimental limits from dark matter direct detection are also included.

9:12AM EA.00007 Search for Exclusive W Boson Decays, CHRISTOPHER CLARKE, Wayne State University — The W boson is an important part of the standard model for its role as a mediator of the weak force, and as such has been studied extensively. Its mass has been measured by LEP and Tevatron experiments. Since the first W’s were produced at the SppS in the 1980’s the properties of the W boson have been studied at the Tevatron, LEP, and the LHC. None of these studies have reconstructed an exclusive W boson decay. We propose to search for the exclusive decay W → J/ψD^{±} and related low-multiplicity, partially reconstructed decays. The chosen mode yields an all charged track final state where J/ψ → μ^{+}μ^{-} and D^{±} → K^{±}K^{0}π^{±}. This final state has a good trigger signature, the J/ψ → μ^{+}μ^{-} decay, and a number of constraints to suppress background. We discuss the possible yields in data from the CDF and CMS experiments.

9:24AM EA.00008 FFLO States in Holographic Superconductors, JAMES ALSUP, University of Michigan-Flint, ELEFTHERIOS PAPANTONOPOULOS, National Technical University of Athens, GEORGE SIOPSIS, University of Tennessee — We discuss the gravity dual of FFLO states in strongly coupled superconductors. The gravitational theory utilizes two U(1) gauge fields and a scalar field coupled to a charged AdS black hole. The first gauge field couples with the scalar sourcing a charge condensate below a critical temperature, and the second gauge field incorporates a magnetic field that couples to spin in the boundary theory. The scalar is neutral under the second gauge field. By turning on a magnetic interaction between the second U(1) field and the scalar, it is shown that, in the high-field limit, an inhomogeneous solution possesses a higher critical temperature than the homogeneous case, giving rise to FFLO states close to zero temperature.

9:36AM EA.00009 Measurement of Anomalous Trilinear Couplings of Electroweak Gauge Bosons, KEVIN SIEHL, Wayne State University, CMS COLLABORATION — The standard model of particle physics predicts specific couplings between the electroweak gauge bosons with each other. Any deviation of these couplings from the standard model predictions is a sign of new physics. We use MCFM to simulate the production of WW and WZ boson pairs for a range of coupling values around standard model values. Comparing cross sections in the simulations to data allows us to measure anomalous trilinear gauge couplings, or place limits on them.

Saturday, October 6, 2012 8:00AM - 10:12AM – Session EB Condensed Matter and Materials Physics

8:00AM EB.00001 Strained Islands Evolution during Thin Film Heteroepitaxy with Planar and Pre-patterned Substrates, CHAMPIKAGIGIRIWALA GAMAGE, ZHI-FENG HUANG, Wayne State University — Evolution of strained islands or quantum dots is analyzed via constructing a continuum elasticity model based on the second order perturbation theory. The resulting nonlinear dynamic equation for film morphology also incorporates the film-substrate wetting effect. In order to study the formation and evolution of strained islands on a planar substrate for different film-substrate misfit strain, we analyze the time dependent behavior of the structure factor for surface heights, its moments and the surface roughness, and obtain the detailed dynamic process of island coarsening and stabilization. We also study the formation of these nano structures on a nonplanar patterned substrate. The properties of islands formed are highly affected and controlled by the periodicity and amplitude of the pre-defined substrate patterns, as shown in our analytic and numerical results.

8:12AM EB.00002 Effects of Electric Fields on Lamellar Structures of Liquid-Crystalline Block Copolymers, SIMISO MKHONTA, Department of Physics and Astronomy, Wayne State University, Detroit, Michigan 48201, USA, ZHI-FENG HUANG, Department of Physics and Astronomy, Wayne State University, Detroit, Michigan 48201, USA, KEN ELDER, Department of Physics, Oakland University, Rochester, Michigan 48309, USA, MARTIN GRANT, Physics Department, McGill University, Montreal, Canada — We investigate the electrically induced lamellar contraction in microphase separated liquid-crystalline diblock copolymer using the phase field-crystal model. We demonstrate that collective rotations of the constituents liquid-crystal molecules relative to the layer normal can lead to unusually large changes of the lamellar spacing. We also demonstrate that the orientational order of the constituent liquid-crystals can accelerate microphase separation and can also lead to fast dislocation motion. Our results are directly relevant to the studies of electrically tunable block copolymer photonic crystals with a full color display.

8:24AM EB.00003 Characterization and magnetic properties of pure and transition metal doped ZnO thin films, EHAB ABDELHAMID, DEBABRATA MISHRA, WISSAM FAWAZ, BORIS NADGORNY, GAVIN LAWES, Wayne State University, LAWES TEAM, NADGORNY TEAM — Zinc oxide (ZnO), a hexagonal n-type semiconductor, has been widely studied because of the ease of changing its properties by doping with selected elements. Although pure ZnO is paramagnetic, many studies confirm that doped ZnO thin films show room temperature ferromagnetism. This allows the potential to control the electrical properties of the semiconductor using magnetic fields. In this study, pure and Ti, V, and Co doped ZnO thin films were prepared on silicon substrates by spin coating. X-ray diffraction and Raman spectroscopy both confirm the formation of a single phase ZnO wurtzite structure. Magnetic measurements on the samples show magnetization for the as-prepared samples. The magnetization increases dramatically on vacuum annealing, which can be attributed to the incorporation of oxygen vacancy defects. Moreover, doping with Ti increases the saturation magnetization around five times as compared to pure ZnO, while the magnetization in the Co doped samples increases by 12 times. Finally, fitting the magnetization curves shows that the approach to saturation follows a 1/H dependence, suggesting the governance of defects rather than magnetocrystalline anisotropy.
8:36AM EB.00004 Patterning of Heteroepitaxial Overlayers from Nano to Micron Scales  
FABIO JUNES SANCHEZ, KEN ELDER, Oakland University, GIULIA ROSSI, PEKKA KANERVA, Aalto University School of Science, SEE-CHENN YING, Brown University, ENZO GRANATO, Instituto Nacional de Pesquisas Espaciais, CRISTIAN V. ACHIM, TAPIO ALA-NISSILA, Aalto University School of Science — Thin heteroepitaxial overlayers have been proposed as templates to generate stable, self-organized nanostructures at large length scales, with a variety of important technological applications. However, modeling strain-driven self-organization is a formidable challenge due to different length scales involved. In this talk a method for predicting the patterning of ultra thin films on micron length scales with atomic resolution will be presented. The model is used to make quantitative predictions for the type of superstructures (stripes, honeycomb, triangular) and length scale of pattern formation of two metal/metal systems, Cu on Ru(0001) and Cu on Pd(111). The findings are in excellent agreement with existing experiments and call for future experimental investigations of such systems.

8:48AM EB.00005 Percolation behavior in metallic-insulator composite systems and the filling factor near the percolation threshold  
RUPAM MUKHERJEE, DEBABRATA MISHRA, ZHIFENG HUANG, BORIS NADGORNY, Wayne State University — We investigate the percolation behavior in various composite metal – insulator systems including LiCoO$_2$/CrO$_2$, MgB$_2$/Al$_2$O$_3$, CrO$_2$/Al$_2$O$_3$, CrO$_2$/CaCO$_3$. The effect of particle size and shapes in these systems has been studied to better understand the geometrical phase transitions. The power law exponent around the percolation threshold has been found to be 2.0±0.04 in all the cases, which agrees well with the theoretical result. Interestingly, the filling factor of these composite systems also exhibits the power law dependence near the percolation threshold with the value found to be dependent on the shape of the insulating particle. The exponent ranges from 0.2 to 0.4 depending on size of particles of a given shape in the composite system.

9:00AM EB.00006 Magnetoresistance in ferromagnetic metal/ferromagnetic semiconductor micro-structures  
TAYLOR REID, Miami University, ANDREI SOKOLOV, University of Nebraska-Lincoln, ROBERT TOLLEY, JUSTIN GUENTHER, DIANA DAHLIAH, TAYLOR REID, ROBERT TOLLEY, CHRIS LITTLE, Miami University, XINYU LIU, JACEK FURDYNA, University of Notre Dame, KHALID EID, Miami University — We use SQUID magnetometry and circular contacts to study the magnetoresistance in GaMnAs/Pt bilayer structures. Our magnetization hysteresis loops show that there is no measurable coupling between the two ferromagnetic layers, even though they are not separated by any nano-magnetic spacer layers. Furthermore, the field-dependent magnetization shows a rich behavior that depends on the width of the GaMnAs in the circular structures. Samples with the narrowest gaps show a magnetoresistance effect that seems to be due to the tunneling magnetoresistance at the interface between py and GaMnAs.

9:12AM EB.00007 Andreev effect in GaMnAs/Nb microstructures for improved extraction of spin polarization  
JUSTIN GUENTHER, DIANA DAHLIAH, TAYLOR REID, ROBERT TOLLEY, CHRIS LITTLE, Miami University, XINYU LIU, JACEK FURDYNA, University of Notre Dame, KHALID EID, Miami University — Point contact Andreev reflection is a powerful technique for extracting the spin polarization in a large variety of ferromagnetic materials. Yet, it produced conflicting data that proved difficult to model when studying spin polarization in GaMnAs, due in part to two main problems: the high resistivity of GaMnAs makes it difficult to isolate the interfacial conductance and characterize it properly and there can be a Schottky barrier at the GaMnAs/superconductor interface. We use photolithography to fabricate GaMnAs/Nb micro-structures that offer a direct way to extract the interface conductance and the spin polarization at the interface. Furthermore, our results show that the Schottky barrier can play a crucial role in determining the behavior of the interface conductance when varying the applied voltage.

9:24AM EB.00008 Combustion Synthesis of Energy Storage Materials$^1$, W. ETHAN EAGLE, MARGARET WOOLDRIDGE, University of Michigan — Advancement in the understanding of state of charge and efficiency requires better coupling of battery level properties with the micro-structure of the constituents. The composition of the target synthesis material, lithium manganese oxide (LiMn$_2$O$_4$, or LMO for short) is known to impact lithium ion battery properties. Following this motivation, our aim is to demonstrate control over the microstructure and compositional properties of LMO using parameters of the combustion synthesis environment. In this experiment, one or both solid phase precursors, lithium acetate-hydrate and manganese acetate-hydrate, were aerosolized and delivered to a hydrogen-oxygen Hennen burner at atmospheric pressure. The characteristic time scales for reaction and flow control the synthesis process. Controlling reactant concentrations targets changes in nanoparticle composition and flow rate controls residence times and synthesis temperatures. To explore the effects of composition, first lithium oxide (Li$_2$O) and manganese oxide (Mn$_2$O$_3$) powders were generated independently from the corresponding acetate precursors. Following that, several mixtures of lithium and manganese acetate precursor trials were conducted and the resulting material properties were investigated using TEM and XRD.

$^1$Supported by GM/UM Advanced Battery Coalition for Drivetrains

9:36AM EB.00009 Photoluminescence Enhancement of Embedded Ga:GaAs Nanocomposites  
SUNYEOL JEON, MYUNGKOO KANG, JIA-HUNG WU, JIEUN LEE, VANESSA SIH, RACHEL GOLDMAN, University of Michigan — When electromagnetic radiation is incident upon metallic nanoparticles(NPs), surface plasmon resonance(SPR) is generated. Metallic NPs on semiconductors have shown significant promise for various applications, such as enhanced light emission, and negative refactive index metamaterials. Metallic NP-induced photoluminescence(PL) enhancement has been demonstrated and attributed to the matching of the NP SPR energy with the band gap energy. To date, plasmonics research has focused exclusively on Ag and Au NPs; however, their optical response is limited to low SPR energies(3.5eV). It was recently shown that Ga NPs produce size-dependent SPR, ranging from near-IR to visible wavelengths. Furthermore, 2D and 1D Ga NP arrays with SPR quality factors comparable to Ag and Au were reported. Here, we fabricate embedded Ga:GaAs nanocomposites utilizing off-normal focused-ion-beam(FIB) irradiation followed by molecular beam epitaxy overgrowth. The density(diameter) of the close-packed Ga NPs increases(decreases) with increasing the off-normal irradiation angle. We discuss the relative influences of Ga NP diameters and GaAs overgrowth thickness on the enhancement of the GaAs near-band edge emission, including the donor-acceptor pair and band-to-band emission.
of the Earth, what is the origin of Dark matter-energy and many other extraordinary results associated with cosmology.

E = mc²; the time-dilation phenomenon and Fitzgerald-Lorentz contraction. This theory will also explain why indeed we never feel the speed proposed. This completely new theory leads to miscellaneous results some of which are: the second Einstein's postulate; the well-known identity on what laws the watches, another important concept used frequently in this research, record them. Armed, then, with this mathematical is the concept of event. This study tries, first, to provide a mathematical background showing how must deal with these events and based

1 Acknowledgements: Financial support through DMR grants #0806572 and #1105121.

10:00AM EB.00011 High-Efficiency Magnetization Measurements of Variable Composition Co-Fe-Ni Alloys with a Scanning Hall Probe Microscope. GIRFAN SHAMSUTDINOV, DEBABRATA MISHRA, BORIS NADGORYN, Department of Physics and Astronomy, Wayne State University, Detroit, MI 48201, ZHAO PENG, Department of Physics, Ohio State University, Columbus, OH 43210, Ji-CHENG ZHAO, Department of Materials Science and Engineering, Ohio State University Columbus, OH 43210 — A Scanning Hall Probe Microscope with a submicron scale Hall probe (HP) was used for high efficiency measurements of magnetic properties of a Co-Fe diffusion couples. This Co-Fe couple is an assembly of two metal blocks, which were placed in intimate contact and then exposed to high temperature to allow thermal interdiffusion to create solid-solution with a composition varying gradually from pure Fe to pure Co. The change in the magnetic field in the vicinity of this variable composition Fe-Co alloy with the width of approximately 400 microns was measured continuously as the HP was scanned across the interdiffusion region. Using a simple model we then determined the corresponding saturation magnetizations of Co-Fe alloy. The values of the saturation magnetization were found to be in good agreement with the known values for pure Fe and Co. The composition variation along the scan line was measured independently using Energy Dispersive X-ray Spectroscopy (EDS). Similar measurements were performed for the Fe-Ni and Co-Ni interfaces. This study demonstrates that Scanning Hall microscopy can be used for high efficiency and high accuracy measurements of saturation magnetization in variable composition alloys.

Saturday, October 6, 2012 8:00AM - 9:36AM — Session EC AMO and Astrophysics McGregor Conference Center I - David Cinabro, Wayne State University

8:00AM EC.00001 The theory of the anti-maser: coherent perfect absorption of RF, MICHAEL AVILES, ANTHONY MAZZOCCHI, JIM ANDREWS, NATHAN DAWSON, MICHAEL CRESCIMANNO, Dept of Physics and Astronomy, Youngstown State University — The radio frequency (RF)-analog of the anti-laser is developed using four terminal network theory combined with the telegrapher’s equation. We describe solutions of the Coherent Perfect Absorption (CPA) condition that are interpretable as the slab dielectric anti-laser. We find a host of other solutions, some of which have no simple optical analogue. Broadband solutions are found which hint at the possibility of a new type of asymmetric transient CPA phenomenon, and point out that this study suggests a potentially new low loss, reversible RF devices.

8:12AM EC.00002 Experimental demonstration of the anti-maser, ANTHONY MAZZOCCHI, MICHAEL AVILES, JIM ANDREWS, NATHAN DAWSON, MICHAEL CRESCIMANNO, Dept of Physics and Astronomy, Youngstown State University — We denote by “anti-maser” a coherent perfect absorption (CPA) process in the radio frequency domain. We demonstrate several experimental realizations of the anti-maser suitable for an advanced undergraduate laboratory. Students designed, assembled and tested these devices, as well as the inexpensive laboratory setup and experimental protocol for displaying various CPA phenomenon.

8:24AM EC.00003 Understanding temperature tuning of the all polymer co-extruded laser, MICHAEL CRESCIMANNO, JIM ANDREWS, MICHAEL AVILES, NATHAN DAWSON, JOSHUA PETRUS, ANTHONY MAZZOCCHI, Department of Physics and Astronomy, Youngstown State University, KEN SINGER, Department of Physics, Case Western Reserve University, ERIC BAER, Macromolecular Sciences, Case Western Reserve University, HYUNMIN SONG, unaffiliated — We investigate the effects of elevated temperatures on a few types of all-polymer multilayer films that were fabricated using a co-extrusion melt-process technique. We report on the anisotropic thermal expansion of the multilayer films, which affects the photonic crystal structure via constituent wise induced anisotropic strains and a change in the relative refractive indices. In addition to the characterization of these films in the temperature range of approximately 20-95 degrees C, we show the application to non-contact temperature sensing and wavelength tuning of all polymer Distributed Feedback (DFB) lasers and Distributed Bragg Reflector (DBR) lasers.

8:36AM EC.00004 An Apparatus for Verification of Absolute Calibration of Quantum Efficacy for Charge-Coupled Devices, REBECCA COLES, None — The LBNL Microsystems Laboratory produces backside illuminated, high resistivity, p-channel, charge-coupled devices (CCDs). A system was developed to test the quantum efficiency (QE) of the CCDs; the percentage of electrons that are emitted from the CCD surface per amount of light that it’s exposed to. The QE system was designed and constructed to test smaller chips than would current produced. To continue testing, I redesigned the QE apparatus to make room for the new, larger size, CCDs while still preserving measurement accuracy. I removed the photodiode that formally sat alongside the CCD in the Dewar, and installed it in a separate container. Instead of the CCD and the photodiode taking flux measurements simultaneously, the processes are now preformed separately. The error caused by the separation has remained less than 1.78%.

8:48AM EC.00005 The Arithmetic of Events and a New Theory of Gravitation, MALEK ABBASI, Department of Mathematics, Tarbiat Modares University P.O. Box 14115-175, Tehran, Iran — Of fundamental importance in physics is the concept of event. This study tries, first, to provide a mathematical background showing how must deal with these events and based on what laws the watches, another important concept used frequently in this research, record them. Armed, then, with this mathematical background, the Gravitational Clouds Theory, a novel theory of gravitation concerning the role of the matter and energy in the universe, is proposed. This completely new theory leads to miscellaneous results some of which are: the second Einstein’s postulate; the well-known identity E = mc²; the time-dilation phenomenon and Fitzgerald-Lorentz contraction. This theory will also explain why indeed we never feel the speed of the Earth, what is the origin of Dark matter-energy and many other extraordinary results associated with cosmology.
Extending Newton’s Apsidal Theorem\(^1\). \textit{Cameron Tuckerman, Ulrich Zurcher\(^2\), Physics Department, Cleveland State University} — For the Kepler potential \(\Phi = \mu/r\), the orbit is closed and the apsidal angle \(\Delta \Theta = 2\pi\). For the potential \(\Phi(r) = \mu/r^2 - \eta/r\), the orbit is open [Bertrand’s theorem] and the trajectory has the general shape of a rosette. Newton found an expression for the Apsidal precession for small eccentricities \(\Delta \Theta = 2\pi/\sqrt{\mu}\). We extend this result for arbitrary orbital parameters; we introduce a description in terms of an effective angular momentum and a Keplerian potential \(\Phi_{\text{eff}} = -\rho/r\). We find an exact expression for the Apsidal precession. For \(|\rho| < 0.3\), we find \(\Delta \Theta = 2\pi/n\alpha\) and find expressions for the exponent \(\alpha\) that are correct with \(1\%\). We discuss possible applications to the orbits of stars in elliptical galaxies.

\(^1\)Supported by a grant from the Provost’s Initiative for Undergraduate Research [CSU]
\(^2\)corresponding author

\textbf{9:12AM EC.00007 GEMS (Gravity Electro-Magnetism Strong) SU(5) Theory and The Prediction of Exchange Boson Masses}. \textit{JOHN BRANDENBURG, Morningstar Applied Physics LLC, MORNINGSTAR APPLIED PHYSICS TEAM} — The GEMS SU(5) \(^1\) theory includes short range Nuclear Forces in the GEM unification theory \(^2\), where the importance of the square root of the proton-electron mass ratio: \(\sigma = 42.8503\) was found. The creation of mass by a Higgs field coupling must, by the Equivalence Principle, be viewed in the context of General Relativity. This is done here using Kaluza-Klein theory in a Feynman-Hawkings path integral formalism. GEM theory, quantum concepts of virtual particles, and ZPF (Zero Point Fluctuation) allow understanding of the Strong Force and Weak forces as the extension of electrodynamics in the quantum limit. The Strong and Weak forces are found to be associated with EM models of the electron and proton as finite sized structures respectively. Higher order Mie resonances off the EM “mass at a distance” structures associated with the electron, proton and fifth dimension generate the quanta with masses of the pion \(m_\pi = 2m_\eta/\alpha \approx 140.0\) MeV and Z boson: \(m_Z = 2\pi m_\pi = 80.4\) GeV. The \(\eta\) meson \(m_\eta = 2980\) GeV is identified with the 5th dimension compactification force mediated by the Radion field. Another particle associated with this mass inducing field is the “Radion” or Higgs scattering quanta off the fifth dimension with a mass \(m_{\sigma \eta} \approx 128.6\) GeV which is the Higgs Boson. A GEMS SU(5) Georgi-Glashow model, is proposed, where the unification energy is now the Planck energy.

\(^1\)Brandenburg, J.E. (2012)., \(^2\)STAIF II Conference Albuquerque NM

\textbf{9:24AM EC.00008 Derivation of the Schwartzchild Metric From the “Self Censorship” of the ZPF (Zero Point Energy) in the GEM Theory}. \textit{JOHN BRANDENBURG, Morningstar Applied Physics LLC} — The GEM theory \(^1\) links the EM stress tensor directly to the metric tensor by the principle of “self censorship” of the ZPF \(^2\) where the definition of \(g_{uv} = F_{u}F_{v}/4\) for Planck scale fields makes the stress tensor vanish even when fields are present. The first order form of the metric is recovered as Lorentzian due to alternating regions of strong electric and magnetic fields similar to that seen in models of spacetime in “Loop Gravity,” where the model admits perturbations. The GEM ExB drift models of gravity is used The first order perturbations on the fields are considered to be of the order of the fine structure constant alpha. Radiation fields due to a single charged particle of mass M fall off as \(1/r\) and give the values (G=c=1) \(g_{tt} = 1-2M/r\). (1) Brandenburg, J.E. (2012)., (2) STAIF II Conference Albuquerque NM 2.Brandenburg, J.E. (2007). IEEE Transactions On Plasma Science, Vol. 35, No. 4., p845.

\textbf{Saturday, October 6, 2012 8:00AM - 10:00AM — Session ED Biophysics, Applied Physics, and Education McGregor Conference Center E - Xiang-Qiang (Rosie) Chu, Wayne State University}

\textbf{8:00AM ED.00001 Nanomechanics and dynamics of confined water and other liquids}. \textit{Peter Hoffmann, Wayne State University} — From oil recovery to molecular biology, nanoconfined water plays an important role in many areas of research. However, the mechanics and dynamics of nanoconfined water are not well understood. Over the last ten years, a number of groups have measured the mechanics of confined water using atomic force microscopy (AFM) or surface force apparatus (SFA) - often with contradictory results. At Wayne State University, we have developed high resolution AFMs for ultra-small amplitude, linear measurements of the mechanics and dynamics of confined liquids. We have shown that water shows a distinct slow-down in dynamics under confinement (PRB 2004), co-discovered a dynamic “solidification” in a model liquid (Langmuir 2006), and showed that normal and shear stiffness are closely related in confined liquids (Rev. Sci. Instr. 2008). Recently, we found dynamic solidification also in water layers (PRL 2010), a finding that explains the contradictory findings in earlier measurements and points to surprisingly complex behavior in this seemingly simple system. Here we will review these findings, as well as present new findings that show the profound effects of ion concentration on these dynamical effects, as well as measurements of colloidal systems, which illustrate that some findings at the molecular scale can be understood from purely geometric considerations and are not dependent on molecular-scale interactions.

\textbf{8:12AM ED.00002 Manipulating Water Droplet Behavior on Aluminum Surfaces Using Micro-lithography}. \textit{Mujid Alheshibri, Tyler Brest, Andrew Sommers, Khalid Eid, Miami University} — In this work, we use photolithography to create alternating hydrophobic/hydrophilic Cu micro-channels on an aluminum surface. The contact angle that is formed between water droplets and the surface is clearly asymmetrical due to the different surface properties at the contact line between the droplets and the patterned surface. An HDFT self-assembled mono-layer allows for a large change in the water droplet contact angle on the copper, but seems to have no effect on the aluminum surface. We will show our results on the effect of the surface patterning, oxidation of the metal and surface roughness on water droplet behavior.
We thank the AFOSR for supercomputer time at AFRL and ARSC.

8:36AM ED.00004 Photothermal Therapy of Cancer Cells mediated by Blue Hydrogel Nanoparticles. TAEYIJUANA CURRY, University of Michigan, Ann Arbor, MI, USA 48108, TAMIR EPSTEIN, H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA 33612, ROAUL KOPELMAN, University of Michigan, Ann Arbor, MI, USA 48108 — Coomassie Blue dye has been covalently linked into a polycrylamide nanoparticle matrix, so as to form nontoxic, biodegradable and cell specific targetable nanoparticles for photothermal therapy (PTT) of cancer. The nanoparticle were found to be approximately 80-95 nm in diameter, with an absorbance value of 0.52. Using an inexpensive, low intensity LED array light source (590nm, 25mW/cm²), with 20 minute excitation times, at 37 °C, PTT induced hyperthermia/thermolysis in HeLa cells, in vitro, resulting in virtually complete cell death when observed 3 hours after exposure. These multifunctional particles have been previously used in cancer delineation, for surgery, and in photoacoustic imaging studies; the addition of the PTT function now enables a multi-pronged medical approach to cancer.

8:48AM ED.00005 Controlled RGD Peptide Adsorption on Aggregation-Free, Size-Selected Hydroxyapatite Nano-Parcticle Substrates. PARIMAL BAPAT, Department of Physics, University of Alabama at Birmingham, U.S.A, BONNIE CULPEPPER, Department of Biomedical Engineering, University of Alabama at Birmingham, SUSAN BELLIS, Department of Cell, Developmental and Integrative Biology, University of Alabama at Birmingham, RENATO CAMATA, Department of Physics, University of Alabama at Birmingham — Numerous studies of cell attachment, differentiation, and proliferation have been carried out on nanostructured hydroxyapatite (HA) surfaces with cell adhesive peptides containing the RGD (Arg-Gly-Asp) motif. Although these studies have yielded useful insights into the role of RGD peptides in cell-HA biomaterial interactions, the heterogeneity of typical nanophase HA materials makes it difficult to decouple the effects of nanotopography and biochemical cues. In this work we have used aggregation-free, size-controlled HA nanoparticles with mean size in the 20-70 nm range, synthesized by gas-phase laser ablation and deposited on atomically flat bioinert substrates that may help overcome this challenge. Nanoparticle deposits with adjustable number concentration were characterized by transmission electron microscopy, atomic force microscopy, and X-ray diffraction. RGD peptides modified by the addition of a polyglutamate sequence and a fluorescent conjugate, were coated onto the HA nanoparticle substrates. Intensity histograms of fluorescent microscopy images show that peptide adsorption on the substrates scales with the concentration of HA nanoparticles. High HA nanoparticle concentrations also lead to peptide clustering tunable in the 100-1200 cm⁻².

9:00AM ED.00006 Organic photovoltaic based on copper phthalocyanine with high open circuit voltage and significant current and voltage stability. KHALIL HAMAM, MOHAMMAD AL-AMAR, CLEMENT BURNS, Western Michigan University — Organic semiconductors are under investigation as a possible material to create low cost solar cells. We fabricated photovoltaic devices consisting of copper phthalocyanine (CuPc) modified with a sulfonated group /perylene-3, 4, 9, 10-tetracarboxylic dihydride (PTCDA)/ bathocuproine (BCP) A large open circuit voltage (VOC) of 0.74 V was recorded, superior to cells based on CuPc/PTCDA (VOC = 0.55V). Our solar cells exhibits little change in their voltage and current for more than 7 months, superior to many organic solar cells which degrade significantly over days or weeks.

9:12AM ED.00007 Investigation of High Pressure, Multi-Hole Diesel Fuel Injection Using High Speed Imaging. STEVEN MORRIS¹, ETHAN EAGLE², MARGARET WOOLDRIDGE³, University of Michigan — Research to experimentally capture and understand transient fuel spray behavior of modern fuel injection systems remains underdeveloped. To this end, a high-pressure diesel common-rail fuel injector was instrumented in a spherical, constant volume combustion chamber to image the early time history of injection of diesel fuel. The research-geometry fuel injector has four holes aligned on a radial plane of the nozzle with hole sizes of 90, 110, 130 and 150 μm in diameter. Fuel was injected into a non-reacting environment with ambient densities of 17.4, 24.0, and 31.8 kg/m³ at fuel rail pressures of 1000, 1500, and 2000 bar. High speed images of fuel injection were taken using backlighting at 100,000 frames per second (100 kfps) and an image processing algorithm. The experimental results are compared with a one-dimensional fuel-spray model that was historically developed and applied to fuel sprays from single-hole fuel injectors. Fuel spray penetration distance was evaluated as a function of time for the different injector hole diameters, fuel injection pressures and ambient densities. The results show the differences in model predictions and experimental data at early times in the spray development.

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²Post-Doctoral in University of Michigan Combustion Synthesis Laboratory.
³Professor of Mechanical and Aerospace Engineering and PI of University of Michigan Combustion Synthesis Laboratory.
9:24AM ED.00008 Imaging Studies of the Effects of Ethanol/Gasoline Blends on Spark-Assisted HCCI1, MOHAMMAD FATOURAIE, MARGARET WOOLDRIDGE, University of Michigan — Spark assist (SA) has been demonstrated to extend the operating limits of homogeneous charge compression ignition (HCCI) modes of engine operation. This experimental investigation focuses on the effects caused by the SA HCCI operation on ignition and combustion properties of 100% indolene and 70% indolene/30% ethanol blends. The spark assist effects are compared to baseline HCCI for each blend by varying spark timing at different fuel/air equivalence ratio (φ = 0.4–0.6). High speed imaging is used to understand the effects of flame propagation on heat release rates. Ethanol generally improves engine performance with higher indicated mean effective pressure (IMEP) and higher stability compared to 100% indolene. SA advances phasing within a range of 5 CAD at lower engine speeds (700 rpm) and 11 CAD at higher engine speeds (1200 rpm). SA does not affect heat release rates until immediately (within 5 CAD) prior to autoignition. Unlike previous studies, flames were not observed for all SA conditions. During SA operation, more fuel mass was burned by flame propagation with gasoline compared to E30.

1The authors thank the Department of Energy, National Science Foundation (CBET-0457224) and Ford Motor Company-Ford Research Laboratory for financial support of this project.

9:36AM ED.00009 A Team-taught Physical Science Course, JAMES SULLIVAN1, AMBER PLEIMAN, University of Cincinnati — During the summer of 2012 the authors co-taught a course designed to acquaint current and future teachers to various aspects of Physics and Chemistry. The course was woven around the basic concept of energy and emphasized laboratory work in groups.

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9:48AM ED.00010 Quantized conductance in educational labs: a consequence of nano-scale confinement, TONY SILVIDI, ROBERT TOLLEY, HERBERT JAEGER, KHALID EID, Miami University — We developed a robust and inexpensive setup to demonstrate the quantization of conductance in a macroscopic gold wire with a nano-constriction. Our setup uses a manually operated bending beam and a micrometer to break and reconnect the gold wire and get the quantized behavior. Alternatively, we use a piezo-crystal to precisely control the motion by manually changing an applied DC voltage across the piezo-crystal. We also will review our work on using an Arduino to control the piez-crystal via a computer in order to run the demonstration in a classroom or as an experiment either in a course in nano-science and technology or in contemporary physics. This is a direct demonstration of the emergence of quantum mechanical behavior due to the wave nature of matter and due to the confinement at the nano- or atomic scale.

Saturday, October 6, 2012 10:30AM - 11:30AM — Session FA Nuclear Physics  McGregor Conference Center BC - Sean Gavin, Wayne State University

10:30AM FA.00001 FRIB – Facility for Rare Isotope Beams1, MARC HAUSMANN, Facility for Rare Isotope Beams, Michigan State University — FRIB, the planned “Facility for Rare Isotope Beams” at Michigan State University (MSU) will be a world-leading next generation rare isotope research facility. FRIB will be based on a 400 kW, 200 MeV/u driver linac and will provide a wide variety of rare isotope beams at unprecedented intensities. Upon completion, FRIB will create exciting opportunities for experiments with fast, stopped and reaccelerated beams. FRIB will make new classes of experiments in the nuclear structure and nuclear astrophysics areas possible. It will enable the experimental exploration of nuclear structure very far from stability and make information critical for the explanation of elemental abundances observed in the universe accessible. In addition, special isotopes in previously unavailable quantities will become available for studies of fundamental symmetries and for societal needs. This talk will present an overview of the planned FRIB facility and of the exciting science opportunities that FRIB will generate.

1This material is based on work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661.

Saturday, October 6, 2012 11:30AM - 12:30PM — Session GA Science in the Media  McGregor Conference Center BC - Gavin Lawes, Wayne State University

11:30AM GA.00001 The Hoopla Over the Higgs Boson: A Window into the State of Science Journalism, ADRIAN CHO, Science Magazine — On July 4, experimenters at the European particle physics laboratory, CERN, near Geneva, Switzerland, held a special seminar in which they reported that they had at last discovered something resembling the Higgs boson, the last missing piece in particle physicists’ standard model. The event drew more than 100 journalists, including myself, and the days leading up to the seminar evolved in almost a caricature of a media circus. Rumors coursed across the internet, bloggers prognosticated about what would be reported, anonymous sources whispered confidence levels to eager reporters, and on the very eve of the seminar CERN’s own press office inadvertently leaked a video explaining many of the details. At a post-seminar press conference, dozens of photographers and videographers swarmed Peter Higgs, the eponymous theorist from the University of Edinburgh. Higgs even had his own handler to help him fend off the press onslaught. It was all great fun, but for a traditional journalist the event highlighted the many open questions we journalists now face. In the age of blogs and Twitter, does anybody really care that journalists try to put together fair, balanced, and accessible accounts of events? Or are people just as happy to get their information directly from researchers through their blogs or the lab through its press office? Is being first out with the story the only measure of success these days, or is there still a market for deeper analysis? I’ll use the Higgs hoopla as a lens to lay out the questions as I see them. I am hoping to get the answers of the members of the audience in a discussion.