Joint Fall 2011 Meeting of the Texas Sections of the APS, AAPT, and Zone 13 of the SPS
Commerce, Texas
http://www.aps.org/meetings/meeting.cfm?name=TSF11
RICHARD TAPIA, Director, Center for Excellence and Equity in Education, Department of Computational and Applied Mathematics (CAAM), Rice University — Texas has the fastest growing Hispanic population in the nation. Hispanics will soon comprise a majority of the state’s population. Yet this population has a high school drop-out rate of nearly 60% and is vastly underrepresented in STEM (science, technology, engineering, and mathematics) disciplines in the student bodies and faculties of the state’s universities. The scientific and economic health of the state is threatened with the formation of such a large scientific underclass. But Rice is making a difference, positioning its underrepresented population. Yet this population has a high school drop-out rate of nearly 60% and is vastly underrepresented in STEM (science, technology, engineering, and mathematics) disciplines in the student bodies and faculties of the state’s universities. The scientific and economic health of the state is threatened with the formation of such a large scientific underclass. But Rice is making a difference, positioning its underrepresented minority students for STEM leadership throughout the state and nation. The speaker will discuss several successful national award-winning projects that illustrate the importance of improving the opportunities for minority students.

Our goal is to improve graduate education for all students by improving the opportunities for minority students. Our primary efforts have focused on developing supportive learning environments through the implementation of Modeling Instruction in several sections of introductory physics and providing dedicated space for student collaboration outside of class. We provide data indicating that the Modeling courses support enhanced learning, attitudes, and retention and that the space is being utilized by students to integrate into the physics department.

The APS Minority Bridge Program, THEODORE HODAPP, Director of Education and Diversity for the American Physical Society (APS) — Physics has one of the lowest participation rates for underrepresented minorities and women in all of Science, Technology, Engineering and Mathematics (STEM) fields. Things are improving for women and while still not representative of the population, the trends have been encouraging. Underrepresented minorities, however, have not been as fortunate. I will describe the current status of participation in physics, and a new program being launched by the American Physical Society that aims to significantly increase the number of minorities who receive PhDs in physics. The Minority Bridge Program is bringing together representatives from doctoral granting institutions and universities that educate minority students to establish a set of model programs based on the successes of existing efforts and capitalizing on the strengths of the American Physical Society.

Harry Swinney, University of Texas at Austin, and Heather Galloway, Texas State University–San Marcos

Friday, October 7, 2011 11:30AM - 1:20PM –
Session C1 Keynote Talk: Our Sustainable Earth
Grady Price Blount, Texas A&M University–Commerce

11:30AM C1.00001 Our Sustainable Earth, RAYMOND L. ORBACH, Director, Energy Institute, The University of Texas at Austin, Former U.S. Under Secretary for Science — Recent evidence demonstrates that the earth has been warming monotonically since 1880. Transient to equilibrium temperatures takes centuries to develop, as oceans are slow to respond to atmospheric temperature changes. Atmospheric CO₂ concentrations, from ice core and observatory measurements, display consistent increases from historical averages, beginning about 1880, and can be associated with the industrial revolution. The climactic consequences of this human dominated increase in atmospheric CO₂ define a geologic epoch that has been termed the “Anthropocene.” The issue is whether this is a short term, relatively minor change in global climate, or an extreme deviation that lasts for thousands of years. Eight “myths” that posit the former are examined in light of known data. The analysis strongly suggests the latter. In order to stabilize global temperatures, sharp reductions in CO₂ emissions are required, of the order of 80%. Two examples of economically sustainable CO₂ emission reduction demonstrate that technological innovation has the potential to maintain our standard of living while stabilizing global temperatures.

Friday, October 7, 2011 1:40PM - 2:40PM –
Session D1 Nuclear Physics I
Texas A&M University
1:40PM D1.00001 Simulation of Fast Neutronics in an Accelerator-Driven Sub-Critical Core
C. GWYN ROSAIRE, Texas A&M University, Dept. of Nuclear Engineering.
AKHDIVOR SATTAROV, PETER MCINTYRE, Texas A&M University, Dept. of Physics.
PAVEL TSVETKOV, Texas A&M University, Dept. of Nuclear Engineering —
Accelerator-driven subcritical fission in a molten salt core (ADMS) is being developed as a technology for green nuclear power. 
ADMS burns its fertile fuel to completion, it cannot melt down, and it destroys long-lived minor actinides. 
The ADMS core consists of a vessel filled with a molten salt eutectic of UCl₃ and NaCl. The fast neutrons of ADMS makes possible two unique benefits: isobrearing, a steady-state equilibrium in which ²³⁵U is bred to ²³⁹Pu and the ²³⁹Pu fissions, and destruction of minor actinides, in which fission of the intermediate nuclides dominates of breeding. Results of simulations of the fast neutrons in the ADMS core will be presented.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund.

1:52PM D1.00002 The Beta Delayed Proton and Gamma Decay of ²⁷P For Nuclear Astrophysics
A. BANU, V.Z. GOLDBERG, B.T. ROEDER, A. SPIRIDON, R.E. TRIBBLE, T. DAVISON, P.J. WOODS, G.J. LOTAY, J. WALLACE, D. DOHERTY, A. SAASTAMOINEN — The creation site of ²⁶Al is still under debate. It is thought to be produced in hydrogen burning and in explosive helium burning in novae and supernovae, and possibly also in the H-burning in outer shells of red giant stars. Also, the reactions for its creation or destruction are not completely known. When ²⁶Al is created in novae, the reaction chain is: ²⁴Mg(p,γ)²⁵Al(β⁺)²⁵Mg(p,γ)²⁶Al, but this chain can be by-passed by another chain: ²⁵Al(γ)²⁶Si(γ)²⁷P and it can also be destroyed directly. The reaction ²⁶Al(γ)²⁷Si* is another avenue to bypass the production of ²⁶Al and it is dominated by resonant capture. We study these resonances by an indirect method, through the β⁻ decay of ²⁷P. We use ²⁷P produced and separated with MARS and a setup which allows increased efficiency for low energy protons and for high-energy gamma-rays. We measure gamma-rays and β⁻ delayed protons emitted from states above the proton threshold in the daughter nucleus ²⁷Si (S_p = 7.463 MeV) to identify and characterize the resonances. Its lifetime was also measured with accuracy under 1%.

DE-FG02-93ER40773

2:04PM D1.00003 Trojan Horse Method and its application to explosive nucleosynthesis
ROSARIO GIANLUCA PIZZONE, LIVIUS TRACHE, Cyclotron Institute Texas A&M University College Station Usa, CLAUDIO SPITALERI, ENRIQUE RODRIGUEZ, Texas A&M University Ann Arbor Usa, MARCO LA CAGNOTA, GIUSEPPE RAPISARDA, INFN LNS CATANIA ITALY, CLAUDIO SPITALERI, INFN LNS CATANIA ITALY, BRIAN ROEDER, Cyclotron Institute Texas A&M University College Station Usa, BRAD RICHARD, Arkansas Technical University, AR, USA, ROBERTA SPARTA, INFN LNS CATANIA ITALY — In many astrophysical scenarios a key role is played by radioactive-ion-induced reaction. After recent discoveries on the field of gamma ray astronomy it was realized that many pieces of informations on massive stars nucleosynthesis can be achieved after studying the ²⁶Al abundance and the related gamma emission in the Galactic plane. For its understanding a detailed investigation of the nuclear processes producing or destroying this isotope is necessary. Direct measurements of nuclear reaction rates are usually hard to perform since the involved cross sections are very small and especially in the case of radioactive ion beams for which intensities can be significantly lower than stable beams. Thus the role of indirect methods becomes crucial as they can give information on nuclear reaction cross sections in energy ranges as low as the ones required for astrophysical studies. Among them the Trojan Horse Method gives the possibility to study all particle-induced reactions (both charged or neutrons) in the astrophysical energy ranges under appropriate hypotheses.

2:16PM D1.00004 The evaluation of a new method to extract spectroscopic factors using asymptotic normalization coefficients and the astrophysical ¹⁴C(n,γ)¹⁵C reaction rate
M. MCCLESKEY, A.M. MUKHAMEDZHANOV, L. TRACHE, A. BANU, V.Z. GOLDBERG, B.T. ROEDER, E.N. SIMMONS, A. SPIRIDON, R.E. TRIBBLE, Texas A&M University Cyclotron Institute — A new method to determine spectroscopic factors (SFs) that utilizes asymptotic normalization coefficients (ANCs) has been tested at Texas A& M, using ¹⁵C as a test case. The method would use the ANC to fix the external contribution to a non-peripheral reaction which would otherwise be free to vary to unphysical values in a traditional approach. The investigation consisted of two parts. First, the ANC for the ¹⁴C+n configuration in ¹⁵C was determined from the heavy ion neutron transfer reaction ¹³C(p,γ)¹⁴C and the inverse kinematics reaction d(¹³C,p)¹⁴C. Both of these reactions were measured at sufficiently low energy to be peripheral. Next, a non-peripheral reaction d(¹³C,d)¹⁴C was measured with an incident deuteron energy of 60 MeV, and this reaction was used along with the previously determined ANC to attempt to find the SF. The ANC was also used to calculate the astrophysical neutron direct capture rate for ¹⁴C(n,γ)¹⁵C, which was compared with recent direct experimental results.

¹Present address: James Madison University

2:28PM D1.00005 New Results with TECSA
B. T. ROEDER, M. MCCLESKEY, L. TRACHE, A. A. ALHARBI, A. BANU, V.Z. GOLDBERG, E. SIMMONS, A. SPIRIDON, R.E. TRIBBLE, Texas A&M University, S. CHERUBINI, M. GULINO, R.G. PIZZONE, R. SPARTA, C. SPITALERI, INFN-LNS, T. DAVISON, J. WALLACE, P.J. WOODS, Univ. of Edinburgh — The Texas A&M-Edinburgh-Catania Silicon detector Array (TECSA) is a collaborative effort to build a high-efficiency detector Si array useful for measuring reactions of interest for nuclear astrophysics and nuclear structure. The array consists of up to 16 Micron Semiconductor Y1 detectors that are each 300 μm thick. Each detector has 16 annular ring sectors to measure the energy and the scattering angle of the detected particles. So far, we have conducted two experiments with TECSA at Cyclotron Institute Texas A&M Univ. In the first, we measured the d(¹⁴C,p)¹⁵C reaction at 11.7 MeV/u. In the second, we measured d(²⁶Al,p)²⁷Al with an ²⁶Al secondary beam prepared in-flight with MARS. Angular distributions were obtained for both reactions at backward angles. The protons were measured both as singles events and in coincidence with timing signals from the cyclotron RF and a scintillator to measure coincidence between the protons and the beam. Results of the data analysis for the d(¹⁴C,p)¹⁵C run and preliminary results from the d(²⁶Al,p)²⁷Al run will be presented. Also, prospects for the future use of this detector array will be discussed.

Session D2 Atomic, Molecular, and Optical Physics
Sam Rayburn Center Second Floor, Room Innovations I - Donald Kobe, University of North Texas
1:40PM D2.00001 Microwave de-excitation schemes for Rydberg atoms, DANIEL VRINCEANU, LUCA PEROTTI, Texas Southern University — Control of Rydberg atom wavefunctions has evolved from static or periodic protocols to transport ones, exploiting either modulation or chirping of the controlling periodic field. Applications vary from quantum computing schemes using excitation blockades to the production of anti-hydrogen atoms in Penning traps. Theoretical studies have essentially been limited to 1-D models. Applications such as the production of anti-hydrogen atoms mentioned above, instead require the study of some 3D statistical ensemble of orbits. Our preliminary numerical studies show that chirping of the microwave field is most effective in de-exciting atoms that are almost one dimensional, as transport terminates when the two parabolic quantum numbers are equal, thus seriously limiting its efficiency for initial states which are not almost 1D. Alternative approaches are suggested.

1:52PM D2.00002 Nonlinear Optical Spectroscopy of Silicon Nanocrystals Embedded in Silica1, AARON ROBERTS, JUNWEI WEI, MICHAEL DOWNER, University of Texas at Austin — Light-emitting Silicon nanocrystals (Si NCs) embedded in silica are attracting much attention for their potential applications in silicon photonics. However, the relative contributions of the crystalline Si (c-Si) bulk and the nano-interfacial transition region to the photoluminescence remain controversial. Moreover, the micro-structure of the nano-interface separating the c-Si core from the amorphous silica matrix has proven difficult to characterize experimentally. Presented here are results from second harmonic generation spectroscopy and complementary spectroscopic-ellipsometric and micro-Raman measurements of Si NCs of different sizes. Spectroscopy results confirm the preservation of the basic electronic properties of bulk c-Si through the appearance of the E1 and E2 critical point resonances. However, they also demonstrate the existence of an intermediate resonance between E1 and E2 consistent with an amorphous Si nano-interfacial transition region that thins with increasing NC diameter.

2:04PM D2.00003 Accurate Current Integration for Ion Beam Techniques at University of North Texas, NARESH DEOLI, DUNCAN WEATHERS, University of North Texas — An experimental set up has been designed to suppress secondary and tertiary electron currents generated during energetic ion irradiation to obtain accurate current integration for ion beam techniques at the University of North Texas. In one configuration, all secondary electrons were suppressed in the process of production of Bi thin films using sputtering technique by 10-50 keV noble gas atoms. In another configuration, a combination of an electron trap and a biased aluminum mesh was used to suppress any secondary and tertiary electrons in the heavy ion Rutherford backscattering technique for the analysis of thin films. Details of both experimental current integration set ups are presented.

2:16PM D2.00004 Characterization of cluster/monomer ratio in pulse supersonic gas jets1, RICHARD KORZEKWA, XIAOHUI GAO, XIAOMING WANG, BONGGU SHIM, ALEXEY AREFIIEV, MIKE DOWNER, Institute for Fusion Studies, University of Texas at Austin, Austin, Texas 78712 — We determine cluster mass fraction $f_c(r,t)$ at position $r$ within, and time $t$ after firing, a pulsed supersonic gas jet by measuring femtosecond evolution of the jet’s refractive index by single-shot frequency domain holography. A fs pump pulse singly ionizes monomers, while quasi-statically ionizing and heating clusters to a level at which recombination remains negligible as clusters expand. Under these conditions, index evolves in two simple steps corresponding to monomer and cluster contributions, allowing recovery of $f_c$ without detailed cluster dynamic modeling. Variations of $f_c$ with $t$ are measured.

2:28PM D2.00005 Variation of phase of slow light in a uniformly moving dielectric medium1, SANKAR DAVULURI, YURI ROSTOTSEV, University of North Texas — It is very well known that moving objects can drag light. In this presentation, we report the variation of phase of a laser beam when it passes through a medium. We show that the sensitivity of phase of the laser beam to the velocity of moving medium can be greatly enhanced if the light travels with a slow group velocity in the moving medium. We have taken the moving medium consists of three level lambda atoms, and the medium is made transparent by employing a strong drive field to take advantage of electromagnetically induced transparency (EIT). EIT suppresses the absorption of probe beam around resonance and the steep dispersion of probe beam around the resonance results in slowing down the group velocity of probe beam. Finally, we present the dependence of phase as a function of probe beam and velocity of the medium.

1This work was supported by U.S. NSF Grant PHY- 0936283 and DOE Grant DE-FG03-96ER40954.

Friday, October 7, 2011 1:40PM - 2:40PM – Session D3 Condensed Matter Physics and Materials Research I Sam Rayburn Center Second Floor, Room Traditions - Robert Glosser, University of Texas at Dallas

1:40PM D3.00001 Band offsets of atomic layer deposited Al2O3, BeO and HfO2 on Si measured by linear and nonlinear internal photoemission, MING LEI, Dept. of Physics, UT Austin, JUNG YUM, SANJAY BANERJEE, Dept. of Electrical & Computer Engineering, UT Austin, MICHAEL DOWNER, Dept. of Physics, UT Austin — Hf-based high-$k$ dielectrics recently replaced SiO2 as gate oxide in some commercial transistors in order to continue down scaling complementary metal-oxide-semiconductor devices while minimizing leakage currents. Research continues on alternative high-$k$ gate oxides. The required permittivity of advanced gate dielectrics must be balanced against the barrier height for tunneling and thermionic emission leakage currents governed by the offsets of their conduction and valence bands from those of the substrate. Here we present measurements of conduction band offsets of three high-$k$ dielectrics on Si(001) substrates using linear internal photoemission (IPE), detected by measuring photocurrent from a biased MOS capacitor, and internal multi-photon photoemission (IMPE), detected by optical second-harmonic generation (SHG). We present new IPE and IMPE measurements for atomic layer deposited beryllium oxide on Si(001). Band offset measurements for Si/HfO2, show a strong effect of post-deposition annealing on the energy barrier height.
1:52PM D3.00002 Development and Characterization of a Highly Textured Bi-2212 Superconducting Ribbon1. Kyle Damborsky, Texas A&M University, Accelerator Technology Co., Feng Lu, Peter McIntyre, Nathaniel Pogue, Elizabeth Sobby, Texas A&M University — Development of future hadron colliders, high field NMR spectrometers, and a potential muon collider depend upon the availability of superconducting materials capable of producing magnetic fields greater than the upper critical fields of NbTi (12 T) and Nb3Sn (24 T) at 1.9 K. One such material is the high temperature superconductor Bi-2212 which has an upper critical field in excess of 45 T and is presently available as a fine filament round wire. The use of Bi-2212 in very high field magnet development is limited by the small fraction of the intrinsic critical current density achieved in the industry standard oxide powder in tube process wires. This approach is limited by a large porosity, parasitic phase growth, and poor connectivity due to poor texture of the superconducting grains within conductor filaments. To reduce these damaging effects, the authors report upon the development of a new process for pretexturing and compacting fine powder Bi-2212 into highly textured, high density ribbons through a roll processing technique. These ribbons may then be further formed into a round wire conductor through a modified jelly roll process. Details of the roll processing technique and jelly roll conductor will be presented along with an initial characterization of the ribbons.

1This work was supported in part by the DOE SBIR program.

2:04PM D3.00003 TMAH wet etching of silicon micro- and nano-fins for selective sidewall epitaxy of III-Nitride semiconductors. Lianci Liu, Denis Myasishchev, Vladimir Kuryatkov, Sergey Nikishin, Mark Holtz, Texas Tech University, Rusty Harris, Texas A&M University — We describe formation of silicon micro- and nano-fins, with (111)-plane sidewall facets, for selective sidewall epitaxy of III-Nitride semiconductors. The fins are produced by wet etching (110)-oriented silicon wafers. Silicon dioxide is deposited using plasma enhanced chemical vapor deposition for producing a hard mask. The silicon dioxide is patterned using photo- and electron-beam lithography for micro- and nano-fins, respectively, followed by wet etching in hydrofluoric acid. Wet etching to produce the silicon fins is carried out using tetramethyl ammonium hydroxide (TMAH) diluted with isopropyl alcohol (IPA). Atomic force microscopy and scanning electron microscopy are used to determine morphology including the surface roughness of the area between fins and the etching rate of silicon. We tune the etching time, temperature, and percentage of IPA in order to get the best results.

2:16PM D3.00004 Optoelectronic studies of boron-doped and gamma-irradiated diamond thin films. Puskar Chapagain, Anastasiaiia Nemashkalo, Texas Christian University, Fort Worth, TX, Raul Peters, Paine College, Augusta, GA, John Farmer, University of Missouri-Columbia, Columbia, MO, Sanju Gupta, University of Pennsylvania, Philadelphia, PA, Yuri M. Strzhemechny, Texas Christian University, Fort Worth, TX — Elucidation of microscopic properties of a synthetic diamond, such as formation and evolution of bulk and surface defects, chemistry of dopants, etc. is necessary for a reliable quality control and reproducibility in applications. Employing surface photovoltage (SPV) and photoluminescence (PL) spectroscopic probes we studied diamond thin films grown on silicon by microwave plasma-assisted chemical vapor deposition with different levels of boron doping in conjunction with gamma irradiation. SPV measurements showed that while the increase of boron concentration leads to a semiconductor-metal transition, subsequent intense gamma irradiation reverts back the quasi-metallic samples to semiconducting state via compensating electrical components to tune emission properties. We explore the use of doped LaF3 nanocrystals, less than 50 nm in diameter, using a combination of Ce3+, Tb3+, and Eu3+ dopants at concentrations from 1% to 10% by mole. These doped nanoparticles have the advantage of easy synthesis, and may be assembled through various methods depending on the desired properties. They also possess a large surface-to-volume ratio suitable for modification, such as ligands to control solubility in a variety of substances. For enhanced luminosity, we combine the LaF3:Ce3+ with doped yttrium aluminum garnet (Y3Al5O12:Ce3+), prepared through a glycothermal method as nanoparticles of ~30 nm diameter. We propose to use the energy transfer between the Ce dopant on each crystal to effect fast, high-yield response to incident radiation. Morphology of the LaF3 and YAG products is examined, and we quantify response to a range of photon wavelengths, toward the goal of incorporating them into a radiation detection device.

Friday, October 7, 2011 1:40PM - 2:40PM –
Session D4 Nanoscience 1
Sam Rayburn Center Second Floor, Room Vision - Suresh Sharma, University of Texas at Arlington

1:40PM D4.00001 Benchmarks and applications of novel density functionals to semiconductor polymers1. Benjamin Janesko, Texas Christian University — Semiconductor polymers show substantial promise as the active ingredients in inexpensive, flexible, processable “plastic electronics” and “plastic solar cells.” The difficulty and expense of polymer synthesis makes computational prescreening of novel polymer candidates essential for guiding experiment. Density functional theory (DFT), particularly using hybrid exchange-correlation functionals, has been broadly applied to modeling isolated polymer chains. However, these functionals can be formally and computationally problematic for bulk polymers associating via noncovalent interactions. Screened hybrid and “Rung 3.5” density functionals, particularly their dispersion-corrected variants, show promise for ameliorating these limitations. This work presents benchmarks of these new functionals for this problem, and applications to novel conjugated and nonconjugated semiconducting polymers.

1Supported by startup funds from Texas Christian University.
discuss the possibility of using the charge ratio to distinguish the very low integrated luminosity of Oxide nanowires photothermal conversion efficiency of Au/CuS nanostructures. From UV-Vis-NIR spectrometer we obtained that these core/shell nanostructures have maximum absorbance at 1100 nm and absorption intensity much higher than only Au and only CuS nanoparticles systems. This, in turn, attributed to the relatively high photothermal conversion efficiency of Au/CuS nanostructures.

2:04PM D4.00003 Gas sensing properties and role of oxygen vacancies in Indium Oxide nanowires1, PRADIP GALI, FANG LING KUO, GOPAL SAPKOTA, PRATHYUSHA NUKALA, NIGEL SHEPERD, USHA PHILIPOSE, University of North Texas, USHA PHILIPOSE TEAM, NIGEL SHEPHERD COLLABORATION — We report on the effect of oxygen vacancies on defect related emission and the electronic properties of In2O3 nanowires, synthesized by vapor phase transport. The as-grown nanowires connected in an FET type of configuration shows n-type conductivity, which is ascribed to the presence of oxygen vacancies in the nanowire. The resistivity, transconductance, field effect mobility and carrier concentration of the In2O3 nanowires were determined to be 1.82 x10−2Ωcm, 11.2 nS, 119 cm2V−1s−1 and 4.89 x 1011cm−3 respectively. The presence of oxygen vacancies was also confirmed by photoluminescence measurements, which show a strong U.V emission peak at 3.18 eV and defect peaks in the visible region at 2.85 eV, 2.66 eV and 2.5 eV. We present a technique of post-growth annealing in O2 environment and passivation with (NH4)3S to reduce the defect induced emission. A single In2O3 nanowire with ohmic contacts was found to be sensitive to gas molecules adsorbed on its surface.

1The authors gratefully acknowledge financial support from Research Initiation Grant at the University of North Texas.

2:16PM D4.00004 A Study of point defects and cause of nonstoichiometry in InSb nanowires, GOPAL SAPKOTA, USHA PHILIPOSE, University of North Texas, Denton, TX — On account of its direct, narrow band gap (0.18 eV at 300 K) and very high electron mobility (7.8 m2V−1s−1), Indium Antimonide (InSb) is a promising material for device applications. Synthesizing crystalline InSb as a low dimensional system would lead to the realization of nanoscale devices like IR photodetectors. However, its synthesis remains a challenge because its stoichiometry is found to be critically dependant on growth conditions. In this talk, we present a study of the influence of growth parameters such as temperature and vapor pressure of constituents on the morphology and stoichiometry of InSb nanowires. Transport measurements on nanowires show strong n-type conduction attributed to a large number of electrically active impurities – 5 x1018 cm−3. We present a simple thermodynamic model to qualitatively explain our experimental findings of the evidence of point defects in these nanowires. Indium and antimony vacancies and charged versions of these defects are determined as a function of temperature and partial pressure of antimony.

2:28PM D4.00005 Studies of Porosity, Connectivity, and Parasitic Phases in Textured Bi-2212/Ag after Non-Melt Sintering, FENG LU, KYLE DAMBORSKY, PETER MCINTYRE, AL MCINTURFF, NATHANIEL POGUE, KLAUS SMIT, Department of Physics and Astronomy, Texas A&M University, ACCELERATOR RESEARCH LABORATORY TEAM — High-angle grain boundaries (HAGBs) result in weak links that limit current transport in high temperature superconductors. The powder filling in Bi-2212 round wires has random orientation of the grains, and as a result HAGBs are formed during the partial-melt processing. We have developed an alternative method in which Bi-2212 fine powder is roll-processed to produce a continuous ribbon with a high degree of texture. In this study textured Bi-2212 pellets were subjected to sintering to investigate the impact of sintering on texture, density, connectivity, and microstructure. A regime of non-melt sintering parameters were identified which produce near-solid density, improved texture, extensive growth of the Bi-2212 phase, and no significant growth of parasitic phases. We are now applying the process to develop continuous ribbons of textured Bi-2212/Ag green wire in our ‘Textured Powder Jelly-Roll’ process.

1This work was supported in part by DOE under grant DE-FG03-95ER40924. FE-SEM acquisition was supported in part by NSF grant DBI-0116835.

Friday, October 7, 2011 1:40PM - 2:40PM –
Session D5 High Energy Physics I Science Building 127 - Silvia Scorza, Southern Methodist University

1:40PM D5.00001 Benchmark processes at LHC, FREDRICK OLNESS, SMU — At the LHC, W and Z boson production will be used as benchmark processes to calibrate various searches for the Higgs boson, SUSY, and other “new physics” processes. In the context of the PDF global analysis, we examine current data from HERA, Tevatron and fixed targets to properly quantify the PDF uncertainties. This helps us to distinguish “new physics” from “old physics,” thereby maximizing the discovery potential of the LHC.

1:52PM D5.00002 Searching for anomalous top quark production at the early LHC, JUN GAO, Southern Methodist University, CHONG SHENG LI, Peking University, LI LIN YANG, University of Zurich, HAO ZHANG, Peking University — We present a detailed study of the anomalous top quark production with subsequent decay at the LHC induced by model-independent flavor-changing neutral-current couplings, incorporating the complete next-to-leading order QCD effects. Our results show that, taking into account the current limits from the Tevatron, the LHC with √s = 7 TeV may discover the anomalous coupling at 5σ level for a very low integrated luminosity of 61 pb−1. The discovery potentials for the anomalous couplings at the LHC are examined in detail. We also discuss the possibility of using the charge ratio to distinguish the tbg and tcg couplings.

1Journal Ref: Physical Review Letters 107,092002(2011)
2:04PM D5.00003 General-mass treatment for deep inelastic scattering at NNLO in CTEQ PDF analysis, MARCO GUZZI, Southern Methodist University, HUNG-LIANG LAI, PAVEL M. NADOLSKY, C.-P. YUAN — We present an NNLO realization of the general mass scheme S-ACOT-χ for the treatment of heavy-flavour production in neutral current deep-inelastic scattering. Practical implementation of the NNLO calculation is illustrated on the example of semi-inclusive structure functions $F_2(x, Q^2)$ and $F_{Lc}(x, Q^2)$. In a modern global QCD analysis of parton distribution functions (PDFs), several factors are comparable in magnitude to next-to-next-to-leading order (NNLO) radiative contributions in the QCD coupling strength $\alpha_s$. Among these factors, dependence of QCD cross sections on masses of heavy quarks, $m_c$ and $m_b$, can be significant. Global fits are sensitive to two types of mass effects, kinematical suppression of production of $c$ and $b$ quarks near respective mass thresholds in deep inelastic scattering (DIS), and large radiative contributions to collinear production of $cc$ or $bb$ pairs at large collider energy. It is therefore natural to evaluate all fitted cross sections in a “general-mass” (GM) factorization scheme, which assumes that the number of (nearly) massless quark flavors varies with energy, and at the same time includes dependence on heavy-quark masses in relevant kinematical regions. The S-ACOT-χ scheme that we present, is motivated by the QCD factorization theorem for DIS with massive quarks and we show it is valid to all orders of $\alpha_s$.

2:16PM D5.00004 The Systematic Construction of FFHS Gauge Models, DOUGLAS MOORE, Baylor University — It has been shown that the string landscape consists of roughly $10^{5000}$ string vacua. While the construction of all of these models is currently made inaccessible by "limited" technology, systematic construction schemes can be employed to explore regions of the landscape. These surveys can provide incite into the theory that purely analytical analysis cannot. We discuss one such systematic survey scheme being developed and deployed at Baylor University as well as results of a recently completed survey of layer 1 gauge models up to order 22.

2:28PM D5.00005 Gluon distributions in nuclei probed at the CERN Large Hadron Collider, ADEOLA ADELUYI, CARLOS BERTULANI, Texas A&M University-Commerce — Using updated gluon distributions from global fits to data, we investigate the sensitivity of direct photoproduction of heavy quarks and exclusive production of vector mesons to varying strength of gluon modifications. Implications of using these processes for constraining nuclear gluon distributions are discussed.

Friday, October 7, 2011 1:40PM - 2:40PM –
Session D6 Astronomy, Astrophysics and Space Station I
Science Building 122 - Kurtis Williams, Texas A&M University–Commerce

1:40PM D6.00001 How deep does a pulsar crust go? Using terrestrial experiments to explore the outer layers of a neutron star\(^1\), WILLIAM NEWTON, Texas A&M University-Commerce — The composition of the inner neutron star crust has a number of observational consequences via its impact on the mechanical, thermal and hydrodynamic properties of the crustal matter. Based on the nuclear liquid drop model, we examine our knowledge of the crustal composition resulting from our current experimental and theoretical constraints on the nuclear equation of state, focusing on the crust-core boundary layer's density and pressure, proton and free neutron fraction, and nuclear geometry.

\(^1\)Supported in part by NASA grant NNX11AC41G, NSF grants PHY-0757839 and PHY-1068022 and Texas Coordinating Board of Higher Education grant No. 003565-0004-2007.

1:52PM D6.00002 Coagulation of dust particles in plasma, LORIN MATTHEWS, JORGE CARMONA-REYES, VICTOR LAND, QIANYU MA, KRISTEN DELINE, JONATHAN PERRY, BRANDON DOYLE, TRUELL HYDE, CASPER / Baylor University — Dusty plasmas are found in numerous astrophysical environments. Coagulation of the charged dust changes their interaction with the plasma and affects the subsequent dynamics and evolution of the system. The complex microphysics underlying these processes depends on parameters specific to the ambient environment and the grains themselves. Different charging processes can yield populations of grains which are all charged negatively or charged with opposite polarities. The charge on an aggregate distributes itself over the aggregate's surface which can be approximated theoretically by assuming a multipole distribution. The dipole-dipole charge interactions between aggregates lead to rotations of the colliding grains. Other grain properties also influence the coagulation process, such as the monomer shape or the presence of magnetic material. The morphology of the resultant aggregates affects subsequent coagulation. Porous fluffy aggregates are more strongly coupled to the gas, leading to reduced collisional velocities, and greater collisional cross sections. An overview of the numerical and experimental methods used to study dust coagulation at CASPER will be given.

2:04PM D6.00003 The viscous interaction during the Whole Heliosphere Interval, one solar rotation\(^1\), ROBERT BRUNTZ, RAMON LOPEZ, SHREE BHATTARAI, YUE DENG, YANSHI HUANG, Univ. of Texas at Arlington — The Whole Heliosphere Interval (WHI) was a period of intense, coordinated observation and simulation of the Sun and solar system, lasting for one complete Carrington Rotation, March 20 – April 16, 2008. We ran the Lyon-Fedder-Mobarry (LFM) magnetohydrodynamic simulation of the near-Earth space (the magnetosphere), using the complete solar wind data from the WHI, as well as solar wind data with no interplanetary magnetic field (IMF). With no magnetic field, the solar wind-magnetosphere interaction occurs only through the viscous interaction. We will compare the results of the simulation with the full solar wind and the results for no IMF to study the influence of the viscous interaction and the influence of the interplanetary magnetic field.

\(^1\)This material is based upon work supported by CISM, which is funded by the STC Program of the National Science Foundation under Agreement Number ATM-0120950. The National Center for Atmospheric Research is sponsored by the National Science Foundation.

2:16PM D6.00004 Variable Star Search Using ROTSE3 Data, FARLEY FERRANTE, Southern Methodist University — I present results of a variable star search using data from the Robotic Optical Transient Search Experiment 3 (ROTSE3) telescopes. Variable stars vary in apparent magnitude as seen from Earth due either to changes in the stars luminosity or to changes in the amount of the star’s light that reaches Earth. My research is focused on analysis of the time variation of optical light output as recorded in ROTSE 3 images. Specifically, I am attempting to identify short-period variable candidates such as delta Scuti stars, eclipsing binary stars, and contact binary stars. The ROTSE3 telescope sensitivity holds the promise of significantly extending our reach to dimmer objects than previous searches.
2:28PM D6.00005 Asteroid Analysis Using Lightcurve Photometry, JESSICA ZIMMERMAN, Texas A&M University - Commerce — During the summer of 2011 data was taken of asteroid 3807 Pagels, a mid-sized asteroid located in the main asteroid belt in order to identify its rotational period. The asteroid 3807 Pagels is a poorly studied main belt asteroid that has little information recorded about its physical features. Time-series photometry of 3807 Pagels was obtained with a 16-inch telescope connected to a CCD camera located at the Texas A&M University - Commerce Observatory. CCD images were taken continuously with five minute exposure times through the standard broadband V filter. The data was then analyzed using the MPO Canopus program which utilized comparison stars within each CCD image to determine differential photometry and then generate a lightcurve for the asteroid. The final lightcurve did not show a complete rotational period for the asteroid. Thus, additional observations are needed in order to precisely determine 3807 Pagels rotational period. This research is the first steps of a long process of determining more information about the many mid-sized asteroids located in the asteroid belt for the potential of being able to classify these asteroids by their physical characteristics.

Friday, October 7, 2011 1:40PM - 2:16PM –
Session D7 SPS/Undergraduate Abstracts I
Science Building 123 - Gary White, American Institute of Physics

1:40PM D7.00001 Simulation of a Null ellipsometer and a modulating ellipsometer using Mathcad, CYNTHIA MONTGOMERY, WILHELMUS GEERTS, Texas State University at San Marcos — We developed Mathcad worksheets that demonstrate the working of a null Ellipsometer and a modulating Ellipsometer. The worksheet of the null ellipsometer begins with the definition of the Jones matrices for the polarizer, the quarter wave plate, the sample, and the analyzer, followed by calculations of the Jones vectors of the light reflecting of the sample and the light incident upon the detector. The optimum polarizer and analyzer angles that will null the light through the instrument are determined graphically or by two while-loops on the worksheet. Delta and Psi are calculated from those angles and compared to theoretical values. The worksheet for the modulating ellipsometer begins with the definition of the Jones matrices of the polarizer, the sample, the photo-elastic modulator, and the analyzer. From the Jones vector of the light incident upon the detector, the time dependence of the intensity is calculated. The lock-in amplifiers are employed by determining the 1st and 2nd harmonics of the intensity signal. Delta and Psi are calculated from those fourier coefficients and compared with the values found from the Fresnel coefficients.

1:52PM D7.00002 Use of the Wilson-Devinney Code on Transiting Exoplanets, ANDREW KOCUREK, Stephen F. Austin State University — The Wilson Devinney code was originally developed to analyze binary star data. Today, however, many exoplanets are being discovered every month thanks to the Kepler Satellite. With this new data flow of exoplanets, quick analysis of data is a must. Although the Wilson-Devinney code was not programmed with the intent on exoplanet analysis, it will be shown that this program can be used for exoplanet analysis barring a few restrictions.

2:04PM D7.00003 Freely available software for undergraduate astronomy research1, DAVID CRAIG, West Texas A&M University — As part of the ALFALFA project fostering undergraduate research in astronomy, we have begun to explore the use of freely available tools such as TOPCAT and SPLAT, which are visualization and data analysis tools for most of the common file formats used in research astronomy. They have some capabilities also found in systems such as IDL and IRAF, and also feature internet connectivity to large databases such as SDSS, VizieR and many others. Use of these tools in a collaborative research website will be discussed, and they will be briefly demonstrated.

1 University of North Texas summer research grant

Friday, October 7, 2011 1:40PM - 2:40PM –
Session D8 Foundations of Quantum Systems I
Sam Rayburn Center Second Floor, Pride Room -
Harry Swinney, University of Texas at Austin

1:40PM D8.00001 Generation of coherent microwave radiation in a three level lambda system1, SANKAR DAVULURI, YURI ROSTOTSEV, University of North Texas — Generation and control of coherent microwave radiation has gained lot of importance because of its potential applications in many fields like spectroscopy, metrology, atomic physics and Interferometry. In this presentation, we report the possibility of generation of coherent micro wave radiation in a three level lambda system. The upper two levels of the system are driven at resonance by a strong drive field while the highest and lowest levels are coupled by a weak probe field with some detuning. The coherent micro wave is generated between the lower two levels where the electric dipole moment is forbidden. The efficiency of the generated micro wave radiation is found to be very strongly dependent on the wave vector mismatch between the drive and probe fields.

1 University of North Texas summer research grant

1:52PM D8.00002 Quantum storage based on spacial angular control, XIWEN ZHANG, Institute for Quantum Studies and Department of Physics, Texas A&M University, ALEXEY KALACHEV, Institute for Quantum Studies and Dept of Physics, Texas A&M University; Zavoisky Physical-Technical Institute of the Russian Academy of Science, OLGA KOCHAROVSKAYA, Institute for Quantum Studies and Department of Physics, Texas A&M University — We consider the realization of Quantum Memory through off resonant Raman interaction in a three level solid state medium, via angular manipulation of the control field. We find it is in principle possible to obtain retrieval signal with almost one hundred percent efficiency and fidelity in free space.
2:04PM D8.00003 Kinetics And Optical Properties Of The Strongly Driven Gas Medium Of Interacting Atoms, ANDRIL SIŽHUK, Physics Department, TAMU 77843, PHILIP HEMMER, Electrical and Computer Engineering, TAMU — This paper investigates stimulated emission and absorption near resonance for a driven system of interacting two-level atoms. Microscopic kinetic equations for the density matrix elements of N-atom states including atomic motion are built, taking into account atom-field and atom-atom interactions. Analytical solutions are given for the resulting macroscopic equations in different limits, for the system composed of a strong coherent “pump” field and a weak counter-propagating “probe” field. It was shown that the existence of a dipole-dipole (long-range) interaction between atoms separated by distance less than the pump wave-length can cause the formation of periodic polarization and population structures (gratings in time and space) in the pumped medium without a probe field. The "interaction" between pump and probe induced polarization/population gratings through a dipole-dipole interaction mechanism causes the absorption line shape asymmetry. This asymmetry is revealed in increasing probe gain for the “red”-shifted (relative to pump) probe and suppressing the gain for the “blue”-shifted probe field when pump is “red”-shifted relative to the ensemble averaged resonant frequency. The theoretical results are consistent with experimental data for the probe gain as function of frequency and atomic density for sodium vapor with the pump laser tuned near D2 line. Here the dependance of gain on particle density was explained in the terms of the long-range interaction between the atoms.

2:16PM D8.00004 Some preliminary thoughts on the invention of constrained Hamiltonian dynamics, DONALD SALSBURY, Austin College — I will present some tentative remarks on the origins of constrained Hamiltonian dynamics, based in part on interviews recently conducted by myself and Dean Rickles with several key contributers. These interviews with James Anderson, Stanley Deser, Charles Misner, and Josh Goldberg were partially supported by the Center for the History of Physics of the American Institute of Physics, and will eventually be made available on the Center web page.

2:28PM D8.00005 Motivation for the Optical Characterization of Light Pollution in West Texas, SHIVAKUMAR SURENDRANATH, HILLARY PROFFIT, HARDIN DUNHAM, Angelo State University — We have developed a process for photographing the night sky and analyzing the CCD count data to generate a visual representation of the distribution of light pollution in the night sky. Repeating this process at strategic locations will allow for the accumulation of meaningful data over several years in which the background light pollution is expected to change. The Clean Energy Act of 2007 mandates the change from incandescent to fluorescent lighting at the end of 2011 for residences. The spectrum shift from this change is expected to increase the amount of scattered light in the night sky. We present evidence for the motivation behind mapping the light pollution distribution in West Texas in order to inform the public about conserving dark sky natural resources.

Friday, October 7, 2011 3:40PM - 4:40PM
Session F1 Nuclear Physics II Sam Rayburn Center Second Floor, Room Innovations A - Bao-An Li, Texas A&M University—Commerce

3:40PM F1.00001 Neutron-Proton pairing and the Symmetry Energy in Nuclear Matter, YUAN TIAN, BAO-AN LI, ZHONG-YU MA — The effect of neutron-proton(n-p) pairing in symmetry energy is studied in the symmetric matter. A separable n-p pairing interaction has been introduced by adjusting the pairing properties of the bare nucleon-nucleon interaction in the symmetric matter. The isospin triplet channel $T=1$ n-p pairing has small effect on the symmetry energy, but the effects of isospin singlet channel $T=0$ n-p pairing is significant especially at very low densities.

1 This work is supported by the US National Science Foundation grant PHY-0757839, PHY-1068022 and the US National Aeronautics and Space Administration under grant NNX11AC41G issued through the Science Mission Directorate.

3:52PM F1.00002 Magnetic effects in heavy-ion collisions at intermediate energies, LI OU, BAO-AN LI, Department of Physics and Astronomy, Texas A&M University—Commerce — The time-evolution and space-distribution of internal electromagnetic fields in heavy-ion reactions at beam energies between 0.2 to 2 AGeV are studied within IBUU11 model. While the magnetic field can be significantly higher than the estimated surface magnetic field of magnetars, it has almost no effect on nucleon observables as the Lorentz force is normally much weaker than the nuclear force. Very interestingly, however, the magnetic field generated by the projectile-like (target-like) spectator has a strong focusing/diverging effect on $\pi^+$/\$\pi^-$ at forward (backward) rapidities. Consequently, the differential $\pi^-/\pi^+$ ratio as a function of rapidity is significantly altered by the magnetic field while the total multiplicities of both positive and negative pions remain about the same. At beam energies above about 1 AGeV, the differential $\pi^-/\pi^+$ ratio is sensitive to the density dependence of nuclear symmetry energy $E_{\text{sym}}(\rho)$. So magnetic effects should be carefully considered in future studies of using the differential $\pi^-/\pi^+$ ratio as a probe of the $E_{\text{sym}}(\rho)$ at supra-saturation densities.

1 This work is supported by the US National Science Foundation grant PHY-0757839, PHY-1068022 and the US National Aeronautics and Space Administration under grant NNX11AC41G issued through the Science Mission Directorate.

4:04PM F1.00003 Observational effects of nuclear pasta in neutron stars, MICHAEL GEARHEART, Texas A&M University - Commerce — Neutron stars (NSs) provide us with an excellent laboratory for examining nuclear theory under conditions not obtainable here on Earth. In the solid inner crust of the NS near the transition to the liquid core, nuclei can form cylindrical, slab and bubble structures (so-called pasta phases). Some NSs are observed to undergo gamma ray flares which have oscillations in the X-ray tail of their lightcurve. These oscillations are thought to be caused by torsional oscillations in the crust which depends on the shear modulus (rigidity) of the crust. We present a study of the lower and upper bound observational effects of the pasta regime on the frequency of the torsional modes and the maximum quadrupole ellipticity sustainable by the crust.

4:16PM F1.00004 Statistical Tests on Neutron Star Glitches, JOSHUA HOOKER, Texas A&M Commerce — Glitches in pulsars are occasional, sudden increases in their rotation frequency as the pulsar otherwise steadily spins down. Using a set of neutron star equations of state which span the experimentally constrained range of asymmetric nuclear matter properties, we calculate the crustal moment of inertia, which relates to the size of a glitch in a broad class of glitch models in which the sudden spin-ups are due to angular momentum transfer between some of the superfluid neutrons in the star and the crust. We present a statistical test to compare the observational data to compare with our theoretical results.

1 This work is supported by the US National Science Foundation grant PHY-0757839, PHY-1068022 and the US National Aeronautics and Space Administration under grant NNX11AC41G issued through the Science Mission Directorate.
4:28PM F1.00005 Accelerator-Driven Subcritical Fission in a Molten Salt Core: Green Nuclear Power for the New Millennium, PETER MCINTYRE, Texas A&M University — Scientists at Texas A&M University, Brookhaven National Lab, and Idaho National Lab are developing a design for accelerator-drive subcritical fission in a molten salt core (ADSM). Three high-power proton beams are delivered to spallation targets in a molten salt core, where they provide ~3% of the fast neutrons required to sustain 600 MW of fission. The proton beams are produced by a flux-coupled stack of superconducting strong-focusing cyclotrons. The fuel consists of a eutectic of sodium chloride with either spent nuclear fuel from a conventional U power reactor (ADSM-U) or thorium (ADSM-Th). The subcritical core cannot go critical under any failure mode. The core cannot melt down even if all power is suddenly lost to the facility for a prolonged period. The ultra-fast neutronics of the core makes it possible to operate in an isobreeding (ADSMS-U) or thorium (ADSMS-Th). The subcritical core cannot go critical under any failure mode. The core cannot melt down even if all power is suddenly lost to the facility for a prolonged period. The ultra-fast neutronics produces a very low equilibrium inventory of the long-lived minor actinides, ~10^4 less than what is produced in conventional power plants. ADSMS offers a method to safely produce the energy needs for all mankind for the next 3000 years.

Friday, October 7, 2011 3:40PM - 4:16PM —
Session F2 Physics Education Research I — Sam Rayburn Center Second Floor, Room Innovations B -
Toni Sauny, Angelo State University

3:40PM F2.00001 Mathematical Rigor in Introductory Physics, MICHAEL VANDYKE, WILLIAM BASSICHIS, Texas A&M University — Calculus-based introductory physics courses intended for future engineers and physicists are often designed and taught in the same fashion as those intended for students of other disciplines. A more mathematically rigorous curriculum should be more appropriate and, ultimately, more beneficial for the student in his or her future coursework. This work investigates the effects of mathematical rigour on student understanding of introductory mechanics. Using a series of diagnostic tools in conjunction with individual student course performance, a statistical analysis will be performed to examine student learning of introductory mechanics and its relation to student understanding of the underlying calculus.

3:52PM F2.00002 A Comparison of Visual Spatial Abilities of Students in a Modern Physics Course Versus Students in Introductory Physics Courses, ELIJAH MURPHY, XIMENA CID, RAMON LOPEZ, Univ. of Tx. at Arlington — Due to the abstract nature of physics, students develop skills to create and manipulate mental representations in order to solve problems. It has been shown that physics students have the highest spatial abilities of all STEM (Science, Technology, Engineering, and Mathematics) majors, but previous research has focused solely on introductory courses. I will be presenting a study comparing the spatial abilities of two groups of students, using data collected from a few introductory physics courses and data collected from a modern physics course.

4:04PM F2.00003 TA Mentorship in Lecture significantly enhances students’ learning in mechanics in large introductory physics classes, K. CHENG, MEHMET CAGLAR, Texas Tech University — Lab is an important component of students’ learning in a traditional lecture-lab setting of introductory physics courses. Using standard mechanics concepts and baseline surveys as well as independent classroom observations, the effects of TA mentorship in Lecture on students’ learning of physics concepts and problem-solving skills among different student subgroups taught by other TAs and lecturers using different level of student interactive engagement in classes have been analyzed. Our data indicate that in lecture training of TA promotes lecture/lab synergism in improvement students’ learning of mechanics in large introductory physics classes.

3:40PM F3.00001 Beam Test Data Analysis of GEM Prototype Chamber Using One Bit Readout System, DANRAE PRAY, University of Texas at Arlington, CALICE COLLABORATION — Gas Electron Multiplier (GEM) technology is currently a strong candidate for a Digital Hadron Calorimeter to be implemented in an experiment in future accelerators such as the International Linear Collider. The University of Texas at Arlington High Energy Physics team has been developing prototype GEM detectors which contain two layers of GEM foils. The team performed a two week long beam test of four prototype chambers with dimensions 30cm x 30cm. Three of these chambers were equipped with the one bit DCAL chip readout system jointly developed by Argonne National Laboratory and Fermi National Accelerator Laboratory teams. In this talk, we report the results of the test beam data analysis of GEM prototype detector responses and efficiency dependence on threshold and high voltage of these three DCAL chambers.

3:52PM F3.00002 Test of the diphoton + missing transverse energy background model in ATLAS, KAMILE YAGCI, Southern Methodist University, ATLAS COLLABORATION — I present the data and MC comparisons for the selection variables of the two photon $E_T$ final state in ATLAS experiment. The data is taken from the proton-proton collisions of the 7 TeV center of mass energy at the Large Hadron Collider. The data sample studied was the initial 3.1 pb$^{-1}$ taken in the 2010 run. This analysis excluded the gravity mediated One Universal Extra Dimension model with $\Lambda R=20$, N=6 and $M_X=5$ TeV for a curvature $1/R$ 725 GeV at 95% C.L., where $\Lambda$ is the cutoff scale, N is the number of large extra dimensions and $M_X$ is the (4+N)-dimensional Planck scale.

4:04PM F3.00003 GEM, ANDY JONES — Study of HV Dependent Response and Gain of GEM Prototype Detectors Using Particle Beams The Gas Electron Multiplier (GEM) technology was developed at the European Center for Nuclear and Particle Physics Research (CERN) in 1997. GEM can be used as a sensitive gap detector for a calorimeter to measure particle jet energy to the precision required for future linear collider experiments. The High Energy Physics Group at the University of Texas at Arlington has developed and tested a series of double-layer GEM detectors that are 30cm x 30cm for a Digital Hadron Calorimeter. The team exposed four 30cm x 30cm chambers to particle beams to characterize them. One of the prototype chambers utilizes the KPIX 13 bit readout system, developed by the Stanford Linear Accelerator Center (SLAC) team. In this talk, we will report the effects of varying the chamber voltage potential on beam response, gain and the efficiency.

1Supported by NIH-1RC1GM090897.
1:16PM F3.00004 Study of Position Dependence of GEM Prototype Detector Response and Gain Using Particle Beams, NAM TRAN, DANRAE PRAY, SAFAT KHALED, SEONGTAE PARK, JAEHOON YU — The physics requirements at future International Linear Collider requires high precision measurements of jets of particles emerging from the collision. To meet this requirement, the University of Texas at Arlington High Energy Physics group has been developing the Digital Hadron Calorimeter for the future International Linear Collider using Gas Electron Multiplier (GEM) technology. The group has successfully constructed prototypes of various sizes from 10cmx10cm to 30cmx30cm and characterized them on the bench. The team recently conducted a beam test of four 30cmx30cm prototype GEM chambers at Fermi National Accelerator Laboratory. In this talk, we present the result of the beam test data analysis, in particular the position dependence of chamber responses and gains to understand the uniformity of the prototype chamber performance.

4:28PM F3.00005 Stress Management in TAMU3, a 14 Tesla Nb3Sn Dipole1, EDDIE HOLIK III, CHRISTOPHER BENSON, NICK DIAČZENKO, TIM ELLIOTT, RAY GARRISON, ANDREW JAILÉ, ALFRED MCINTURRF, PETER McINTYRE, DIOR SATTAROV — The Accelerator Research Laboratory at Texas A&M University is constructing TAMU3, a model dipole which implements Stress Management within its windings to prevent strain degradation of advanced superconductors under large Lorentz forces. A pier-and-beam support structure is integrated within the windings to intercept Lorentz stress from the inner windings and bypass it around the outer windings. TAMU3 will be the first rendering into practice of Stress Management and may open the way to fields of 16 Tesla and beyond for future hadron colliders, muon colliders, and other applications.

1The authors gratefully acknowledge the support from the DOE under grant DE-FG02-06ER41405.

Friday, October 7, 2011 3:40PM - 4:40PM — Session F4 General Physics & Applications | Sam Rayburn Center Second Floor, Room Vision - Peter McIntyre, Texas A&M University

3:40PM F4.00001 Fluid dynamics and heat transfer in an accelerator-driven subcritical fission core1, AKHDIYOR SATTAROV, KARIE BADGLEY, THOMAS MANN, PETER MCINTYRE, GWYN ROSAIRE, Texas A&M University — Accelerator-driven subcritical fission in a molten salt core (ADSMS) is being developed as a technology for green nuclear power. ADSMS burns its fertile fuel to completion, it cannot melt down, and it destroys long-lived minor actinides. The ADSMS core consists of a vessel filled with a molten salt eutectic of UCl3 and NaCl. Fission heat is driven by generating fast neutrons by spallation of energetic protons on spallation targets within the core. Fission heat is transferred from the molten salt to liquid Na in a primary heat exchanger located above the core. A conceptual design for the fluid dynamics and heat transfer in the core and in the heat exchanger will be presented.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund.

3:52PM F4.00002 Propagation of a constant velocity fission wave1, MARK DEINERT, The University of Texas at Austin — The ideal nuclear fuel cycle would require no enrichment, minimize the need fresh uranium, and produce few, if any, transuranic elements. Importantly, the latter goal would be met without the reprocessing. For purely physical reasons, no reactor system or fuel cycle can meet all of these objectives. However, a traveling-wave reactor, if feasible, could come remarkably close. The concept is simple: a large cylinder of natural (or depleted) uranium is subjected to a fast neutron source at one end, the neutrons would transmute the uranium downstream and produce plutonium. If the conditions were right, a self-sustaining fission wave would form, producing yet more neutrons which would breed more plutonium and leave behind little more than short-lived fission products. Numerical studies have shown that fission waves of this type are also possible. We have derived an exact solution for the propagation velocity of a fission wave through fertile material. The results show that these waves fall into a class of traveling wave phenomena that have been encountered in other systems. The solution places a strict condition on the shapes of the flux, diffusive, and reactive profiles that would be required for such a phenomenon to persist. The results are confirmed numerically.

4:04PM F4.00003 High-Current Superconducting Cyclotron for Accelerator-Driven Subcritical Fission and for Medical Isotope Production1, KARIE BADGLEY, SAEED ASSADI, PETER McINTYRE, AKHDIYOR SATTAROV, Texas A&M University — A 50 MeV, 5mA proton cyclotron is being developed as the injector for a high-current driver for an accelerator-driven subcritical fission power system (ADSMS), and also for production of isotopes for medical physics. Two innovations have made it possible to design a cyclotron capable of >5 mA beam current: strong-focusing of the bunches by quadrupole focusing channels integrated on the pole faces of the sector magnets, and superconducting rf accelerating cavities to provide sufficient energy gain per turn to cleanly separate the orbits. Simulation results will be presented for the beam dynamics of the intense proton bunches during injection, acceleration, and extraction. Key features for both applications will be discussed.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund

4:16PM F4.00004 Schrödinger Equation as Limit of Klein-Gordon Equation in an Electromagnetic Field, DONALD KOBE, University of North Texas — The gauge principle is used on the Klein-Gordon equation to minimally couple it to the electromagnetic (EM) field. A gauge transformation is made to cancel the term quadratic in the mass. Then we take the nonrelativistic limit for the particle, but not for the EM field. In this limit we obtain a nonrelativistic Schrödinger equation coupled to the relativistic EM field. The space- and time-dependent EM scalar potential (times the charge) has the dimension of energy, but it is not conservative because it can be changed by a gauge transformation. A conservative force is a nonrelativistic concept. If one is present its potential energy can be added to the EM scalar potential (times the charge) to give the usual Schrödinger equation.
4:28PM F4.00005 Equations of state of a system of fermions in a uniform magnetic field at finite density1. ISRAEL PORTILLO VAZQUEZ, EFRAIN J. FERRER, University of Texas at El Paso — The effects of magnetic fields in neutron stars and in quark stars have been studied for many years; however, all these studies did not follow a unique and consistent scheme when finding the field-dependent contributions to the energy density and pressures. Different authors have different stands on what should be the correct field contributions to the pressure and energy. Motivated by this fact, we develop a systematic and self-consistent functional method approach to treat the equation of state of a system of fermions in a uniform magnetic field at finite density and zero temperature. Following our method approach, we find the behavior of the system energy density and pressures, as well as the magnetization, as a function of a magnetic field. We present a graphical representation of the field-dependent anisotropic equation of state of the fermion system. Finally, we show that the introduction of the magnetic field results in a pressure anisotropy, which leads to the distinction between longitudinal- and transverse-to-the-field pressures, and we analyze under what conditions this anisotropy becomes significant.

1This work was supported in part by the Office of Nuclear Physics of the Department of Energy under Contract No. DE-FG02-09ER41599.

Friday, October 7, 2011 3:40PM - 4:40PM – Session F5 Condensed Matter Physics and Materials Research II Science Building 127 - Wilhelmus Geerts, Texas State University–San Marcos

3:40PM F5.00001 Measurement of the Spectral Distribution of Low Energy Electrons emitted as a result of MVV Auger Transition in Cu(100)1. SUMAN SATYAL, P.V. Joglekar, K. SHASTRY, A.H. WEISS, S.L. HULBERT — Auger Photoelectron Coincidence Spectroscopy (APECS) was used to investigate the physics of the Low Energy tail (LET) region of the Auger spectrum of a Cu (100) sample. A beam of 200eV photons was incident on the sample and two Cylindrical Mirror Analyzers (CMA’s) were used to select the energy of electrons emitted from the sample. A APECS spectra was obtained with one of the CMA’s fixed at the energy 136.25keV, which corresponds to the core photoemission peak. The APECS spectra contains the contributions from electrons excited by the MVV Auger transition plus a background due to true coincidences between photo-emitted valence band electrons that undergo inelastic scattering and transfer part of their energy with other valence electrons. Coincidence measurements were made with the fixed analyzer set at various energies between the core and the valence band. These measurements were used to obtain an estimate of the background due to the inelastically scattered valence band electrons.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund.

3:52PM F5.00002 Materials Testing for an Accelerator-Driven Subcritical Molten Salt Fission System: A look at the Materials Science of Molten Salt Corrosion1. ELIZABETH SOOBY, SHREYAS BALACHANDRAN, DAVID FOLEY, KARL HARTWIG, PETER MCINTYRE, Texas A&M University, SUPATHORN PHONGIKAROON, The University of Idaho, NATHANIEL POGUE, Texas A&M University, MICHAEL SIMPSON, PRABHAT TRIPATHY, Idaho National Laboratory — For an accelerator-driven subcritical molten salt fission core to survive its 50+ year fuel life, the primary vessel, heat exchanger, and various internal components must be made of materials that resist corrosion and radiation damage in a high-temperature environment, (500-800 C). An experimental study of the corrosion behavior of candidate metals in contact with molten salt is being conducted at the Center for Advanced Energy Studies. Initial experiments have been run on Nb, Ta, Ni, two zirconium alloys, Hastelloy-N, and a series of steel alloys to form a base line for corrosion in both chloride and bromide salt. Metal coupons were immersed in LiCl-KCl or LiBr-KBr at 700 C in an inert-atmosphere. Salt samples were extracted on a time schedule over a 24-hr period. The samples were analyzed using inductively coupled plasma-mass spectrometry to determine concentrations of metals from corrosion. Preliminary results will be presented.

4:04PM F5.00003 Thermal conductivity and specific heat of Ni nanowires. DENIS MYASISHCHEV, NENAD STOJANOVIC, TROY MILLS, JORDAN BERG, MARK HOLTZ, Texas Tech — As dimensions of materials shrink, important physical properties deviate from their corresponding bulk values. A critical example is thermal conductivity, which drops dramatically at the nanoscale. Effective power dissipation is crucial for solid state devices, but thermal conductivity decreasing with size complicates miniaturization efforts. There have been very few direct measurements of thermal conductivity of nanoscale structures. The 3ω method is a technique for measuring thermal conductivity of a film- or rod-like specimen. The approach has been tested on a large (25 µm diameter) Pt wire over a broad temperature range. The setup built may also be used for 3ω film measurement and is currently being tested on Pyrex glass. Results for 100 nm Ni nanowire specimens will be discussed.

4:16PM F5.00004 Quantum Hall Superfluids in Topological Insulator Thin Films. DAGIM TILAHUN, BYOUNGHAK LEE, Texas State Univ., EWELINA HANKIEWICZ, Universität Würzburg, ALLAN MACDONALD, University of Texas at Austin — Three-dimensional topological insulators have protected Dirac-cone surface states. In this paper we propose magnetic field induced topological insulator thin film ordered states in which coherence is established spontaneously between top and bottom surfaces. We find that the large dielectric constants of these materials increases the layer separation range over which coherence survives and decreases the superfluid sound velocity, but has little influence on superfluid density or charge gap. The coherent state at total Landau-level filling factor ν=0 is predicted to be free of edge modes, qualitatively altering its transport phenomenology.

4:28PM F5.00005 Lithium Iron Phosphate doped on the Iron side with Zirconium. ANDREW TRENCHARD, HANU ARAVA, HUI FANG, GAN LIANG, Sam Houston State University — Lithium ion batteries were constructed from both carbon and noncarbon coated LiFePO4 that was doped with Zirconium on the Iron side at 1%, 2% and 3%. The charge and discharge capacities of the batteries were measured at various C-rates. The results were compared amongst the various rates. The process for constructing the batteries as well as the results will be presented.

Friday, October 7, 2011 3:40PM - 4:40PM – Session F6 Astronomy, Astrophysics and Space Station II Science Building 122 - Kent Montgomery, Texas A&M University–Commerce
3:40PM F6.00001 Status and Prospects for the SuperCDMS Experiment, Bedile Karabuga, Southern Methodist University, SUPERCDCMS COLLABORATION — SuperCDMS, the successor of the Cryogenic Dark Matter Search (CDMS), is a direct detection experiment operated near 40 mK to search for the generic class of dark matter candidates, Weakly Interacting Massive Particles (WIMPs). It is designed to search for the scattering of WIMPs with nuclei in terrestrial Ge detectors. To increase the discrimination power to select WIMP events (nuclear recoils) from the background events (electron recoils), and the resulting sensitivity of the experiment, SuperCDMS has developed an improved detector technology and produced interleaved Z-sensitive ionization and Phonon (iZIP) detectors. In this talk I will describe the experiment and the performance of the iZIP detectors.

5:28PM F6.00002 The effect of white non-stationary data on drifting signal detection1, Mauricio Flores, Alexander Stroeer, Matthew Benacquista, University of Texas at Brownsville — We analyze the effect of non-stationary noise in the detection of drifting signals on unevenly sampled data. Initial frequency estimation is obtained from a Lomb-Scargle periodogram, which is followed by a global multi-start optimization, as working on a dense local Nelder-Mead iter for parameter estimates. It has been found that a varying white noise level has no effect on the required relative signal-to-noise ratio for detection in the proposed algorithm, though affecting the absolute amplitude strength of the signal recording. Future work includes the addition of colored noise to this analysis.

4:04PM F6.00003 Self-Calibration Technique for 3-point Intrinsic Alignment Correlations in Weak Gravitational Lensing Surveys1, Michael Troxel, Mustapha Ishak, Univ. of Texas at Dallas — Weak gravitational lensing can be used to constrain cosmological parameters to high precision using the 2- and 3-point weak lensing shear correlations. The intrinsic alignment (IA) of galaxies has been shown to be a significant barrier to precision weak lensing measurements. We review a proposed self-calibration technique to calculate the induced gravitational lensing-galaxy intrinsic alignment correlation (GI) for the power spectrum in weak gravitational lensing surveys with photometric redshift measurements, which is expected to reduce the IA contamination by at least a factor of 10 for currently proposed surveys. We confirm this using an independent analysis and propose an expansion to the self-calibration technique for the weak lensing bispectrum in order to calculate the dominant lensing-lensing-intrinsic alignment correlation (GGI). We explore the performance of the GGI self-calibration technique and show that it can potentially reduce the IA contamination by up to a factor of 5-10 for most redshift bin choices. The self-calibration thus promises to be an efficient technique to remove both the 2-point and 3-point intrinsic alignment contamination from weak gravitational lensing measurements.

1Supporting grants from NASA and NSF.

4:16PM F6.00004 Magnetic reconnection during northward interplanetary magnetic field during the Whole Heliosphere Interval, Shree Bhattacharai, Ramon Lopez, Robert Bruntz, Kevin Pham, Yue Deng, Yanshi Huang, Univ. of Texas at Arlington — The Whole Heliosphere Interval (WHI) occurred from March 20 (DOY 80) to April 17 (DOY 107) of 2008. We used Lyon-Fedder-Mobarry (LFM) simulation to simulate the geospace response to the solar wind input throughout the WHI using real solar wind conditions and studied the variation of magnetic reconnection with changing interplanetary magnetic field (IMF). Magnetic reconnection is the process in which the geomagnetic field interconnects with the IMF causing transfer of energy from the solar wind to the geospace. We will present results showing behavior of the reconnection potential when the IMF is northward and discuss limitations in current formulations of the dayside reconnection rate for northward IMF.

1This material is based upon work supported by CISM, which is funded by the STC Program of the National Science Foundation under Agreement Number ATM-0120950.

4:28PM F6.00005 Controlling calibration errors in gravitational-wave detectors by precise location of calibration forces, Hernan Daveloz, Mahmuda Afrin Badhan, Mount Holyoke College, Mário Díaz, UTB-TSC, Keita Kawabe, LIGO, Pablo Konverski, UTB-TSC, Michael Landry, Richard Savage, LIGO, UTB-TSC, CGWA COLLABORATION, LIGO, LHO COLLABORATION — To optimize the scientific benefit of interferometric GW detectors, calibration accuracies of better than 5% will be required. However, calibration forces applied to the test masses cause elastic deformation that is sensed by the interferometer detectors, inducing errors in the calibration. These errors increase with actuation frequency and can be greater than 50% at frequencies above a few kHz depending on the location of the calibration forces. They can be reduced significantly, to below 1%, by changing the position at which the forces are applied. Our finite element modeling indicates that with the two forces located within ±1 mm of their design locations, calibration errors due to test mass elastic deformation can be kept below 1% for frequencies up to 3.5 kHz. Thus, precise control of the location of calibration forces should enable overall calibration accuracies of better than 5%.

Friday, October 7, 2011 3:40PM - 4:40PM — Session F7 Biological & Chemical Physics I Science Building 123 - Jennifer Steele, Rice University

3:40PM F7.00001 High-resolution architecture of Gram-negative bacterial cell wall, Ahmed Touhami, University of Texas at Brownsville, John Dutcher, University of Guelph — The major structural component of bacterial cell walls is the peptidoglycan sacculus, which is one of nature’s strongest and largest macromolecules that maintains the large internal pressure within the cell while allowing the transport of molecules into and out of the cell and cell growth. The three-dimensional structure of this unique biopolymer is controversial, and two models have been proposed: the planar model, in which the glycan strands lie in the plane of the cell surface, and the scarp©ld model, in which the glycan strands lie perpendicular to the cell surface. We have used atomic force microscopy to investigate the high resolution structure of isolated, intact sacculi of Escherichia coli K12 bacteria. Atomic force microscopy-single molecule force spectroscopy was performed on single sacculi exposed to the tAmiB enzyme which cleaves the peptide-glycan bonds. Surprisingly, the measurements revealed individual strands of up to 250 nm in length. This finding combined with high resolution AFM images recorded on hydrated sacculi provide evidence for the validity of the planar model for the peptidoglycan structure in Gram-negative bacteria.
3:52PM F7.00002 Detection of superlattice domain formation in ternary lipid mixtures using fluorescence spectroscopy. BURCN MUTLU, STEPHANIE LOPEZ, MARK VAUGHN, JUYANG HUANG, K. CHENG, Texas Tech University — Multicomponent lipid bilayers represent an important model system for studying the structures and functions of cell membranes. At present, the lateral organization of lipid components, particularly the formation of regular distribution, in lipid membranes containing charged lipid, e.g., phosphatidylserine, is not clear. Using a ternary phosphatidylcholine/phosphatidylserine/cholesterol lipid bilayer system, the presence of ordered domain formation was examined by measuring the fluorescence anisotropy of the embedded fluorescent probe, 22-{[N-(7-nitrobenz-2-oxa-1,3-diazol-4-yl)amino]-23,24-bisnor-5-cholen-3β-ol (NBD-CHOL), with structure similar to that of a cholesterol, as a function of phosphatidylserine composition. The plot of the anisotropy vs. phosphatidylserine revealed abrupt changes at certain critical compositions of phosphatidylserine. Some of these critical compositions agree favorably with those predicted by the headgroup superlattice model suggesting that the charged phosphatidylserine lipid molecules adopt a superlattice-like distribution in the lipid bilayer at some predicted compositions. The ordered distribution of charged lipids may play an important role in the regulation of the composition of the biological membranes.

4:04PM F7.00003 Fundamentals of Charge Transport through DNA. JASON SLINKER, The University of Texas at Dallas, NATALIE MUREN, SARA RENFREW, JACKIE BARTON, California Institute of Technology, CHRIS WOHLGAMUTH, MARC MCMILLAN, Texas Tech University — Achieving charge transport (CT) through DNA comolents its inherent biological recognition capabilities and its unmatched capacity to be patterned into precise, nanoscale shapes. We have probed the length and temperature dependence of DNA charge transport with DNA-mediated electrochemistry. Cyclic voltammetry of 100-mer and 17-mer DNA monolayers on gold revealed sizable peaks from distally-bound Nile Blue redox probes for well matched duplexes, but highly attenuated redox peaks from monolayers containing a single base pair mismatch, demonstrating that the charge transfer is DNA-mediated. The similarity in electron transfer rates through 100-mer and 17-mer monolayers is consistent with fast transport through the DNA and rate-limiting tunneling injection. Temperature dependence studies of 17-mer and 34-mer duplexes showed CT is thermally activated and highly sensitive to the integrity of the DNA base pair stack. Activation energies are increased by the presence and identity of single base pair mismatches. Furthermore, the yield of DNA CT with temperature argues that this CT is conformationally gated. These results elucidate the mechanism of DNA CT and direct the use of DNA as molecular wires in electronic applications.

4:16PM F7.00004 Fiber optic spanner. BRYAN BLACK, SAMARENDRA MOHANTY, UT Arlington — Rotation is a fundamental function in nano/biotechnology and is being useful in a host of applications such as pumping of fluid flow in microfluidic channels for transport of micro/nano samples. Further, controlled rotation of single cell or microscopic object is useful for tomographic imaging. Though conventional microscope objective based laser spanners (based on transfer of spin or orbital angular momentum) have been used in the past, they are limited by the short working distance of the microscope objective. Here, we demonstrate development of a fiber optic spanner for rotation of microscopic objects using single-mode fiber optics. Fiber-optic trapping and simultaneous rotation of pin-wheel structure around axis perpendicular to fiber-optic axis was achieved using the fiber optic spanner. By adjusting the laser beam power, rotation speed of the trapped object and thus the microfluidic flow could be controlled. Since this method does not require special optical or structural properties of the sample to be rotated, three-dimensional rotation of a spherical cell could also be controlled. Further, using the fiber optic spanner, array of red blood cells could be assembled and actuated to generate vortex motion. Fiber optical trapping and spinning will enable physical and spectroscopic analysis of microscopic objects in solution and also find potential applications in lab-on-a-chip devices.

4:28PM F7.00005 A new Monte Carlo method for investigating geometrical structures of lipid membranes with atomistic detail. SARA CHENG, UC Berkeley, LIMING QIU, K. CHENG, MARK VAUGHN, Texas Tech University — The distribution statistics of the surface area, volume and voids of lipid molecules are important parameters to characterize the structures of self-assembling lipid membranes. Traditional methods are mostly based on various assumptions of the thickness of the lipid membrane and the volumes of different types of lipid molecules. However, those methods usually lead to an over- or underestimation of the average surface area of lipid molecules when compared to the experimental results of the pure lipid systems. We developed a new Monte Carlo method that is able to estimate the distributions and averages of surface area, volume and void space of the lipid molecules in the absence and presence of proteins of the MD simulation results of lipid membranes at the atomic scale. We successfully validated our new method on an ordered hard-sphere system and on a phospholipid/cholesterol binary lipid system, all with known structural parameters. Using this new method, the structural perturbation of the conformal annular lipids in close proximity to the embedded protein in a lipid/protein system will also be presented.

Friday, October 7, 2011 3:40PM - 4:40PM –
Session F8 Condensed Matter Physics and Materials Research III Sam Rayburn Center Second Floor, Pride Room - Charley Myles, Texas Tech University

3:40PM F8.00001 Surface Plasmon Enhancement of Organic Solar Cells. DAVID SHOPE1, JENNIFER STEELE2, Trinity University — Organic photovoltaic (OPV) devices are inherently less efficient than silicon based devices. The short electron diffusion lengths in OPVs require the cells to be kept thin, diminishing their light absorption. One way to increase the absorption of these devices is to launch surface plasmons (SPs) along one of the electrodes at specific wavelengths in the solar spectrum. SPs are coherent electron oscillations that exist at the surface of a metal-dielectric boundary, and serve to focus light at the metal surface. This increase in absorption ultimately impacts the overall efficiency of the device. The OPV cells are fabricated on top of glass slides and consist of an organic heterojunction active layer residing between ITO and aluminum electrodes. SP coupling is achieved by forming sinusoidal gratings of various periods along the active layer/Al electrode boundary. Efficiency measurements of patterned and unpatterned samples were taken to determine if the gratings have any effect on the cell efficiency at the predicted wavelengths. No significant changes in efficiency have been observed, which could be due to the abnormally low efficiencies of the devices that were tested.

1Department of Chemistry and Physics
2Department of Physics and Astronomy
and the cyclic amines, 3-cyclopenten-1-amine, 2-aminoindan, 2-cyclopenten-1-amine, 1-aminoindan, and 2-hydroxytetralin have been studied. The cyclic alcohols, 3-cyclopenten-1-ol (3CYPO), 2-cyclopenten-1-ol, 2-cyclohexen-1-ol, π say that the lowest energy form can interconvert through ring-puckering or internal rotation vibrations. The interconversions and relative energies of all the π bonding molecules have been used to investigate several molecules capable of intramolecular spectroscopy have been used to investigate several molecules capable of intramolecular

... and interpretation of the results has been challenging. We used the atomic force microscope to pull proteins and DNA, and determined the equilibrium properties of the molecules using the recently derived nonequilibrium work theorem. I will present applications of the technique in single biomolecules are pulled while their force response is being monitored. The process is often nonequilibrium, associated with it have become one of the most challenging and puzzling problems in cosmology and physics. Cosmic acceleration can be caused by (i) a repulsive dark energy pervading the universe, (ii) an extension to General Relativity that takes effect at cosmological scales of distance, or (iii) the acceleration may be an apparent effect due to the fact that the expansion rate of space-time is uneven from one region to another in the universe. I will review the basics of these possibilities and provide some recent results on these questions.

Friday, October 7, 2011 5:15PM - 6:05PM –
Session G1 Plenary Session III
Sam Rayburn Center Second Floor, Room C - David Hough, Trinity University

5:15PM G1.00001 Why Is the Expansion of the Universe Accelerating? , MUSTAPHA ISHAK-BOUSHAKI, Associate Professor, Head of the Cosmology Group, University of Texas at Dallas — For more than a decade, a number of cosmological observations have been indicating that the expansion of the universe is accelerating. Cosmic acceleration and the questions associated with it have become one of the most challenging and puzzling problems in cosmology and physics. Cosmic acceleration can be caused by (i) a repulsive dark energy pervading the universe, (ii) an extension to General Relativity that takes effect at cosmological scales of distance, or (iii) the acceleration may be an apparent effect due to the fact that the expansion rate of space-time is uneven from one region to another in the universe. I will review the basics of these possibilities and provide some recent results on these questions.

Friday, October 7, 2011 2:45PM - 3:35PM –
Session E1 Plenary Session II
Sam Rayburn Center Second Floor, Room C - Jennifer Steele, Rice University

2:45PM E1.00001 Single Molecule Manipulation , CHING-HWA KIANG, Associate Professor, Rice University - Houston — Single-molecule manipulation studies open a door for a close-up investigation of complex biological interactions at the molecular level. In these studies, single biomolecules are pulled while their force response is being monitored. The process is often nonequilibrium, and interpretation of the results has been challenging. We used the atomic force microscope to pull proteins and DNA, and determined the equilibrium properties of the molecules using the recently derived nonequilibrium work theorem. I will present applications of the technique in areas ranging from fundamental biological problems such as DNA mechanics, to complex medical processes such as the mechanical activation of von Willebrand Factor, a key protein in blood coagulation.

6:10PM - 6:10PM –
Session H1 Poster Session (6:10 pm - 7:30 pm) Sam Rayburn Student Center Second Floor -
WDLFs.

use our models to explore the encoded white dwarf physics and star formation history of our Galaxy in forthcoming new generations of observed

order to construct model WDLFs, which we test for compatibility with previous model results and historical observed WDLFs. Our goal is to

the most current white dwarf evolution models available and several simple assumptions regarding the form of star formation rates over time in

the star formation history of the Galaxy, the cooling physics of white dwarfs, and the evolution of white dwarf progenitor stars. We have used

- Commerce — White dwarfs are the final stage of stellar evolution for the vast majority of stars in the Galaxy. The number of white dwarfs

exhibits ellipsoidal variations. This research is supported by a National Science Foundation Partnership in Astronomy and Astrophysics Research and Education (PAARE) grant to the University of Texas at El Paso.

1University of Texas at Brownsville

H1.00002 McDonald Observations of J1118+480 , LORENA MONROY, PAUL A. MASON, University of Texas at El Paso, E.L. ROBINSON, University of Texas at Austin — Starting in the summer of 2010 and continuing to the summer of 2011, we observed J1118+480 at McDonald Observatory using Argos (a charged-coupled device, CCD, camera) for a total of 13 nights. We present the light curves from the gathered nights that have been reduced using scientific lineinx operating system and IRAF. The light curve data is converted to Heliocentric Julian Date (HJD) and the delta Magnitude between a comparison star and the target star (J1118+480) is plotted. We performed a period search of our light curves using Phase Dispersion Minimization (PDM) and we discuss the implications of the period search. This research is supported by a National Science Foundation, Partnership in Astronomy and Astrophysics Research and Education (PAARE) grant to the University of Texas at El Paso.

H1.00003 Optical Observation of Low Mass X-Ray Binary J1753.4-0126 , AURELIO PAEZ, PAUL A. MASON, University of Texas at El Paso, Department of Physics, E.L. ROBINSON, University of Texas at Austin, Department of Astronomy — We conducted optical observations of the black hole candidate J1753.4-0126 with the 82 inch (2.1 m) Otto Struve Telescope at the McDonald Observatory. A total of 20 nights of data were collected from May 2010 through June 2011. Data was reduced using the Interactive Reduction and Analysis Facility (IRAF). We present the resulting light curves. We discuss our progress in this analysis, which uses a phase dispersion minimization code in order to find periodicity. This research is supported by a National Science Foundation Partnership in Astronomy and Astrophysics Research and Education (PAARE) grant to the University of Texas at El Paso.

1This research is supported by a National Science Foundation Partnership in Astronomy and Astrophysics Research and Education (PAARE) grant to the University of Texas at El Paso.

H1.00004 Optical Characterization and GIS Mapping of Light Pollution in West Texas , HILLARY PROFFIT, SHIVAKUMAR SURENDRANATH, HARDIN DUNHAM, Angelo State University — Images of the night sky have been collected in Tom Green County using two SBIG, all-sky CCD cameras. A process has been developed using various software to extract the CCD count data from the images and create an intensity profile across stars in the sky. By correlating stellar magnitudes with the CCD counts recorded, we are able to create an intensity profile of the night sky. Combining current geographical information through the use of GPS locations, the light pollution distribution can be mapped. This research will present data processing methods, techniques, and preliminary results which will be used to map the distribution of light pollution over several years. The continuation of mapping light intensity distributions in West Texas will provide a foundation for future comparisons of light pollution, and raise public awareness for preserving natural dark-sky resources.

H1.00005 Optical Observation of Low Mass X-Ray Binary V1727 Cygni, ALEX PRICE, PAUL MASON, University of Texas at El Paso, EDWARD L. ROBINSON, University of Texas at Austin — This research is based upon optical observations of the neutron star V1727 Cygni (=4U 2129+47). A total of 19 nights of data were collected from September 2010 through August 2011 at the McDonald Observatory via the 82 inch (2.1 m) Otto Struve Telescope. The Interactive Reduction and Analysis Facility (IRAF) was used to reduce the data collected. We present the resulting light curves. We will describe our analytical methodology, which makes use of a phase dispersion minimization program in order to identify periodicity. Preliminary results seem to support previous research by Bothwell, Torres, Garcia, and Charles that V1727 Cygni is part of a three-body system. Preliminary results also suggest that this system exhibits ellipsoidal variations. This research is supported by a National Science Foundation Partnership in Astronomy and Astrophysics Research and Education (PAARE) grant to the University of Texas at El Paso.

1This research is supported by a grant from the National Science Foundation.

2Department of Physics

3Department of Astronomy

H1.00007 Equation of State in a Strongly Interacting Relativistic System, JASON KEITH, EFRAIN FERRER, Physics Department, The University of Texas at El Paso — The graphical representation of the equation of state of a fermion system with a four-fermion interaction in the strong coupling regime is shown as a function of the four-fermion coupling constant. The crossover from a superconducting BCS regime to a Bose-Einstein-condensate (BEC) regime is obtained by increasing the coupling constant. We show the characteristic quasi-particle spectra for each phase. We discuss how the BEC regime becomes unstable in the strong coupling limit giving rise to BCS stable bound states.

H1.00006 Modeling the White Dwarf Luminosity Function, RICK NAVARRO, Texas A&M University - Commerce — White dwarfs are the final stage of stellar evolution for the vast majority of stars in the Galaxy. The number of white dwarfs as a function of their luminosity (the white dwarf luminosity function, or WDLF) is the convolution of several pieces of interesting information: the star formation history of the Galaxy, the cooling physics of white dwarfs, and the evolution of white dwarf progenitor stars. We have used the most current white dwarf evolution models available and several simple assumptions regarding the form of star formation rates over time in order to construct model WDLFs, which we test for compatibility with previous model results and historical observed WDLFs. Our goal is to use our models to explore the encoded white dwarf physics and star formation history of our Galaxy in forthcoming new generations of observed WDLFs.
H1.00008 Tunneling, Diffusion and Dissociation of Feshbach Molecules in Optical Lattices. TAYLOR BAILEY, CARLOS BERTULANI, Texas A&M University-Commerce, EDDY TIMMERMANS, Los Alamos National Laboratory — We show that tunneling and diffusion of cold Rydberg molecules in optical lattices leads to a somewhat unexpected effects. One of these effects is the resilience of the molecules to dissociation as their binding energy decreases. We also quantify the dynamics of molecular diffusion and dissociation of molecules in 1D harmonic optical lattice potential by comparing to analytical models. It is found that after an initial transient, the wave packet for dissociating molecules can be described by a power diffusion pattern of the type \( \sigma(t) \propto t^{1/2} \) where \( \sigma \) is the dispersion of the packet. Surprisingly, we could not obtain such a simple power law fit for the dispersion of dissociated atoms.

H1.00009 Downstream electron beam exciter diagnostic with energy dependent cross section responses for process tool applications¹, P.L. STEPHAN THAMBAN, GABRIEL PADRON WELLS, The University of Texas at Dallas, JIMMY HOSCH, Verity Instruments Incorporated, MATTHEW GOECKER, The University of Texas at Dallas — Optical emission spectroscopy (OES) still remains as the primary diagnostic in plasma process tools in micro-electronics industry. With newer plasma processes and detection demands in low open area etches, process monitoring with direct optical signals is severely limited. Here we present a diagnostic method that realizes optical signals due to an electron beam from an inductively coupled plasma. Distinct merits such as energy dependent optical emission cross section responses and stable operability in polymerizing / corrosive etch environments will be presented. Electron impact optical cross section responses of transitions in fluorocarbon, oxygen and inert gas chemistries will be shown. Such controllability, in the context of species density measurement will be discussed.

¹Project funded by NSF Grant (CBET-0922902) and Verity Instruments Incorporated.

H1.00010 Improvements to a Compton Polarimeter¹, BRANDON CAVNESS, Angelo State University, DAVE GASKELL, Jefferson Laboratory, MARK DALTON, Virginia State University — The Jefferson Lab in Newport News, Virginia, uses a polarized electron beam to perform research on the substructure of nuclear nucleons. Jefferson Lab uses a relatively new Compton polarimeter to continuously measure the polarization of the electron beam delivered by the Continuous Electron Beam Accelerator Facility (CEBAF) accelerator. The Compton polarimeter determines beam polarization by colliding a high-power laser with the electron beam and measuring the scattered photons and electrons. The Compton polarimeter utilizes this asymmetry of Compton scattering rates to measure polarization to \( (\pm 1\%) \) every few hours. For an accurate measurement, the laser polarization and the position of the scattered photon cone must be well known. The focus of this project was to expand the instrumentation to monitor and control the Compton polarimeter with the intent of improving the electron beam polarization measurement. The individual components of the system are all working as intended, but the system as a whole will not be tested until beam operations resume. An improved measurement of the electron beam polarization will reduce the uncertainty of future experiments.

¹U.S. Department of Energy, National Science Foundation

H1.00011 SPP Excitation Using Extremely Low Intensity Light¹, JOHN SANDY, DANIEL DOMINGUEZ, LUIS GRAVE DE PERALTA, Texas Tech University — We present the results of experiments designed to create and detect Surface Plasmon Polaritons (SPP) using low intensity light such that SPP excitation is achieved under extremely low intensity condition. This is accomplished using an experimental apparatus which utilizes a laser-intensity varying system, a PMMA on gold on glass sample, and a Single Photon Counting Module (SPCM). We image the characteristic SPP propagation ring using a typical CCD camera and find the corresponding is accomplished using an experimental apparatus which utilizes a laser-intensity varying system, a PMMA on gold on glass sample, and a Single Photon Counting Module (SPCM). We image the characteristic SPP propagation ring using a typical CCD camera and find the corresponding

¹Texas Tech University

H1.00012 Excitation of atomic and nuclear coherence by strong optical fields, YURI ROSTOVTSEV, University of North Texas, TREENA CHATTERJEE, TAMS, University of North Texas — Recent progress in ultrashort, e.g. attosecond, laser technology allows to obtain ultra-strong fields which can be of the same order of magnitude as the electric field created by an atomic nucleus. Interaction of such strong and broadband field with atomic systems even under the action of a far-off resonance strong pulse of laser radiation should be revisited. As we have shown, such pulses can excite remarkable coherence on high frequency transitions. We have perform classical calculations and compare it with results of \textit{ab initio} calculations using TDDFT for several atoms and simple molecules interacting with strong optical fields. We compare efficiency generation with the efficiency of high harmonic generation approach, and discuss the CEP effects and possible applications of the results to excitation of nuclear transitions.

H1.00013 Analysis of crystals using electron diffraction. ROBERT NICK LANNING, CRISTIAN BAHRI, Department of Physics, Lamar University — Measurements of diffraction patterns produced by electron beams incident on crystals reveal their atomic arrangement and allow one to find the length of the chemical bonds with high precision. Using fundamental principles we can understand the formation of electronic wave packets when electron projectiles pass through the crystal. The effective electronic charge of the atoms in the crystal acts as an arrangement of narrow slits which generate the Fourier transform of the sinusoidal waves associated to the electron projectiles incident on the crystal. Our study has applications in electronic microscopy, microbiology, and crystallography. This project was supported by the STAIRSTEP program [1] under a NSF-DUE grant. The project is designed to engage STEM undergraduate students in high-quality research in several fields of science including physics, at Lamar University.


H1.00014 Study of plasmonic crystals by Plasmon Tomography far-field Superlenses¹. WILLIS AGUTU, Physics, CHARLES REGAN, Electrical and Computer Engineering, ARQUIUMDES COLUMBIE, University College, ROBIER RODRIGUEZ, Physics, AYRTON BERNUSSI, Electrical & Computer Engineering and Nano Tech Center, LUIS DE-PERALTA, Physics, PHYSICS COLLABORATION, DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING COLLABORATION, NANO TECH CENTER COLLABORATION, UNIVERSITY COLLEGE COLLABORATION — We explore the use of surface plasmon polariton (SPP) tomography far-field superlenses for quantitative characterization of plasmonic crystals. Useful semi-empirical relations are obtained from the quantitative information extracted from the FP images. In addition, based on the comparison of the FP images corresponding to plasmonic crystals with holes of different sizes, we present a comprehensive discussion about the formation of directional stop-bands in the fabricated plasmonic crystals.

¹This work was partially supported by the NSF CAREER Award (ECSS-0954490), U.S. Army CERDEC contract (W15P7T-07-D-P040), and by the J. F. Maddox Foundation.
H1.00015 Determining Favorable Binding Configurations of the Anti-Cancer Drug Ellipticine to the KV11.1 Potassium Channel V-VI Transmembrane Domain Through Autodock Simulations, DAWN LIPSCOMB, University of Texas at San Antonio, LORENZO BRANCALEON, University of Texas at San Antonio — Ellipticines such as 9-methoxy-N-2-methyllellipticinium acetate (MMEA) and 9-hydroxy-N-2-methyllellipticinium acetate (NMEA, Celiptium ®) are antineoplastic drugs that exert their selective cytotoxicity against leukemia and endometrial carcinoma. Ellipticine’s action is also related to severe physical side effects, but the link between undesired effects and pharmacological application is not well understood. We investigated the binding of Ellipticine derivatives with the Kv11.1 potassium ion channel using Autodock and revealed that hydroxyellipticinium derivatives provide binding configurations with Kv11.1, but the energy, location and estimated dissociation constant varied. The binding energy is as follows: Chloroceliptium (-6.60 kcal/mol) > Celiptium (- 6.37 kcal/mol) > Methoxyceliptium (- 6.20 kcal/mol) > Datelliptium (-6.08 kcal/mol). Autodock simulations demonstrate that binding affinity is high at opposing ends of the channel and low within the channel interior. These favorable binding configurations suggest that Ellipticine derivatives may bridge among end subunits of the channel and potentially inhibit the flow of ions.

H1.00016 Nanostructured thermites based on iodine pentoxide for bio agent defeat systems, MKHITAR HOBOSYAN, ALEXANDER KAZANSKY, KAREN MARTIROSYAN, University of Texas at Brownsville — The risk for bioterrorist events involving the intentional airborne release of contagious agents has led to development of new approaches for bio agent defeat technologies both indoors and outdoors. Novel approaches to defeat harmful biological agents have generated a strong demand for new active materials. The preferred solutions are to neutralize the biological agents within the immediate target area by using aerosolized biocidal substances released in situ by high energetic reactions. By using nano-thermite reactions, with energy release up to 25 kJ/cc, based on I2O5/Al nanoparticles we intend to generate high quantity of vaporized iodine for spatial deposition onto harmful bacteria for their destruction. In this report, the effect of reaction product on growth and survival of Escherichia coli (E-coli) expressing GFP (Green Fluorescent Protein) was investigated. Moreover, we developed an approach to increase sensitivity of the detection. The study has shown that I2O5/Al nanosystem is extremely effective to disinfect harmful biological agents such as (E-coli) bacteria in seconds.

H1.00017 Thermophoresis in microfluidic devices: Lattice-Boltzmann simulations, JENNIFER PEARCE, DAVID WILSON, SETH NORMAN, The University of Texas at Tyler — Thermophoresis, or mass accumulation due to a temperature gradient, has been shown to occur in microfluidic channels with fluid flow. It has separately, without flow, to lead to separation of different sizes of polymers. Here we report on simulations that combine these effects, fluid flow and size segregation. The simulation is based on the lattice-Boltzmann method for the fluid and a bead spring model for the polymer and has reproduced quantitatively thermophoresis of DNA. We investigate if thermophoresis can be used to separate polymers of different sizes using thermal flow field fractionation in microfluidic devices.

H1.00018 Electromagnetism of Bacterial Growth, AILIYASI AINIWAER — There has been increasing concern from the public about personal health due to the significant rise in the daily use of electrical devices such as cell phones, radios, computers, GPS, video games and television. All of these devices create electromagnetic (EM) fields, which are simply magnetic and electric fields surrounding the appliances that simultaneously affect the human bio-system. Although these can affect the human system, obstacles can easily shield or weaken the electrical fields; however, magnetic fields cannot be weakened and can pass through walls, human bodies and most other objects. The present study was conducted to examine the possible effects of bacteria when exposed to magnetic fields. The results indicate that a strong causal relationship is not clear, since different magnetic fields affect the bacteria differently, with some causing an increase in bacterial cells, and others causing a decrease in the same cells. This phenomenon has yet to be explained, but the current study attempts to offer a mathematical explanation for this occurrence. The researchers added cultures to the magnetic fields to examine any effects to ion transportation. Researchers discovered ions such as potassium and sodium are affected by the magnetic field. A formula is presented in the analysis section to explain this effect.

H1.00019 Temperature Dependence of DNA Charge Transport, CHRIS WOHLGAMUTH, MARC MOWILLIAMS, JASON SLINKER, UT Dallas — Charge transport (CT) through DNA has been extensively studied, and yet the mechanism of this process is still not yet fully understood. DNA CT has been utilized in sensing proteins and DNA fragments, and it has been postulated that it may assist DNA damage prevention and repair. Besides the benefits of understanding charge transport through this fundamental molecule, further understanding of this process will elucidate the biological implications of DNA CT and advance sensing technology. Therefore, we have investigated the temperature dependence of DNA CT by measuring the electrochemistry of DNA monolayers modified with a redox-active probe. By using multiplexed electrodes on silicon chips, we compare the cyclic and square wave voltammetry of distinct DNA sequences under identical experimental conditions. Accordingly, we compare well matched DNA duplexes to those containing a single base pair mismatch, which has been shown to attenuate CT. The yield of CT is shown to follow Arrhenius behavior, with increased activation energies for mismatches that structurally distort the duplex. These observations suggest that charge transport is thermally activated and highly dependent upon DNA conformation.

H1.00020 Real-Time Interaction between Antimicrobial Peptide and Lipid Membrane Using Atomic Force Microscopy and Confocal Microscopy, JIE HU, Department of Physics and Astronomy, University of Texas at Brownsville, VERNITA GORDON, Center for Nonlinear Dynamics, University of Texas at Austin, AHMED TOUHAMI, Department of Physics and Astronomy, University of Texas at Brownsville, UNIVERSITY OF TEXAS AT BROWNSVILLE COLLABORATION — Peptide-glycylcylleucine-carboxyamide (PGLa) is a helical cationic amphiphilic antimicrobial peptide known to interact with bacterial membranes. The electrostatic interaction is the major determinant that triggers the affinity of the PGLa towards bacterial membranes. Here, Atomic Force Microscopy (AFM) and Confocal Microscopy (CM) were used to investigate this interaction. Giant Unilamellar Vesicles (GUV) mimicking E. coli membranes were prepared by the natural swelling method that allows the fluorescence dye to be encapsulated in the GUVs. After GUVs were incubated with PGLa in medium with low ionic strength, excessive leakage of the internal contents of GUVs was detected. Our results demonstrate that AFM and CM, as well as appropriate sample preparation protocols, are needed to obtain detailed mechanistic insights into antimicrobial function.
H1.00021 Porphyrin-Mediated Photoinduced Conformational Changes to Albumin. SARAH ROZINEN, LORENZO BRANCALONI, UTSA — Many biological and nonbiological uses of protoporphyrin-IX (PPIX) depend on its ability to bind large macromolecules such as human serum albumin (HSA). HSA is both biomedically and technologically relevant to PPIX (free base and metal), and its binding site for PPIX-derivatives is well established. The irradiation of PPIX noncovalently bound to Betalactoglobulin (BLG) is known to cause protein conformational changes that are pH-dependent due to BLG’s intrinsic conformational transitions. These processes have not been extensively studied in nonphysiological pH conditions for FePPIX or PPIX bound to HSA. This study implemented a combination of optical and computational methods to compare binding characteristics of hemin and PPIX to HSA as well as structural effects of low-dose irradiation of the ligand on the protein. Spectroscopic data suggests that irradiation of the Soret band of PPIX bound to HSA is capable of modifying the globular protein structure by direct charge transfer between the porphyrin and the binding site at both physiological and acidic pH confirmations. Computational docking simulations predict lower free energy of binding for PPIX than for heme.

H1.00022 Titrated fluorescent binding of Thioflavin-T with bovine serum albumin, JACOB FRIDAY, JEREMIAH BABCOCK, LORENZO BRANCALONI, University of Texas at San Antonio — Thioflavin-T (ThT) can be used as a bio-marker to detect protein aggregation. ThT can be applied towards detecting protein structural changes, and possibly, protein structure. Spectroscopic analysis was used to investigate the interaction of bovine serum albumin (BSA), a globular α-helix structured protein, with Thioflavin-T in titrated phosphate buffer solutions from pH 2 — 10. The objective for this study was to analyze the binding characteristics of BSA, with the fluorescent marker, ThT. Under constant concentrations of 40 µM ThT and 10 µM BSA, absorbance spectra and fluorescence spectroscopy was used to determine the binding characteristics of Thioflavin-T to BSA. Evidence is not certain on whether binding occurred or not, and future plans are to investigate the protein folding dynamics of partial β-sheet proteins such as lactoglobulin.

H1.00023 Polarized Reflectance Measurement of Burned Skin Tissues, HECTOR MICHAEL DE PEDRO, CHUAN-I. CHANG, FARANAK ZARNANI, ROBERT GLOSSER, University of Texas at Dallas, Physics, D. MAAS, A. IDRIS, Department of Surgery, The University of Texas Southwestern Medical Center, UNIVERSITY OF TEXAS AT DALLAS, PHYSICS COLLABORATION, UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL CENTER COLLABORATION — In the US, there are over 400,000 burn victims with 3,500 deaths in 2010. Recent evidence suggests that early removal of burn tissues can significantly increase the success of their recovery, since burns continue to spread and damage surrounding tissues after hours of injury. The rationale behind this procedure is that burns trigger the body’s immune system to overreact, causing additional damage. Therefore, it is important to distinguish burn areas so that it can be removed. The problem with this is that it is difficult to recognize the margins of the burn area. In our project, we use polarized reflectance as a tool to identify the burned tissues from unburned ones.

H1.00024 Investigating the Mechanical Properties of Plasma von Willebrand Factor Using Atomic Force Microscopy, SITARA WIJERATNE, ERIC BOTELLO, Department of Physics and Astronomy, Rice University, HUI-CHUN YEH, ZHOU ZHOU, ANGELA BERGERON, Department of Medicine, Baylor College of Medicine, ERIC FREY, Department of Physics and Astronomy, Rice University, JOEL MOAKE, Department of Bioengineering, Rice University, JING-FEI DONG, Department of Medicine, Baylor College of Medicine, CHING-HWA KIANG, Department of Physics and Astronomy, Rice University — Single-molecule manipulation allows us to study the real-time kinetics of complex cellular processes. The mechanochemistry of different forms of von Willebrand factor (VWF) and their receptor-ligand binding kinetics can be probed by atomic force microscopy (AFM). Since plasma VWF can be activated upon shear, the structural and functional properties of VWF that are critical in mediating thrombus formation become important. Here we characterized the mechanical resistance to domain unfolding of VWF to determine its conformational states. We found the shear-induced conformational changes, hence the mechanical property, can be detected by the change in unfolding forces. The relaxation rate of such effect is much longer than expected. Our results offer an insight in establishing strategies for regulating VWF adhesion activity, increasing our understanding of surface-induced thrombosis as mediated by VWF.

H1.00025 Raman Micro-spectroscopy Study of Healthy and Burned Biological Tissue, FARANAK ZARNANI, ROBERT GLOSSER, Department of Physics, The University of Texas at Dallas, Richardson, TX 75080, AHAMED IDRIS, Department of Surgery, The University of Texas Southwestern Medical Center, Dallas, TX 75390 — Burn injuries are a significant medical problem, and need to be treated quickly and precisely. Burned skin needs to be removed early, within hours (less than 24 hrs) of injury, when the margins of the burn are still hard to define. Studies show that treating and excising burn wounds soon after the injury prevents the wound from becoming deeper, reduces the release of proinflammatory mediators, and reduces or prevents the systemic inflammatory reaction syndrome. Also, removing burned skin prepares the affected region for skin grafting. Raman micro-spectroscopy could be used as an objective diagnostic tool that will assist burn surgeons in distinguishing unburned from burned areas. As a first step in developing a diagnostic tool, we present Raman micro-spectroscopy information from normal and burned ex vivo rat skin.

H1.00026 Photoinduced Charge Transfer Process, LUIS BASURTO, Department of Computational Science, University of Texas at El Paso, TUNNA BARUAH, RAJENDRA ZOPE, JOSE RODRIGUEZ, Department of Physics, University of Texas at El Paso — The photoinduced charge transfer process is the fundamental process in a photovoltaic system. Organic photovoltaics contain a donor-acceptor molecular system which undergoes photoinduced charge transfer leading to a large dipole moment. Often the charge transfer properties of such donor-acceptor systems are measured in solution. The dipole moments on the solvent molecules creates a reaction field. To simulate this reaction field we adopt an approach similar to the explicit solvent model proposed by Washel and co-workers. We use Monte Carlo simulations to determine various possible solvent structures. We use a carotenoid-porphyrin-C60 molecular triad as the light-harvesting system. This molecular triad has a very large dipole moment (153 Debye) in the charge separated state. The resulting solvent structures and the reaction field as a function of temperature will be presented.

1Supported by US Army Grant W81XWH-07-1-0675, UT Southwestern, and UT Dallas.
H1.00027 Calix[6]arene electron beam sensitivity and contrast dependence on functionalization and molecular weight1, GREGORY SPENCER, DANIEL RALLS, STEPHAN WOLFE, MICHAEL BLANDA, ANUP BANDYOPADHYAY, Texas State University-San Marcos — Calixarenes are macrocyclic molecules that have shown high resolution as electron beam resists. Earlier work has demonstrated that the sensitivity can be increased by adding functional groups to the molecular rim of these ring-shaped molecules. However, these earlier studies used either unfunctionalized resists or ones that were fully functionalized. In this study, the number of functional groups added to a calix[6]arene structure was deliberately varied from zero to the maximum possible number of groups. This allowed direct observation of the effect of the number of attached groups on the sensitivity. Two different conformers were used; a cone conformation and the 1,2,3-alternate conformer. Both used xylenyl groups as bridging units, giving conformationally-locked monomers. The number of added allyl groups was varied from 0 to 8. The resulting nine resists were exposed and contrast curves were measured by AFM. This allowed measurement of both resist sensitivity and contrast. The sensitivity was found to be a strong function of the number of pendant groups. Also the effect of molecular weight on sensitivity was found for the heaviest resist, after the functional group effect saturated between four and six groups. These results and comparison with others will be discussed.

1Supported in part by NSF grant MRI 0414202 and IGERT 0549487.

H1.00028 Spectroscopic analysis of temperature dependent growth of WO3 and W0.95Ti0.05O3 thin films, YOUNG YUN, FELICIA MANCIU, DURRER WILLIAM, JAMES HOWARD, CHINTALAPALLI RAMANA, OPTICAL SPECTROSCOPY LAB TEAM, DR. RAMANA'S TEAM COLLABORATION — We present a comparative spectroscopic study of the morphology and composition of tungsten oxide WO3 and W0.95Ti0.05O3 thin films, grown by radio frequency magnetron reactive sputtering at substrate temperatures varied from room temperature (RT) to 500 °C, using Raman and X-ray photoelectron spectroscopy (XPS). The Raman results demonstrate the occurrence of a phase transformation from a monoclinic WO3 structure to an orthorhombic or tetragonal configuration in the W0.95Ti0.05O3 thin films. This result is based on the observed shifting, with Ti doping, to lower frequencies of the Raman peaks corresponding to W-O-W stretching modes of WO3 at 806 and 711 cm−1, to 879 and 690 cm−1, respectively. Also, higher growth temperatures are required to obtain crystalline microstructure for Ti-doped WO3 films than for WO3 films. XPS data indicate that the doped material has a reduced W3+ stoichiometry at the surface, with the presence of W+6 and W+5 tungsten oxidation states; this observation could also be related to the existence of a different structural phase of this material, corroborating with the Raman measurements.

H1.00029 Morphology and chemical composition of Zn-Co alloy electrodeposits from alkaline solutions, MEYSAM HEYDARI GHARAHCHESHMEH, AHMED TOUHAMI, Department of Physics and Astronomy, University of Texas at Brownsville — Zn-Co alloy electrodeposits were obtained from weakly alkaline glycine solutions by using direct current. The influence of current density, electrolyte temperature, electrolyte’s Co2+ concentration on the surface morphology and chemical composition were investigated by using scanning electron microscope (SEM) and energy dispersive spectroscopy (EDX), respectively. The results showed that increasing temperature, electrolyte’s Co2+ concentration and current density, increases cobalt content of the coatings. It was also shown that increasing current density, up to 15 mA cm−2, decreases the grain size and further increase in current density increases the grain size of the deposits.

H1.00030 Effects of electronic correlations on the mechanical properties of Gallium Phosphide using density functional theory (DFT+U)1, FRASHANT KHATRI, BRANDON BUTLER, University of Texas at Arlington, JOHN A. TURNER, National Renewable Energy Laboratory, MUHAMMAD N. HUDA, University of Texas at Arlington — Developing an efficient material for solar energy conversion and storage has been an important task for many scientists working on renewable energy technology. Gallium phosphide (GaP) alloys are among the materials that have potential to be used in the solar technology. Hence, we investigate the elastic property, mainly the bulk modulus, and electronic properties of GaP. The goal of this work is to study the effect of electron correlation on the mechanical stability of GaP. The calculation of energy as a function of cell volume has been performed using density functional theory with U-parameter (DFT+U). The Roothaan-Hartree-Fock self-consistent field equations, total energy, bulk modulus, B0, and its first pressure derivative, B0′, the bulk modulus obtained using different U-parameter was compared with published experimental values. The use of U-parameter in Gallium d-orbital has increased the theoretical value of bulk modulus, making it closer to the experimental value. On the other hand, increasing values of U on Phosphorus p-orbital decreases the bulk modulus further. The physical consequences of these results will be discussed.

1Supported by National Renewable Energy Laboratory, Department of Energy.

H1.00031 Positron Doppler Broadening of Pure Elemental Metals, DESMOND FERNANDEZ1, Southern University and A&M College, C.A. QUARLES, Texas Christian University — Positron Doppler Broadening experiments using either a Sodium 22 or a Germanium 68 source were run on a range of pure elemental metals. The results are presented as ratios of the 511 keV annihilation line spectra to selected standard metals as a function of momentum of the atomic electron. The data are compared with theoretical calculations and with previous experimental results using the Coincidence Doppler Broadening method. Additionally, systematic investigations were done to determine the best techniques for optimization of the data. The factors that have an effect on the data include counting rate, detector resolution, amplifier shaping time, source backing material, background and total number of counts in the 511 keV annihilation peak. Furthermore, we were able to extend our results using the Germanium 68 source to a quality close to that of the more expensive and complex Coincidence Doppler Broadening practice.

1REU summer student at TCU supported by NSF REU grant PHY-0851558.

H1.00032 Calculating the Phonon Dispersion From First Principles, FRANK CEBALLOS, ANDY O’HARA, UT Austin, ALEXANDER SLEPKO, ALEXANDER DEMKOV, UT Austin — The goal of this project was to construct a user-friendly tool that can compute the phonon dispersion for any solid with a periodic crystal structure. The phonon dispersion describes the crystal’s vibrational properties and thermodynamic properties of the solid. Using the Vienna Ab-initio Simulation Package (VASP) we constructed three bases between the atoms. Assuming harmonic approximation we numerically evaluate force constant matrix. The lattice Fourier transform of the force constants yields the dynamical matrix, whose eigenvalues and eigenvectors represent the allowed phonon frequencies and displacement patterns for specific k-vectors. Our code then plots the frequencies along high symmetry lines in the Brillouin zone. We will present our results for silicon, GaAs and ZrO2.
H1.00033 Investigation of a strain generated internal field in an InGaAs/GaAs quantum well heterostructure\textsuperscript{1}, KALEB GILBERT, JAMES MATTHEWS, SAUNCY TONI, Angelo State University — Piezoelectrically active InGaAs/GaAs quantum wells grown along the \textit{<111>} crystal axis have been investigated using temperature dependent photoluminescence spectroscopy. The goal of this work is to determine the temperature dependence of the internal electric field generated by strain within the quantum well layer as a function of temperature. Data was collected over a temperature range of 8-150 K; Excitation intensity was varied at each temperature using neutral density filters. By examination of the emission energy as a function of incident excitation power density, we may induce local magnetization. However, no spin polarization occurs for carbon vacancies (V\textsubscript{C})

\textsuperscript{1}This work was supported by the Heterofunctional Materials Initiative in collaboration with Texas State University.

H1.00034 Electronic Structure of Semiconductor Random Alloys, KEVIN KENDALL, Texas State University at San Marcos, BYOUNGHAK LEE, Department of Physics, Texas State University at San Marcos, XAVIER CARTOIXA, Departament d’Enginyeria Electronic, Universitat Autonoma de Barcelona — We present a theoretical investigation of the evolution of the electronic properties of the random alloys as they undergo a transition from one pure crystal to another. For random substitutional alloys the Bloch wavevector is not a good quantum number due to the lack of translational invariance. In spite of this obvious fact the conventional methods used for random alloys calculations, e.g., Virtual Crystal Approximation and Coherent Potential Approximation, assume a medium that pertains the same symmetries of the parent compounds. The question we ask is how well the band structures from such effective medium theories agree with the real electronic structures. We address this issue using direct simulations of randomly distributed (Al,Ga)As and Ga(P,As) atom structures.

H1.00035 Remote plasma-assisted deposition of metals onto the surface of nanocrystalline ZnO, SERGIO A. LEAL\textsuperscript{1}, Houston Baptist University, Houston, TX, ANASTASIA NEMASHKALO, PUSKAR CHAPAGAIN, SHRIDEHAR PANT, Texas Christian University, Fort Worth, TX, PHILLIP ALARCON\textsuperscript{2}, Paschal High School, Fort Worth, TX, YURI M. STRZHEMECHNY, Texas Christian University, Fort Worth, TX — Controllable surface modification of nanoscale ZnO is crucial for many existing and future applications. We investigated the effectiveness of metal deposition using remote O\textsubscript{2}/He plasma passing through a metal mesh electrode onto the surface of ZnO nanopowders with an average grain size of 25 nm. Surface stoichiometry was monitored in situ with Auger electron spectroscopy, whereas surface optoelectronic properties were probed; also in situ, using surface photovoltage (SPV) spectroscopy. We observed a strong dependence of surface modification on the distance from the metal electrode. At short distances the metal coverage was reaching tens of percent of one monolayer. Simultaneously we observed a significant improvement of the SPV response pointing to metal-enhanced surface charge dynamics.

\textsuperscript{1}REU student at TCU supported by NSF grant PHY-0851558

\textsuperscript{2}Participant in TCU RAP program supported by TCU Andrews Institute grant

H1.00036 Evidence for evanescent waves at interfaces in a high-index prism/liquid-crystal-Au-NPs/glass/air structure and effects of relative concentration of gold nanoparticles, wavelength, polarization, and incident angle of the laser beam, KUNAL TIWARI, ANKIT SINGH, SURESH SHARMA, UT Arlington, Texas 76019 — Incorporation of relatively small concentrations of gold nanoparticles (Au NPs) in a polymer-dispersed liquid crystal (PDLC) is known to lower the operating threshold voltage and increase optical transmission through the device.\textsuperscript{1} In order to understand whether there is an interplay between the localized surface plasmon resonance at Au-NPs-dielectric interfaces and the electro-optical properties of PDLC devices, we have investigated propagation of light through a high-index prism/liquid-crystal-Au-NPs/glass/air structure by using Kretschmann geometry as functions of concentration of Au NPs in the liquid crystal, and the wavelength, polarization, and angle of incidence of the laser beam. We will discuss to what extent the results of these experiments support an interplay between the localized surface plasmon resonance at NPs/dielectric interfaces and optical propagation through the above-described structure.


H1.00037 Comparison of Low Energy CVV Auger transitions in Cu and Au (100) using Measured and estimated values\textsuperscript{1}, K. SHASTRY, Univ of Texas at Arlington, S. F. MUKHERJEE, S. SATYAL, P.V. Joglekar, A.H. WEISS — Low energy Auger lineshapes are difficult to measure because they sit on a large background due to secondary electrons arising from loss processes unrelated to the Auger mechanism. In this poster we discuss the implications of our PAES measurements of the ratio of the integrated Auger Peak and integrated low energy tail (LET) intensities for comparisons between theoretical and measured values of the Auger intensities. The experiments were carried out at university of Texas at Arlington on Cu (100) and Au (100) crystals. Our conclusions regarding the importance of the LET in determining the ratio of electrons in the Auger peak to the number of initial core holes are discussed in light of the electron stimulated Auger results obtained by Seah et.al using monte carlo simulations on various elements.

\textsuperscript{1}NSF DMR 0907679

H1.00038 Characterization of Si and C implantation induced defects in 4H-SiC, VENKATA KUMMARI, MANGAL BHUSHAN, EL. BIBHUTA ROUT, TILO REINERT, University of North Texas, DANIEL SPEMANN, University of Leipzig, WEILUN JIANG, Pacific Northwest National Laboratory, FLOYD MCDANIEL, University of North Texas, UNIVERSITY OF LEIPZIG COLLABORATION, PACIFIC NORTHWEST NATIONAL LABORATORY COLLABORATION — Silicon Carbide is considered to be a promising material for dilute magnetic semiconductors (DMSs). Past experimental studies reveal that ferromagnetism can be observed in SiC diluted with 3d transition metals. Recent studies, based on first principle calculations, show that for SiC monolayers, the presence of silicon vacancies (V\textsubscript{Si}) may induce local magnetization. However, no spin polarization occurs for carbon vacancies (V\textsubscript{C}), Si-C divacancies, and Si-C antisite defects. Ion implantation is an excellent technique to create vacancies for defect induced magnetism. We have implanted Si and C into 4H-SiC at low energy 60 keV to study the implantation defects for different fluences which corresponds to different percentages of simulated damages (e.g. 10 – 60 %) obtained using Monte-Carlo simulations code SRTIM/TRIM-2008. Defect disorder after ion implantation has been investigated using Rutherford Backscattering Spectrometry/Channeling (RBS/C) and Raman spectroscopy.
H1.00039 Synthesis and Characterization of Transitional Metal Nanosystems in Semiconductor. MANGAL DHOUBHADEL, BIBHU ROUT, VENKATA KUMMARI, JEROM DUGGAN, TILO REINERT, FLOYD MCDANIEL, University of North Texas — Low energy (less than 80 keV) transition metal ions (Ag, Cu) were implanted into Si(100) to create buried metal-silicon layers. The physical structure of the defects due to the various ion energies and fluencies has been studied. The evolution of defects clusters in the Si due to the implanted ion as well as the morphology of formed nanostructures was observed for various annealing parameters. The annealing temperature (∼500 °C) was kept moderately low to study the diffusion of the implanted metal ions. The samples were characterized using Rutherford Back Scattering Spectrometry (RBS), Ion Channeling (RBS/C), Raman Spectroscopy and Transmission Electron Microscopy (TEM).

H1.00040 Synthesis and Characterization of Au®Cu Core-Shell Nanoparticles. SUBARNA KHANAL, JESUS VELAZQUEZ-SALAZAR, MIGUEL JOSE YACAMAN, University of Texas at San Antonio — The synthesis of bimetallic nanoparticles has become so important in present times due to its diverse applications of nanotechnology. Particularly most of the bimetallic nanoparticles are focused to use in catalysis, plasmonic, magnetic, sensors, and many other applications. In Au/Cu case, the bulk Au and Cu are soluble at all compositions. But the structure of Au/Cu nanoparticles depends on the preparation methods. The structure might be the core shell, alloys or other morphology. Au- Cu core-shell nanocrystals were prepared using a two-step polyol reduction method. First, Au core seeds were prepared by reducing HAuCl₄ . 4H₂O in ethylene glycol (EG) using oil-bath heating in the presence of polyvinylpyrrolidone (PVP) as a polymer surfactant. Then Cu shells were overgrown on Au core seeds by reducing Cu(OAc)₂ in EtOH with PVP again using oil-bath heating. The morphology is studied by STEM HITACHI S-5500. The resultant crystal structures were characterized using TEM, high-resolution (HR)-TEM and the STEM were using for the study of micro analysis.

H1.00041 Synthesis and characterization of Au/Pd core/shell bimetallic nanoparticles. NABRAJ BHATTARAI, University Of Texas at San Antonio, JESUS VELAZQUEZ-SALAZAR, GILBERTO CASIL-LAS GARCIA, MIGUEL J. YACAMAN — The structure of nanoparticles plays an important role in many applications of nanotechnology like plasmonics, catalysis, electronic, optical, sensing and others. Using the bimetallic nano particles the properties will be changed. The particle shape is equal important as the size of the particles. The production of high index facet nanoparticles changes the shape by increasing the kinks and density of atomic steps by increasing the catalytic activity of the reactions. The structure of Au/Pd nanoparticles depends on the preparation methods. The structure might be the core shell, alloys or others. We synthesized Au-Pd core-shell cubic nanoparticle of size 30nm. The morphology is studied by STEM HITACHI S-5500. The HRTEM image, diffraction pattern, weak beam dark field image is obtained by JEOL 2010-F transmission electron microscope equipped with field emission gun and an ultra-high-resolution pole piece with STEM attachment. The micro analysis EELS and EDS spectra is obtained by ARM 200F. The distribution of nanoparticles is observed by EDS mapping. The strains from weak beam dark field image and the reconstructed image from tomography confirmed the nanocube structure. Also the EDS mapping and EELS spectrum confirmed the Au core and Pd shell structure.

1The author would like to thank RCMI grant (2G12RR013646-11) for funding.

H1.00042 Structural and Magnetic Properties of Multifunctional Gold, Silica, and C225 antibody tripoly coated Superparamagnetic Iron Oxide nanoparticles. GAN LIANG, Sam Houston State University, MARITES MELANCON, CHUN LI, University of Texas MD Anderson Cancer Center — In this study, extensive structural and magnetic characterizations have been carried out on the silica, gold, and C225 antibody tripoly coated iron oxide nanoparticles for image-guided laser ablation of head and neck cancers. X-ray absorption and x-ray diffraction results show the phase of the uncoated and coated nanoparticles to be in the γ-Fe₂O₃ structure. The nanoparticles are studied by transmission electron microscopy and it is found that these nanoparticles have an average diameter of 82 nm and contain 142 antibodies per nanoshell. The magnetization measured at 500 Oe indicates that coating of the iron oxide nanoparticles by silica/gold/C225 decreases blocking temperature from 160 K to about 55 K, which can be explained by the spin-disorder induced change in the effective volume of the γ-Fe₂O₃ core. The blocking temperature decreases from 95 K to 55 K with an increase of magnetic field from 100 Oe to 500 Oe. It is found that the coercivity of the tripoly coated nanoparticles decreases from 195 to 25 Oe with an increase of temperature from 5 K to 300 K.

1Supported by the National Science Foundation under Grant No. CHE-0718482 and 2011 ERG grant of Sam Houston State University.

H1.00043 Of intent, citation game, and scale-free networks in science: A heuristic argument. VICTOR CHRISTIANTO, Sciprint.org, FLORENTIN SMARANDACHE, University of New Mexico — A heuristic argument was presented in favor of hypothesis that scientific communication corresponds to a process known as scale-free network. As a result, it is argued that scientific referencing through citation follows the same process, therefore it could be expected that this shall also exhibit fractality as observed in various phenomena associated with scale-free networks. This argument appears conceivable, coined here as “citation game.”

H1.00044 Pilot Study on Alternative Pictorial Representations and Supporting Text of Sound Standing Waves of Air Columns in a Pipe. LIANG ZENG, The University of Texas-Pan American, CHRIS SMITH, JENNIFER RODRIGUEZ, EDGAR CORPUZ — Alternative pictorial representations of sound standing waves of air columns in pipes. Through a pilot study utilizing surveys and interviews, we validated our design and investigated the differences in the effects on student learning of underlying physics concepts between the new design and the existing one in an introductory physics textbook. The implications of our results for teaching were discussed.
H1.00045 Conductance Control Iris for the K150 Cyclotron H- Ion Source, ARMANDO MALDANADO, Angelo State University, HENRY CLARK, GABRIEL TABACARU, Texas A&M University Cyclotron Institute — A multi-cusp H- ion source has been installed on the K150 cyclotron for the production of high intensity proton beams. These beams will be used to create secondary radioactive ions for the Upgrade Project [1]. One of the limiting factors in creating an intense beam comes from poor vacuum along the injection line caused by the ion source itself. A large flow of hydrogen gas is required to make the Hydrogen negative (H-) ions in the ion source. As a result, many of the hydrogen molecules exit the ion source and migrate into the injection line and deteriorate the vacuum. To reduce the flow of these molecules into the injection line, a computer controlled iris will be installed between the ion source and the injection line. With the iris set at the correct diameter, the vacuum in the injection line should improve the transport efficiency of the H- ions to the cyclotron inflector should increase. For the project we used an 8" OD Conflat DVM brand iris with an MDrive 17 Plus motor which will be controlled by a Labview software interface.

1This work was supported by Department of Energy and the National Science Foundation REU program.

H1.00046 Electron screening and its effects on Big-Bang nucleosynthesis, JOHN FUQUA, CARLOS BERTULANI, Texas A&M University-Commerce — We study the effects of electron screening on nuclear reaction rates occurring during the Big Bang nucleosynthesis epoch. The sensitivity of the predicted elemental abundances on electron screening is studied in details. It is shown that electron screening does not produce noticeable results in the abundances unless the traditional Debye-Hückel model for the treatment of electron screening in stellar environments is enhanced by several orders of magnitude. The present work rules out electron screening as a relevant ingredient to Big Bang nucleosynthesis and other exotic possibilities for the treatment of screening, beyond the mean-field theoretical approach.

H1.00047 Testing Scintillators for Homeland Security, JAMES BOURBEAU, University of Texas, Arlington, ANDREW BRANDT, RASOOL KENARANGUI, ALEX WEISS, WEI CHEN, UTA — Scintillating nanoparticles have a bright future in radiation detection, especially in the area of detecting nuclear devices. As part of a UTA nanoparticle scintillator development team funded by the Department of Homeland Security, I have been developing a scintillator test stand using various radioactive sources and a Hamamatsu S3590 photodiode. I will present initial test results.

1Funded by NSF/Department of Homeland Security ARI program.

H1.00048 Angelo State Society of Physics Students Peer Pressure Team Public Engagement Efforts – Do we make a difference?, JEREMY JOHNSON, TONI SAUNCY, Angelo State University — The Angelo State Society of Physics Students Peer Pressure Team travels throughout West-Central Texas for a week following the spring semester. The goals of this activity are two-fold. First the group seeks to engage undergraduate presenters in public service; the second goal is to enhance attitudes about science and encourage students in K-12 public schools to study science. Many of the schools we choose for our outreach visits are geographically isolated and populated with socioeconomically disadvantaged students, and/or groups underrepresented in physics. Over the week, the Peer Pressure Team visited over 1300 students, teachers and administrators. At each visit, surveys were collected to gauge the program’s effectiveness. Student responses indicate a strong desire to study more science in their regular school curriculum. In addition, results are used to determine which demonstrations leave the most lasting impression on the audience participants. The 2011 Road Tour was dedicated to the 100th anniversary of the discovery of the nucleus by Rutherford.

1This work was supported by the Angelo State University President’s Circle Award.

H1.00049 Construction of a Single Beam Optical Trap with a Modified Design, DAVID TO, TANYA DAX, TONI SAUNCY, Angelo State University — We have constructed an apparatus known as an optical tweezers using off the shelf, fairly inexpensive components. These include a 20 mw HeNe laser, a standard student lab optical microscope, and an inexpensive CCD firewire camera. The trap is designed to work with polystyrene spheres of various diameters, but to be robust enough for more advanced research. The goal of the work is to use the device for undergraduate research projects but also for use in the advanced labs at Angelo State. Trapping is achieved in the device by focusing the collimated laser beam using a 100x oil immersion objective on the microscope. At the position of the beam waist, the light produces gradient forces that trap the micron-sized spheres. Images are collected and processed using LabVIEW software. Measurement of particle size is accomplished through software tools for use with unknown-sized samples in the future.

1This work was supported by the Heterofunctional Materials Initiative in collaboration with Texas State University.

H1.00050 Developing a procedure for the fabrication of PLED structures for an advanced undergraduate lab, JORDAN PEREZ, TONI SAUNCY, Angelo State University — Using polymer materials in thin layers to fabricate Light Emitting Diode (LED) structures is a topic of much current research. Because the structures are composed of commercially available polymers, they have become accessible as tools for teaching at the undergraduate level for advanced labs. At Angelo State, the fabrication of polymer-based LED structures is being pursued in order to develop a procedure that can be reproduced easily by undergraduate students. The structure consists polymer layers: PEDOT:PSS–MEH-PPV sandwiched between Indium Tin Oxide (ITO) coated glass slides. An Indium Gallium Eutectic metal layer on the ITO serves as the cathode, while the bottom ITO layer serves as the anode. Devices have been fabricated which emit light in response to an external voltage as low as 7V. The results have been inconsistent primarily due to the difficulties in layering the polymers uniformly on the ITO substrates. An inexpensive spin coater is used to deposit polymer layers; determining the proper spin rate and controlling the spin rate are thought to be the primary issues in producing uniform layers.

1This work was supported by the Heterofunctional Materials Initiative in collaboration with Texas State University.
We present examples suggesting that these properties can lead to practical applications such as the detection of faint transients in heavy noise.

Deviations from universality therefore indicate the presence of regular signals even when low signal to noise ratio prevents their direct detection.

singularities of the Z-transform are universally distributed. Addition of a regular signal to the random one locally perturbs this distribution.

LUCA PEROTTI, DANIEL VRINCEANU, DANIEL BESSIS, Texas Southern University — We consider the Z-transform of a random time series, extension to the complex plane of the discrete time Fourier transform. Regardless of the specific characteristics of the random signal itself, the singularities of the Z-transform are universally distributed. Addition of a regular signal to the random one locally perturbs this distribution. Deviations from universality therefore indicate the presence of regular signals even when low signal to noise ratio prevents their direct detection. We present examples suggesting that these properties can lead to practical applications such as the detection of faint transients in heavy noise.

Friday, October 7, 2011 7:35PM - 9:30PM –
Session J1 Banquet  Sam Rayburn Center Second Floor, Room C - Fred Olness, Southern Methodist University

7:35PM J1.00001 Dinner and Awards –

8:30PM J1.00002 The Scientific Method - Critical and Creative Thinking , JOHN COTTON, RANDALL SCARLISE, Department of Physics, Southern Methodist University, Dallas — The “scientific method” is not just for scientists! Combined with critical thinking, the scientific method can enable students to distinguish credible sources of information from nonsense and become intelligent consumers of information. Professors John Cotton and Randall Scalise illustrate these principles using a series of examples and demonstrations that is enlightening, educational, and entertaining. This lecture/demonstration features highlights from their course (whose unofficial title is “debunking pseudoscience”) which enables students to detect pseudoscience in its many guises: paranormal phenomena, free-energy devices, alternative medicine, and many others.

Saturday, October 8, 2011 8:30AM - 9:20AM –
Session K1 Plenary Session IV Sam Rayburn Center Second Floor, Room C - Bao-An Li, Texas A&M University–Commerce

8:30AM K1.00001 The World-Wide Effort to Understand the Visible Matter in Our Universe , ROBERT E. TRIBBLE, Distinguished Professor of Physics & Astronomy, Texas A&M University - Cyclotron Laboratory Director — A general goal in nuclear physics is to explain the origin, evolution, and structure of the visible matter in the universe. Today, nuclear physicists are working at a wide range of facilities around the world to provide information to help guide us to an understanding of this issue. I will provide a general overview of the field, which will focus on the important questions that are being addressed, the facilities that are being used to answer them, and a roadmap of the new construction projects that will define the field in the next decade.

Saturday, October 8, 2011 9:25AM - 10:13AM –
Session L1 General Physics & Applications II Sam Rayburn Center Second Floor, Room Innovations A - Michael Sadler, Abilene Christian University

9:25AM L1.00001 Aerodynamic Self Excitation of a Taut Elastic Ribbon, SAM MATTESON, DAVID LAMBERT, University of North Texas — The investigators analyzed, both theoretically and experimentally, the motion of a taut ribbon of elastic material in an air stream to show that the resulting standing-wave motion is a manifestation of self excitation. Self excitation is a phenomenon in which the oscillatory motion of the object extracts energy from a steady energy source. Such a ribbon simulates the motion of the human vocal folds as well as that of unstable bridge “galloping,” such as is famously exemplified in the Tacoma Narrows bridge collapse. The phenomenon discussed in this talk is also relevant to aerodynamic flutter and the “quaking” of leaves of trees in the breeze. Chief among the findings of this work is the origin of inharmonic modes of oscillation of a self excited ribbon.

9:37AM L1.00002 A Newtonian Theory of the Fizeau Experiment, JAMES ESPINOSA1, Rhodes College, JAMES WOODYARD, West Texas A&M University — In 1965, Fox reviewed the experiments considered as evidence against Ritz’s theory of emission and found almost all of them to be compatible with Ritz’s theory by applying a simple modification. His critiques have been restated by some graduate textbooks such as Jackson’s Classical Electrodynamics. Unfortunately, the vast majority of textbooks at the undergraduate level have entirely ignored Fox’s paper. Over the past decade, we have continued the work of Ritz into gravitational and atomic phenomena with great success but now revisit some of Fox’s reservations about the emission theory of electromagnetism. His most serious argument against Newtonian physics was Fizeau’s experiment, which both he and Einstein considered incompatible with classical kinematics. Unknown to Fox, the Italian physicist Carlo Somigliana published a paper in 1922 reminding the physics community that this “inconsistency” had been solved 30 years before Einstein by Woldemar Voigt. We will review this important paper and discuss possible reasons for Fox’s ignorance of this important contribution.

1Present Employer TGS-NOPEC

9:49AM L1.00003 Signal induced breaking of universal noise statistical properties, LUCA PEROTTI, DANIEL VRINCEANU, DANIEL BESSIS, Texas Southern University — We consider the Z-transform of a random time series, extension to the complex plane of the discrete time Fourier transform. Regardless of the specific characteristics of the random signal itself, the singularities of the Z-transform are universally distributed. Addition of a regular signal to the random one locally perturbs this distribution. Deviations from universality therefore indicate the presence of regular signals even when low signal to noise ratio prevents their direct detection. We present examples suggesting that these properties can lead to practical applications such as the detection of faint transients in heavy noise.
10:01AM L1.00004 Lunar in situ resource utilization by activated thermites, MKHITAR HOBOYSAN, KAREN MARTIROSYAN, University of Texas at Brownsville — NASA’s anticipated returns to the Moon by 2020, subsequent establishment of lunar in situ resource utilization technologies are essential. The surface of Moon is covered with small eroded particles of regolith called lunar dust that adheres electro-statically to everything coming in contact with it, and is of much concern for future lunar base because of its continual mitigation. The next major concern is the protection of equipment and personnel in long term expeditions from harmful UV radiation, which can be made by constructing protective buildings. For construction of permanent structures it is highly desired to have regular shaped sintered regolith with utilization of local materials and with minimum energy consumption. In this study the concept of sintering of lunar regolith with activated thermite reactions is discussed. The thermodynamic calculations as well as the experimental procedure is provided to prove the effectiveness of activated thermites for regolith sintering using local lunar resources with a low (15 wt. %) concentration of aluminum or magnesium. The thermite method is much more energy efficient than the other sintering methods suggested in literature.

Saturday, October 8, 2011 9:25AM - 10:01AM –
Session L2 Physics Education Research II  Sam Rayburn Center Second Floor, Room Traditions - Pavel Nadolsky, Southern Methodist University

9:25AM L2.00001 A Comparison of Student Spatial Abilities Across STEM Fields, THAD LOFTIS, XIMENA CID, RAMON LOPEZ, Univ. of Texas at Arlington — It has been shown that STEM (Science, Technology, Engineering, and Mathematics) students have higher spatial abilities than students in the liberal arts or humanities. In order to track the change in spatial abilities within a group, studies in physics have examined topics in kinematics, chemistry has examined topics on molecular diagrams, mathematics has examined topics related to geometry, and engineering has developed courses specifically targeting students’ spatial abilities. It is understood that students in STEM fields improve their spatial abilities while taking STEM courses, but very few studies have done comparisons amongst the different STEM fields. I will be presenting data comparing different STEM students’ spatial ability, assessed using the Mental Rotation Test.

9:37AM L2.00002 Exploring the Relationship Between Students’ Visual Spatial Abilities and Comprehension in STEM Fields, XIMENA CID, RAMON LOPEZ, Univ. of Tx. at Arlington — It is well known that student have difficulties with concepts in physics and space science as well as other STEM fields. Some of these difficulties may be rooted in student conceptual errors, whereas other difficulties may arise from issues with visual cognition and spatial intelligence. It has also been suggested that some aspects of high attrition rates from STEM fields can be attributed to students’ visual spatial abilities. We will be presenting data collected from introductory courses in the College of Engineering, Department of Physics, Department of Chemistry, and the Department of Mathematics at the University of Texas at Arlington. These data examine the relationship between students’ visual spatial abilities and comprehension in the subject matter. Where correlations are found to exist, visual spatial interventions can be implemented to reduce the attrition rates.

9:49AM L2.00003 The Effect of Problem Format on Students’ Answers, BETH THACKER, MARK ELLERMANN, KEITH WEST, Texas Tech University — The same problem written in multiple formats was administered as a quiz in the large introductory physics sections in both the algebra-based and calculus-based classes. The formats included multiple choice only, multiple choice and explain your reasoning, explain your reasoning only, ranking and explaining your reasoning, and a few others. We present the data.

1This project is supported by the NIH grant 5RC1GM090897-02.

Saturday, October 8, 2011 9:25AM - 10:25AM –
Session L3 High Energy Physics III  Sam Rayburn Center Second Floor, Room Innovations B - RACHEL MANNINO, Texas A&M University

9:25AM L3.00001 On the correlation of extra MSSM Higgs to stringent flat directions in heterotic string theory, JARED GREENWALD, Baylor University — It has been proposed that the number of extra copies of MSSM Higgs, as found in heterotically derived string GUT models, may be correlated to the existence and multiplicity of all-order stringent flat directions. We consider a handful of these GUT models and show that, even with a small number of MSSM Higgs, one can find all possibilities of flatness or lack thereof. Specifically, we present three flipped SU(5) and an SO(10) model and report on their respective D and F-flatness. We will report on each of the models’ observable and hidden gauge content as well. Additionally, we comment on the possible relationship between flat direction phenomenology and moduli stabilization.

9:37AM L3.00002 LUX Dark Matter Search Experiment, RACHEL MANNINO, Texas A&M University, LUX COLLABORATION — The Large Underground Xenon (LUX) dark matter search experiment is a two-phase xenon time-projection chamber (TPC) which is positioned to be the most sensitive dark matter detector once it is deployed underground in the fall 2012. I will discuss the design, construction, and current status of the detector as it is being commissioned on the surface and readied for a science run.

1Texas A&M DOE grant: DE-FG02-95ER40917

9:49AM L3.00003 Constraints on the gluon PDF from inclusive jet production, ZHIHUA LIANG, Southern Methodist University — We studied how well we can constraint the gluon Parton Distribution Function(PDF) with the LHC data, and we will present an fixed order(s) jet event caculation program for this research. This code is based on the EKS codes, together with the Cuba Library, ROOT system and fastJet.

1SMU
10:01AM L3.00004 Measuring low energy quenching factors for nuclear recoils in NaI(Tl) . TYANA STIEGLER, JAMES WHITE, ROBERT WEBB, Texas A&M University — An investigation of the low energy nuclear recoil response of NaI(Tl) will be discussed. The experiment uses low energy neutrons produced via the Li(p,n) reaction and utilizes a high light output NaI(Tl) crystal. The goal is to improve on published measurements at energies relevant to DAMA/LIBRA and other low-mass WIMP experiments. The experimental design and setup, shielding optimization, neutron beam calibration techniques and preliminary results will be included.

10:13AM L3.00005 Bc absorption cross sections by pions , M.A.K. LODHI, Texas Tech U, FAISAL AKRAM, SHAHEEN IRFAN, Punjab U, Pakistan, SONAINA UNDLEE, Texas Tech U — The cross sections of Bc absorption by mesons are calculated using hadronic Lagrangian based on SU(5) flavor symmetry by imposing the gauge symmetry. The coupling constants are preferably determined empirically using vector meson dominance (VMD) model, heavy quark symmetries or QCD sum rules. Calculated cross sections are found to be in range 2 to 7 mb and 0.2 to 2 mb for the processes and respectively, when the monopole form factor is included. It is noted that the cross section estimates are highly dependent on the choice of form factor and the value of cut off parameter aside from the values of coupling constants used. These results could be useful in calculating production rate of meson in relativistic heavy ion collisions.

Saturday, October 8, 2011 9:25AM - 10:13AM –
Session L4 Nanoscience II Sam Rayburn Center Second Floor, Room Vision - Jennifer Steele, Rice University

9:25AM L4.00001 Ab initio DFT study of the adsorption of thiol molecules on Au nanoparticles1 , HECTOR BARRON, LUCAS FERNANDEZ-SEIVANE, UTSA, MONICA OLVERA DE LA CRUZ, Northwestern University, MIGUEL JOSE-YACAMAN, XOCHITL LOPEZ-LOZANO, UTSA, UTSA-NW COLLABORATION — Recent studies have shown that the Au nanoparticle surface has a strong binding affinity towards thiols, in which the thiol–Au interface allows the surface conjugation of various peptides, proteins, and DNA. Notwithstanding the interaction between Au–Au and thiol–Au are still under debate mainly because of the difficulty to consider a sufficient number of Au-molecule configurations, the large-scale atomistic simulations have been based on old ab initio DFT data, while the process of adsorption have not been completely understood or properly taken into account. In this work the adsorption of methyl-thiol molecules on Au55 gold clusters is investigated by performing density functional theory (DFT) calculations within the generalized gradient approximation (GGA) with the SIESTA code. Different conformations of methyl-thiol-Au55 systems were treated founding that the methyl-thiol molecule prefers to be adsorbed on the Top and Bridge sites, which are energetically more favorable for the adsorption. These results will provide valuable information regarding the fundamental interactions and behavior of methyl-thiol passivated Au nanoparticles.

1The authors wish to thank the financial support by NSF Grant DMR-0934218

9:37AM L4.00002 Nanowires filled with nanoparticles: application to solar cells , SUMAN DHAYAL, GOPAL SAPKOTA, USHA PHILIPOSE, YURI ROSTOVTSEV, Univ of North Texas, DR. USHA PHILIPOSE GROUP COLLABORATION — Gold nanoparticles have interesting properties of nano-antennas that focus the radiation field in relatively small, much smaller than the wavelength of radiation, regions. Optical and electronic properties of nanowires experiencing huge field enhancement can be modified due to these plasmonic interactions. We have developed generalized Mie theory to demonstrate the effect of enhancement of electric field near gold nanoparticles and study the novel optical and electronic properties of these new structures: nanotubes with the pores filled with metal nanoparticles and nanowires with metal nanoparticles as inclusions on their surface. In the talk, we discuss the applications of such novel nanoscale hybrid metal/semiconductor composites in applications such as sensitive sensors and efficient photovoltaics.

9:49AM L4.00003 STM Studies of Mn12-Ph on Highly Oriented Pyrolytic Graphite , K. REAVES, WPI-AIMR, Tohoku University, Japan and Department of Physics and Astronomy, Texas A&M University, K. KIM, Y.G. KIM, K. ITAYA, K. IWAYA, T. HITOSUGI, WPI-AIMR, Tohoku University, Japan, H. ZHAO, K.R. DUNBAR, Department of Chemistry, Texas A&M University, W. TEIZER, WPI-AIMR, Tohoku University, Japan and Department of Physics and Astronomy, Texas A&M University — Mn12O22(C12H5COO)16 (referred to as Mn12-Ph) has been deposited onto Highly Oriented Pyrolytic Graphite (HOPG) which was then observed via Scanning Tunneling Microscopy (STM). Mn12-Ph displays tunneling of quantized magnetization below 3K. In other Mn12 ligand variants this magnetic phenomenon can alter the electronic behavior of the molecule, making it a good candidate for a molecular logic gate. At room temperature, film formation was studied to optimize samples for subsequent low temperature studies. At 4.2K isolated objects were observed on the surface clearly distinct from the graphite lattice underneath. Spectroscopic data indicates a bias voltage dependence thought to be associated with metallic-core molecules.

10:01AM L4.00004 Transport properties of Sb doped Si nanowires , PRATHYUSHA NUKALA, GOPAL SAPKOTA, PRADEEP GALI, PHILIPOSE USHA, University of North Texas, USHA PHILIPOSE TEAM — n-type Si nanowires were synthesized at ambient pressure using SiCl4 as Si source and Sb source as the dopant. Sb doping of 3-4 wt% was achieved through a post growth diffusion technique. The nanowires were found to have an amorphous oxide shell that developed post-growth; the thickness of the shell is estimated to be about 3-4 nm. The composition of the amorphous shell covering the crystalline Si core was determined by Raman spectroscopy, with evidence that the shell was an amorphous oxide layer. Optical characterization of the as-grown nanowires showed green emission, attributed to the presence of the oxide shell covering the Si nanowire core. Etching of the oxide shell was found to decrease the intensity of this green emission. A single undoped Si nanowire contacted in an FET type configuration was found to be p-type with channel mobility of 20 cm2V−1S−1. Sb doped Si nanowires exhibited n-type behavior, compensating for the holes in the undoped nanowire. The doped nanowires had carrier mobility and concentration of 160 cm2V−1S−1 and 9.6 x 1018cm−3 respectively.

Saturday, October 8, 2011 9:25AM - 10:25AM –
Session L5 Condensed Matter Physics and Materials Research IV Science Building 127 - Heather Galloway, Texas State University–San Marcos
at Brownsville as a result of annealing. Since annealing minimize voids and defects, the resulting conduction results from an improvement in the amorphous structure of the material. The overall probability of inflation is influenced by the coupling of the gravitational and electromagnetic fields.

The results can be described in terms of two competing, parallel conduction mechanisms, where exponential carrier activation (Arrhenius) conduction dominates at low temperatures and hopping conduction dominates at high temperatures. From our analysis, we observed that the conductivity of these films dramatically improved the capacity at fast C-rate. 2 at.% W doping further enhances the capacity and retention of capacity.

Microscopy measurements of such films display rms values indicative of atomically smooth films. This work is supported by AFOSR under grant # FA9550-10-1-0133.

9:49AM L5.00003 Magnetic and structural properties of BiFeO₃ thin films grown epitaxially on SrTiO₃/Si substrates¹, DANIEL CURRIE, RYAN LAUGHLIN, GOKUL RADHAKRISHNAN, WEERASINGHE PRIYANTHA, ROCIO CONTReras-Guerrero, RAVINDRANATH DROOPAD, NIKOLETA THEODOROPOULOU, Department of Physics, Texas State University — We are using molecular beam epitaxy (MBE) to grow BiFeO₃ (BFO) thin films. SrTiO₃ (STO) on Si is used as a virtual substrate to enable the growth of BFO. Commensurate growth of STO on Si using MBE has been achieved by using co-deposition with the fluxes adjusted for stoichiometric growth and the growth rate is determined using RHEED intensity oscillations. The native oxide of the Si substrates is removed in-situ by deoxidation at around 750 °C using a flux of Sr. The substrate is cooled to 500 °C and additional Sr is added to form template with a (2x1) surface structure. BFO is then deposited on well-characterized STO (2-20mm thick) on Si using Fe and oxygen plasma with an overpressure of Bi flux, the growth rate being controlled by the incoming Fe flux. The RHEED pattern taken during deposition of BFO shows 2-D growth front with a 6-fold surface reconstruction. The structural and magnetic properties of the BFO samples have also been measured.

¹This work is supported by AFOSR under grant # FA9550-10-1-0133.

10:01AM L5.00004 Electrochemical Performance of Lithium Iron Phosphate Doped with Tungsten, HANU ARAVA, ANDREW TRENCIARD, GAN LIANG, HUI FANG, Sam Houston State University — Due to its high thermal stability, low cost and high theoretical charge capacity, LiFePO₄ has emerged as one of the most promising cathode materials for large-scale lithium ion batteries. In this work, we systematically investigated the effect on structure and electrochemical properties brought by W doping on Fe site of LiFePO₄. LiFe₁₋ₓWₓPO₄ (x = 0.01, 0.02, 0.03) samples with and without carbon coating were prepared by using solid-state reaction. The phase and structure of as prepared powders were characterized by X-ray diffraction. Cycling charge and discharge measurement at various C-rates and cyclic voltammetry were employed to reveal the electrochemical properties. Results showed that C coating dramatically improved the capacity at fast C-rate. 2 at.% W doping further enhances the capacity and retention of capacity.

10:13AM L5.00005 Temperature dependent conductivity mechanisms in p-type amorphous silicon thin films⁎, K. SHRESTHA, T.M. BEIG, P. GALI, P. NUKALA, C. LITTTLER, V.C. LOPES, U. PHILIPPOSE, A.J. SYLLAIOS, Univ of North Texas, L-3 COMMUNICATION COLLABORATION — Temperature dependent conductivity measurements were performed on p-type α-Si:H thin films grown by Plasma Enhanced Chemical Vapor Deposition from 80K to 450K. The purpose of this study was to better understand carrier transport mechanisms in “as- grown” and “annealed” thin films of α-Si. In both samples, the results can be described in terms of two competing, parallel conduction mechanisms, where exponential carrier activation (Arrhenius) conduction dominates at high temperatures and a variable range (Mott) hopping conduction dominates at low temperatures. From our analysis, we observed an increase in both the activation energy (from 0.22eV to 0.28eV) and the Arrhenius conductivity prefactor (from 22 Ω-cm⁻¹ to 63 Ω-cm⁻¹) as a result of annealing. Since annealing minimize voids and defects, the resulting conduction results from an improvement in the amorphous nature of the material.

⁎Supported by ARO grant W911NF-10-1-0410, William W. Clark, Program Manager.

Saturday, October 8, 2011 9:25AM - 10:25AM –
Session L6 Cosmology & General Relativity Science Building 122 - Mario Diaz, University of Texas at Brownsville

9:25AM L6.00001 Universal Behavior in Inflationary Cosmology, SEAN DOWNES, TAMU — Inflation is studied using a Singularity Theory, resulting in a set of universality classes with distinct quantitative behavior. The physical observables are shown to be insensitive to the model-dependent details. This strongly suggests inflation is an emergent behavior. Examples from IIB string theory and the supersymmetric field theories are given. Finally, the problem of initial conditions is addressed in the context of the overall probability of inflation.
regions (voids) will be presented. Evidence of the development of virialization and an improved approach for determining the fractal dimensions of low density expanding universe. The evolution of the power spectra and correlation function will be followed and their relation to the correlation dimension in the position-velocity plane. Here we present the recent results of our on-going study of the fractal geometry of one dimensional models of the universe, such as galaxies and galactic clusters, originated as very small density fluctuations in the early universe. The existence of galaxy clusters and super-clusters suggests that a natural scale for the matter distribution may not exist. A point of controversy is whether the distribution is fractal and, if so, over what range of scales. Even with recent astronomical surveys and simulations, it is difficult to extract information concerning fractal properties with confidence. With one-dimensional models we can overcome these limitations by carrying out simulations with on the order of a quarter of a million particles. They clearly demonstrate that the important dynamics for cluster formation occurs in the position-velocity plane. Here we present the recent results of our on-going study of the fractal geometry of one dimensional models of the expanding universe. The evolution of the power spectra and correlation function will be followed and their relation to the correlation dimension will be explored. Evidence of the development of virialization and an improved approach for determining the fractal dimensions of low density regions (voids) will be presented.

Time Rate and Light Speed in Variable Motion Spaces , PENG LIN YANG — This paper presents a transformation that applies to variable motion spaces, which is different from the Lorentz transformation that described uniform motion spaces in the Einstein’s Special Theory of Relativity. In the new transformation, the two equations which describe two coordinates or variable motion spaces, can transform from one into another. Furthermore, from the transformation, no matter how two spaces relatively move—variable speed or constant speed, the light speed in either space is constant, which is observed from its own view. But from a third view, the light speeds in the two spaces are not constant.

A Figure of Merit Analysis of Current Constraints on Testing General Relativity using the Latest Cosmological Data Sets , JASON DOSSETT, Department of Physics, The University of Texas at Dallas, JACOB MOLDENHAUER, Department of Physics and Astronomy, Francis Marion University, MUSTAPHA ISHAK, Department of Physics, The University of Texas at Dallas — Currently, much attention is going into testing general relativity to see if cosmic acceleration is due to dark energy or a modification to gravity at cosmological scales. An increasingly popular approach to this problem is parameterizing modifications to the growth equations in general relativity, particularly the Poisson’s equation and the ratio between the two metric potentials in the perturbed FLRW metric. We compare some of the various modified growth (MG) parameterizations that have been proposed in recent literature. Next we place constraints on the MG parameters using current cosmological data. A Figure of Merit approach is then used to study and compare the constraining power of various combinations of data sets on the MG parameters. We find that adding up current data sets does not consistently improve the uncertainties on MG parameters due to tensions between the best-fit MG parameters preferred by different data sets. Finally, for all the parameterizations used, we find that the values corresponding to general relativity are within the 95% confidence level contours for all data set combinations.

Searching for the “Fifth Force” with the Spectrum of Gravitational Wave Signals from Oscillating Neutron Stars, WEIKANG LIN, TAMU-Commerce — What information about the “fifth force” could be drawn from the gravitational waves signals? As long as the maximum mass of the neutron star is concerned, there is a degeneracy between the uncertainty in nuclear matter properties and the uncertainty in the gravity, since the soft EOS can also produce a large enough maximum mass under the effect of Yukawa term. We investigated the Yukawa-term-modified gravity on the mode oscillation frequencies of non-rotating neutron stars. The existence of Yukawa term could bring down significantly the mode oscillation frequencies. The distinct effect on stellar mode oscillation frequencies would help to solve the above degeneracy. While there have been some experiments to search and set constraints on the “fifth force,” we state that the gravitational wave detection would open a new approach to this problem.

 Angelo State Society of Physics Students Road Tour 2011 1, STEPHEN PARKER, TONI SAUNCHY, Angelo State University — For the past seven years at the end of each spring semester, the ASU Society of Physics Students has journeyed throughout Texas for a week long outreach to various K-12 schools. During the week long outreach effort, a variety of physics demonstrations were presented to over 1300 students, teachers and school administrators. The goal of this public engagement activity is to both encourage younger students to consider following STEM related career paths and to spark an overall interest in science. Demonstrations focused on several aspects of physics. For the 2011 Road Tour, we paid special homage to the 100th anniversary of Ernest Rutherford’s postulation of his model of the atom by explaining his results and their implications in 1911. In addition to adding several new demonstrations, the tradition of having a custom laser light show for each school was continued. As always, the fan favorite “Nitrogen Bomb” and a new nitrogen thunder cloud were added to our grand finales. The team, consisting of two faculty advisors and eleven students, was able to leave lasting impressions in a new and exciting way across central Texas.

1This work was supported by the Angelo State University President’s Circle Award.

Using Selection Criteria to Optimize Analysis in High Energy Physics , CHRISTOPHER DAVIS, DAVID TOBACK, Texas A&M University. JOEL WALKER, Sam Houston State University, DANIEL CRUZ, Texas A&M University, JACOB HILL, Sam Houston State University — In Experimental High Energy Physics, searches for new particle typically involve rejecting events that pass certain selection criteria. We have studied new methods for improving the sensitivity of our searches in a general way. In particular, the assumption that two requirements are always better than one turns out to not always be true, but can be if optimized properly.
my work's progress is integrated into the project flow of this international collaborative group. This research contributes to the optical link R&D project with Fermi National Laboratory, Oxford University, and CERN, and was as such designed in-house. Multiple 850nm VCSEL laser were used as sources, and TI OPT101 chips were used as detectors. This research contributes to the optical link R&D project with Fermi National Laboratory, Oxford University, and CERN, and my work's progress is integrated into the project flow of this international collaborative group.

Saturday, October 8, 2011 9:25AM - 10:25AM – Session L8 Astronomy, Astrophysics and Space Station III
Pride Room - Mustapha Ishak-Boushaki, University of Texas at Dallas

9:25AM L8.00001 Modeling of Optical Resonators Using Gaussian Beams and Ray Tracing Techniques, LILIANA RUIZ, SERGIO CANTU, VOLKER QUETSCHKE, MALIK RAKHMANOV, University of Texas at Brownsville — One of the main components in the laser stabilization subsystem in the Laser Interferometer Gravitational-Wave Observatory (LIGO) is a triangular ring resonator, which filters out high order Hermite-Gaussian modes in the laser beam. We developed a model to study the optical properties of such resonators and investigate their performance. The propagation of the laser beam is modeled by combining ray tracing techniques with wave optics. The model can be used to analyze various effects due to mirror misalignments and fluctuations of the laser beam pointing.

9:37AM L8.00002 Solar EUV irradiance and geomagnetic energy variation during last solar cycle, YANSHI HUANG, YUE DENG, University of Texas at Arlington — The record-low thermospheric density during last solar minimum has been reported and it has been mainly explained as the consequence of the anomalously low solar extreme ultraviolet (EUV) irradiance. However, relative little attention has been paid to the variation of geomagnetic energy. The geomagnetic energy is dissipated into upper atmosphere by Joule heating and particle precipitation. In this study, to understand and explain the anomalously low density during the solar minimum 23/24, we examine the energy budget to the Earth's upper atmosphere from solar EUV irradiance, Joule heating and particle precipitation heating from 1995 to 2010. The solar EUV power is derived using the latest version of SOLAR2000 solar irradiance specification model and also from the measurement of SOHO/SEM. The empirical model Weimer05 is used to derive the globally integrated joule heating power. The global hemispheric power data is collected from NOAA to show the variation of particle precipitation heating. The variation of different energy inputs and their significance to the neutral density will be discussed.

9:49AM L8.00003 Birkeland currents during the Whole Heliosphere Interval for the Carrington Rotation 2068, KEVIN PHAM, RAMON LOPEZ, ROBERT BRUNTZ, YUE DENG, YANSHI HUANG, Univ. of Texas at Arlington — The Whole Heliosphere Interval (WHI), encompassing Carrington Rotation 2068 (March 20 – April 16, 2008), has been extensively studied through both observations and simulations. The Lyon-Fedder-Mobarry (LFM) global magnetohydrodynamic simulation was run for the duration of the WHI with a variety of inputs and then the Birkeland currents for each run were analyzed. The Birkeland currents are currents that flow along the Earth's magnetic field, connecting the magnetosphere to the high latitude ionosphere. A comparison of the Birkeland currents from the LFM runs will be discussed in detail.

This work was supported in part by an AAS Small Research Grant.
11:10AM M1.00001 All things White Dwarf: The State of Stellar Forensics at the University of Texas and Sandia National Laboratories, DONALD WINGET, Harlan J. Smith Centennial Professor in Astronomy, University Distinguished Teaching Professor, University of Texas at Austin — Astronomy has always been considered an observational science, in contrast with other experimental sciences like physics, chemistry, biology, and geology. This is because it has not been possible to perform experiments on the objects we observe. This situation has changed in a way that is transformational. We are now able to make macroscopic bits of star stuff in the lab: plasmas created under conditions that are the same as the plasmas in stars. Although laboratory astrophysics has long been an important part of astronomical research, what has changed is the ability to produce large enough chunks of a star that we can make measurements and perform experiments. In this way, astronomy joins her sister sciences in becoming an experimental science as well as an observational one. I will describe how this came about, the technology behind it, and the results of recent laboratory experiments. Most importantly, we will discuss how this will change our understanding of the universe and its contents. This work will shed new light on our recent discoveries involving McDonald Observatory: planets around white dwarf stars, massive carbon/oxygen variable white dwarf stars, and white dwarf-white dwarf binaries — including one detached double eclipsing system with an orbital period of 12 minutes. We should measure the rate of change of the orbital period in this system within a year and we expect it to be the highest S/N source of gravitational radiation, easily detectable with LISA or similar approaches.

12:05PM N1.00001 Magnetohydrodynamic Verification Problem and Solution1, JARED ROVNY, DAVID MILLER COLLABORATION, ROBERT RIEBEN COLLABORATION — A new magnetohydrodynamic (MHD) verification test problem has been developed. The problem consists of an infinite conducting cylinder of arbitrary but constant conductivity and uniform magnetic permeability that is rotating at constant angular velocity in an infinite vacuum background. Initially there is a uniform magnetic field everywhere. The two-dimensional time and space dependent solution for the magnetic field in the conductor and the vacuum regions will be discussed.

1conducted at the Lawrence Livermore National Laboratory

12:17PM N1.00002 Equilibrium Properties of a Particle Hopping on a Lattice: A Path Integral Study, MARK O’CALLAGHAN, BRUCE MILLER, Texas Christian University — We study the equilibrium properties of a single quantum particle (qp) hopping on a one-dimensional lattice. We develop the path-integral formalism in which the quantum particle is represented by a closed variable-step random walk on the lattice. Here we explicitly consider the case of a free particle, which can be directly compared with an analytical solution. We utilize the canonical ensemble and derive expressions for the energy, its mean square fluctuation, and the qp-qp correlation function in position. One interesting and salient feature of the computation algorithm that shall be stressed is the importance of computing the bins for the probability of a step of a certain size and direction from least probable to most probable, since in this way additions will be performed from very small numbers progressively to larger numbers. If care is not taken in this manner, errant numerical artifacts are introduced simply because of the error associated with addition (subtraction) of very small numbers to (from) much larger numbers. The intention of this paper is to review the derivations of the aforementioned and provide evidence from numerical (Monte Carlo) simulation of the benefits of the algorithm.

12:29PM N1.00003 Nonspherical model density matrices for Rung 3.5 exchange-correlation functionals1, AUSTIN AGUERO2, Angelo State University, BENJAMIN JANESKO, Texas Christian University — Kohn-Sham (KS) density functional theory models electrons’ complicated many-body interactions using exchange-correlation density functionals. Semilocal functionals, rungs 1-3 on the “Jacob’s Ladder” of approximate exchange-correlation functionals, model the XC energy density at each point r using information from an infinitesimal region about r. Nonlocal fourth-rung exchange functionals incorporate a dependence on the entire one-particle density matrix of the noninteracting KS reference system. Nonlocal functionals provide improved accuracy for many properties, but have higher computational costs, particularly in extended systems. “Rung 3.5” exchange functionals incorporate the product of the KS density matrix with a semilocal model density matrix, balancing the strengths and limitations of semilocal and nonlocal approximations. This work proposes new semilocal model density matrices for Rung 3.5 functionals. Semilocal density matrices containing 1-3 parameters improve upon previous work for both molecular thermochemistry and kinetics, and show promise for development of future non-empirical Rung 3.5 Density Functionals.

1NSF Foundation
2TCU Physics REU

12:41PM N1.00004 Dynamical Stability of a One-dimensional Plasma, MATTHEW ROBERTS, Paschal High School, BRUCE MILLER, Texas Christian University — Since the days of the early computers, computer simulations have been incredibly important to the study of the motion of systems of particles as a way to model such systems as stars in a galaxy or charges in plasmas, which cannot be physically produced in a laboratory. These models are still used today, to the great benefit of the scientific community. In this study, the interaction of a one-electron coal system of charges with periodic boundary conditions is modeled with a computer simulation using an Euler integration technique. The chaos in a particular system is then studied through the computation of the largest Lyapunov exponent for that system. It is revealed that the value for this largest exponent, while independent of the initial conditions for a particular system, is dependent upon the size of the system, i.e. the number of particles in the system, as well as the charge-to-mass ratio of these particles. We will present the results of different computer simulations to demonstrate these dependencies by graphing intermediate averages for the greatest Lyapunov exponents over time for a set of systems of either different sizes, or with different charge-to-mass ratios.
Saturday, October 8, 2011 12:05PM - 1:17PM –
Session N2 Atomic, Molecular, and Optical Physics II Sam Rayburn Center Second Floor, Room Innovations B - Harry Downing, Stephen F. Austin State University

12:05PM N2.00001 Solution of the photon propagation paradox, AMY WEST, ADAM HOUK, CHARLES REGAN, Texas Tech University, AYRTON BERNUSSI, LOUIS GRAVE DÉ PERALTA, Texas Tech University — We present an experimental study on the formation of surface plasmon polariton (SPP) standing waves. We demonstrate that SPP tomography in a quantum eraser arrangement permits the detection of the photons passing through the dark fringes of the observed interference pattern. We present a comprehensive explanation of how photons could pass undetected across the regions occupied by the dark fringes.

12:17PM N2.00002 Common-path spectral phase microscopy, NELSON CARDENAS, SAMARENDRA MOHANTY, UT Arlington — Quantitative phase microscopy is an emerging non-contact method for quantifying physical properties (refractive index, thickness) of materials. The high spatial resolution achieved with millisecond-scale resolution using this non-staining method over a wide-field of view is highly advantageous for mapping dynamic changes in the sample properties due to temperature, pressure and molecular interactions. Since refractive index dispersion is intrinsic to a material, its spectral measurement of refractive index changes will allow characterization and analytical quantification of material. Here, we introduce common-path spectral phase microscopic (CP-SPM) imaging of microscopic objects. CP-SPM is based on a common path interferometer with a tunable laser beam. With this method, we are able to characterize both the refractive index of particles over a continuous wavelength band, and also the characteristics of several types of particles simultaneously.

12:29PM N2.00003 Temperature dependence of the depolarization rates of Ne*(2p_i [J=1]) atoms induced by helium atom collisions, CRISTIAN BAHRIM, Department of Physics, Lamar University, VAIBHAV KHADILKAR, Department of Computer Science, UT Dallas,HIRAKU MATSUKUMA, MASAHIRO HASUO, Department of Mechanical Engineering and Science, Kyoto University — Theoretical depolarization rates for disalignment, disorientation, and alignment destruction of the Ne*(2p_i [J=1]) atoms at temperatures between 10 K and 3000 K are compared with measurements done in Ne-He glow discharges. We perform quantum close-coupling many-channel calculations using a molecular approach for the interaction between Ne*(2p_i [J=1]) and He atoms. Excellent agreement between our calculations and experimental data above 77 K is found for all the J = 1 states. For the 2p_i 1 and 2p_i 2 states this agreement is found even down to 20K. The temperature dependence of the depolarization rates can be explained using the anisotropy of the molecular channels. However for the Ne* (2p_i 1 [J=1]) atoms, our disalignment rate coefficients are larger than the measurements recently reported after the radiation re-absorption is subtracted from the disalignment rates. In this paper we carefully address this issue.

12:41PM N2.00004 Laser wakefield-accelerated multi-GeV electrons using the Texas Petawatt laser, NEIL FAZEL, RAFAL ZGADZAJ, XIAOMING WANG, Institute for Fusion Studies, University of Texas at Austin, WATSON HENDERSON, PENG DONG, University of Texas at Austin, RICHARD KORZEKWA, YEN-YU CHANG, HAI-EN TSAI, AUSTIN YI, VLADIMIR KHUDIK, Institute for Fusion Studies, University of Texas at Austin, SERGUEI KALMYKOV, University of Texas at Austin, GILLIS DYER, ERHARD GAUL, AARON BERNSTEIN, MIKAEL MARTINEZ, TED BORGER, FRANKI AYMOND, DOUG HAMMOND, Center for High Energy Density Science, University of Texas at Austin, R. ESCAMILLA, University of Texas at Austin, SRDJAN MARIJANOVIC, Center for High Energy Density Science, University of Texas at Austin, GENNADY SHVETS, TODD DIGMIRE, MICHAEL DOWNER, University of Texas at Austin, LFWA TEAM — Interaction of intense laser pulse and underdense plasma is a promising source for generating multi-GeV electrons beams within the compact laser, and using relatively low plasma density together with ionization induced injection, to accelerate electrons. Self-focusing and self-guiding of the laser beam, self-injection and trapping of electrons, and some approaches to diagnostics of accelerated electrons are discussed.

12:53PM N2.00005 Visualization of evolving laser-generated structures by frequency domain tomography, YENYU CHANG, ZHENGYAN LI, XIAOMING WANG, RAFAL ZGADZAJ, MICHAEL DOWNER, University of Texas at Austin — We introduce frequency domain tomography (FDT) for single-shot visualization of time-evolving refractive index structures (e.g. laser wakefields, nonlinear index structures) moving at light-speed. Previous researchers demonstrated single-shot frequency domain holography (FDH), in which a probe-reference pulse pair co-propagates with the laser-generated structure, to obtain snapshot-like images. However, in FDH, information about the structure’s evolution is averaged. To visualize an evolving structure, we use several frequency domain streak cameras (FDSCs), each of which a probe-reference pulse pair propagates at an angle to the propagation direction of the laser-generated structure. The combination of several FDSCs constitutes the FDT system. We will present experimental results for a 4-probe FDT system that has imaged the whole-beam self-focusing of a pump pulse propagating through glass in a single laser shot. Combining temporal and angle multiplexing methods, we successfully processed data from four probe pulses in one spectrometer in a single-shot. The output of data processing is a multi-frame movie of the self-focusing pulse. Our results promise the possibility of visualizing evolving laser wakefield structures that underlie laser-plasma accelerators used for multi-GeV electron acceleration.
absorption rate of $B_c$ increases if it is considered to be a large size particle. The monopole form factor used, results indicate that absorption cross section increases with the increase in cutoff parameter. This implies that have peak near threshold with cross section magnitude of few mb. Moreover, by changing values of cutoff parameter in small increments in without form factor explain the $B_c$ absorption cross section by nucleons as a function of initial state centre of mass energy. These processes is also absorption of $B_c$ by commoving hadrons. This absorption must also be considered otherwise the explanation of the signal would not be clear. In order to study hadronic absorption of $B_c$, gauged SU(5) hadronic lagrangian in mesonic exchange model is used. The results with and without form factor explain the $B_c$ absorption cross section by nucleons as a function of initial state centre of mass energy. These processes have peak near threshold with cross section magnitude of few mb. Moreover, by changing values of cutoff parameter in small increments in the monopole form factor used, results indicate that absorption cross section increases with the increase in cutoff parameter. This implies that absorption rate of $B_c$ increases if it is considered to be a large size particle.

Saturday, October 8, 2011 12:05PM - 1:05PM — Session N5 Condensed Matter Physics and Materials Research V

Christopher Littler, University of North Texas

1:05PM N2.00006 Lasing without Inversion in He-like Boron: Transient Response

EYOB SETE, ANATOLOY SVIDZINSKY, Texas A&M University, YURI ROSTOVITSEV, The University of North Texas, HCHEM ELEUCH, PANKAJ JHA, Texas A&M University, SZYMON SUCKEWER, Princeton University, MARLAN SCULLY, Texas A&M University and Princeton University — Lasing without population is more attractive in short wavelength spectral regimes, as traditional lasing condition are difficult to achieve due to fast spontaneous life time for shorter spectral domain. We thus here propose a scheme for demonstration of lasing without inversion in short wavelength regime. Using Helium-like Boron as our gain medium, we show that it is possible to have transient lasing with out inversion at 6.1nm.

We thank A. Dalgaro and G. Drake for helpful discussions. We gratefully acknowledge support of the Office of Naval Research (N00014-07-1-1084, N00014-08-1-0948, and N00014-09-1-0888), the Robert A. Welch Foundation (Award A-1261), and NSF Grant EEC-05408-12200.

Saturday, October 8, 2011 12:05PM - 1:05PM — Session N4 High Energy Physics IV

Sam Rayburn Center Second Floor, Room Traditions - Marco Guzzi

Southern Methodist University

12:05PM N4.00001 ECR Ion Source for a High-Brightness Cyclotron

JUSTIN COMEAUX, Texas A&M University — New technology is being developed for high-brightness, high-current cyclotrons with performance benefits for accelerator-driven subcritical fission power, medical isotope production, and proton beam cancer therapy. This paper describes the design for a 65 kV electron cyclotron resonance (ECR) ion source that will provide high-brightness beam for injection into the cyclotron. The ion source is modeled closely upon the one that is used at the Paul Scherrer Institute. Modifications are being made to provide enhanced brightness and compatibility for higher-current operation.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund.

12:17PM N4.00002 The Search For Supersymmetry in the MET +Jets +Taus Final State Using CMS

ANGELA MAROTTA, WILL FLANAGAN, ANDRES FLOREZ, ALFREDO GURROLA, TERUKI KAMON, JIEUN KIM, ROY MONTALVO, CMS COLLABORATION — Supersymmetry provides a natural candidate for dark matter. A search for SUSY in final states with highly energetic jets, large momentum imbalance, and tau pairs is performed using data samples with a total integrated luminosity of 1143 pb-1 of pp collisions at $\sqrt{s} = 7$ TeV collected with the CMS detector at the CERN Large Hadron Collider (LHC). The Standard Model (SM) backgrounds are estimated using data-driven techniques.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund.

12:29PM N4.00003 High brightness 50 MeV Cyclotron for Accelerator-Driven Subcritical Fission

SAEED ASSADI, KARIE BADGLEY, THOMAS MANN, PETER MCINTYRE, NATHANIEL POGUE, AKHI'DIYOR SATTAROV, Texas A&M University, ACCELERATOR RESEARCH LABORATORY TEAM — The Accelerator Research Lab at Texas A&M University is developing new accelerator technology for a high-brightness, high-current cyclotron with capabilities that will be beneficial for applications to accelerator-driven subcritical fission, medical isotope production, and proton therapy. As a first embodiment of the technology, we are developing a detailed design for TAMU-50, a 50 MeV, 5 mA proton cyclotron with high beam brightness. In this presentation we present devices and beamline components for injection, extraction, controls and diagnostics. We emphasize the system integration and implementation of TAMU-50 for production of medical radioisotopes.

1This work is supported in part by grants from the Mitchell Family Foundation and from the Texas ASE Fund.

12:41PM N4.00004 $B_c$ absorption cross sections by nucleons

SONAINA UNDLEE, M.A.K. LODHI, Texas Tech U — The suppression of $B_c$ may be a signature of the presence of a new state of matter, i.e. quark gluon plasma, but there is also absorption of $B_c$ by commoving hadrons. This absorption must also be considered otherwise the explanation of the signal would not be clear. In order to study hadronic absorption of $B_c$, gauged SU(5) hadronic lagrangian in mesonic exchange model is used. The results with and without form factor explain the $B_c$ absorption cross section by nucleons as a function of initial state centre of mass energy. These processes have peak near threshold with cross section magnitude of few mb. Moreover, by changing values of cutoff parameter in small increments in the monopole form factor used, results indicate that absorption cross section increases with the increase in cutoff parameter. This implies that absorption rate of $B_c$ increases if it is considered to be a large size particle.

Saturday, October 8, 2011 12:05PM - 1:05PM — Session N5 Condensed Matter Physics and Materials Research V

Christopher Littler, University of North Texas

12:05PM N5.00001 Simulation and Modeling of Positrons and Electrons in advanced Time-of-Flight Positron Annihilation Induced Auger Electron Spectroscopy Systems

PRASAD JOGLEKAR, KARTHIK SAHSTRY, SUMAN SATYAL, ALEXANDER WEISS, University of Texas at Arlington — Time of Flight Positron Annihilation Induced Auger Electron Spectroscopy (T-O-F PAES) is a highly surface selective analytical technique in which elemental identification is accomplished through a measurement of the flight time distributions of Auger electrons resulting from the annihilation of core electron by positrons. SIMION charged particle optics simulation software was used to model the trajectories both the incident positrons and outgoing electrons in our existing T-O-F PAES system as well as in a new system currently under construction in our laboratory. The implication of these simulation regarding the instrument design and performance are discussed.

1NSF DMR 0907679
12:17PM N5.00002 Behavior of Phonons in the Optical Properties of Magnetron Sputtered ZnO, SANDEEP SOHAL, YAHYA ALIYOV, ZHAOYANG FAN, MARK HOLTZ, Texas Tech University — Resonance Raman scattering and photoluminescence (PL) emission measurements have used to study the temperature dependence of phonons in the wide band gap semiconductor ZnO. There are strong resonance Raman features observed with excitation wavelength 363.8 nm (photon energy 3.409 eV). Near room temperature, this photon energy correspond to in-coming resonance as confirmed by absorption spectrum. Broad PL is seen at room temperature with peak position at 3.25 eV. This coincides with the overtone of longitudinal optic (LO) band. Strong electron-phonon interactions in ZnO allow six LO phonon orders to be observed in Raman spectrum. Temperature dependence of the LO phonon energy is described by a two phonon decay mechanism with energies 100 and 496 cm⁻¹. The temperature dependence of the PL shift is described by physical approach and two vibrational energies corresponding to the center of the acoustic and optic bands in the DOS, i.e., 125 and 500 cm⁻¹. LO phonon sidebands (PSBs) are also observed at low temperature (23-100K). The temperature shift of the PSB energies are interpreted on the basis of the band gap shift combined with established theory for the PSBs.

1Supported by Organized Research, TAMU-Commerce

12:29PM N5.00003 Formation of Cobalt Oxide at Co/CuO Interface¹, A.R. CHOURASIA, JUSTIN MERRITT, MIKEL MORGAN, Texas A&M Univ.-Commerce — The chemical interaction at the cobalt/copper oxide interface has been investigated by the technique of x-ray photoelectron spectroscopy. Thin films of copper were deposited on titanium substrates. The film was oxidized in an atmosphere of oxygen in a quartz tube furnace. Following the oxidation, the sample was loaded in the deposition chamber for further processing. A thin film of cobalt with thickness 0.5 nm was deposited on the copper oxide. The interface was characterized in situ. The cobalt 2p region, the copper 2p region, and oxygen 1s region has been investigated. The results show the formation of cobalt oxide with the reduction of copper oxide to copper. A 0.3 nm of cobalt was further deposited on the sample to check for the uniform coverage. The second deposition showed the presence of elemental cobalt on the sample. The study shows chemical reactivity at the interface and that the subsequent layer of cobalt does not get oxidized.

¹Supported by Organized Research, TAMU-Commerce

12:41PM N5.00004 Micromagnetic simulations of the transition between vortex and single-domain magnetization states in sub-100 nm nanodots², ANDREW T. KING, IGOR V. ROSCHCHIN, Texas A&M University — The magnetic vortex state in nanodots has demonstrated unique properties, which may improve magnetic data storage technologies. To utilize these properties, we must understand magnetic switching to and from the vortex state. We used a “rigid-vortex approximation” to calculate the total magnetic energy of a nanodot for various magnetic configurations. This was done for 20 nm-thick iron nanodots with different diameters (30, 40, 65, and 80 nm) as a function of applied magnetic field. By analyzing the energy landscape for different magnetic configurations, we calculated the energy barrier for switching from the vortex to the single-domain state (vortex annihilation) and the converse (vortex nucleation). The applied fields required to overcome these two barriers are compared to those obtained from the simulations directly and to the experimental values². The role of the thermal fluctuations in the temperature dependence of these critical fields will be discussed by comparison of the energy barriers with the thermal energy, kT.


12:53PM N5.00005 Effect of Cu Layer on FeMn Magnetic Properties, DOGAN KAYA, Texas A&M University, PRIYANGA JAYATHILAKA, CASEY W. MILLER, University of South Florida, IGOR V. ROSCHCHIN, Texas A&M University — The magnetic vortex state in nanodots has demonstrated unique properties, which may improve magnetic data storage technologies. To utilize these properties, we must understand magnetic switching to and from the vortex state. We used a “rigid-vortex approximation” to calculate the total magnetic energy of a nanodot for various magnetic configurations. This was done for 20 nm-thick iron nanodots with different diameters (30, 40, 65, and 80 nm) as a function of applied magnetic field. By analyzing the energy landscape for different magnetic configurations, we calculated the energy barrier for switching from the vortex to the single-domain state (vortex annihilation) and the converse (vortex nucleation). The applied fields required to overcome these two barriers are compared to those obtained from the simulations directly and to the experimental values². The role of the thermal fluctuations in the temperature dependence of these critical fields will be discussed by comparison of the energy barriers with the thermal energy, kT.

1Work is supported by Texas A&M University, TAMU-CONACYT Collaborative Research Program.

Saturday, October 8, 2011 12:05PM - 1:05PM – Session N6 AAPT
Science Building 122 - Tom O’Kuma, Lee College

12:05PM N6.00001 Making Laboratories Count – Better Integration of Laboratories in Physics Courses¹, JIM SIZEMORE, AAPT — The quality of K-12 education leaves something to be desired and presents higher education faculty with the challenge of instructing under-prepared students. However, by their own admission, students from many institutions inform us that laboratory sections in science classes, including physics, consist mostly of showing up, going through the motions, and getting grades that boost their overall grade. This work presents laboratories that challenge students to take their laboratory work more seriously including specific rubrics enforcing SOLVE and Bloom’s Taxonomy, pre-lab preparation work, and quizzes on pre-lab preparation. Early results are encouraging revealing greater student progress with better integration of laboratory with the rest of a complete physics course.

¹Acknowledgements: Collin College for supporting this work and P. Johnson, M. Brooks, G. Sherman, M. Broyles, and A. Kumar who helped write the instructional content.
12:17PM N6.00002 Innovative Noyce Program for Preparing High School Physics Teachers, ERIC HAGEDORN\textsuperscript{1}, OLGA KOSHELEVA\textsuperscript{1}, AMY WAGLER\textsuperscript{2}, RON WAGLER\textsuperscript{3}, University of Texas at El Paso — The “Robert Noyce Scholarships for Teaching Miners” program at the University of Texas at El Paso currently consists of 14 mathematics majors minoring in secondary education, most of whom are preparing for the Mathematics-Physics Certification. From the time of their selection (junior year), till after they begin teaching, participants in this program will have financial support consisting of a $10,000 per year scholarship during the last two years in college. Programmatic support during these two years consists of four, half-day workshops emphasizing: 1) inquiry-based teaching, 2) mathematics & science integration, and 3) actual inquiry in the form of a senior research project. The workshops are facilitated by a team of university faculty and school district partners (EPISD and YISD). These district partners help with the workshops, but also mentor the scholars when placed at their classroom observation and student teacher sites. Once the scholars graduate and receive certification, they will experience unique induction year support: being hired in pairs or small groups and placed together in the same school. This placement with classmates combined with the mentoring of the same district personnel with whom they are familiar is hypothesized to be uniquely effective.

\textsuperscript{1}This work is generously supported by the National Science Foundation.
\textsuperscript{2}Physics Dept.
\textsuperscript{3}Teacher Education
\textsuperscript{4}Mathematical Sciences
\textsuperscript{5}Teacher Education

12:29PM N6.00003 Does Teaching Experience Improve Student Grades?, LIONEL D. HEWETT, Texas A&M University-Kingsville — The author has been teaching physics for almost fifty years and has tried just about everything suggested to improve one’s teaching ability and to increase student learning. Some of these teaching methods were clearly more productive than others, but has the use of such methods significantly improved the grades of the students taking his classes during this extended period of time? This paper attempts to answer this question by providing data that illustrates how his calculus-based physics grades have changed over the years and discusses some possible reasons for such changes. In all probability, any conclusions derived from this calculus-based physics course would be applicable to most other physics courses taught by most other professors during their teaching careers.

12:41PM N6.00004 Report on the 4th International IUPAP Women in Physics Conference, CYNTHIA CORREA, University of Austin — Stellenbosch, South Africa was the site of the 4\textsuperscript{th} International Union of Pure and Applied Physics (IUPAP) International Conference on Women in Physics, which took place on April 5\textsuperscript{th}-8\textsuperscript{th}. This conference brought together the diverse contributions of 250 female physicist attendees from nearly 60 countries worldwide to dissect the challenges faced by female physicists worldwide and to propose strategies to attract and retain more girls and women to the field. Having served as a member of the U.S. Delegation, I will discuss the resolutions reached and highlight the most important results of Global Survey of Physicists, where nearly 15,000 physicists shine light on how gender affects their lives and careers.

12:53PM N6.00005 Discovering the Barriers to Rural Women in STEM, JENNIFER KREFT PEARCE, SARA MCCASLIN, LEANN MORGAN, The University of Texas at Tyler — This study investigates the attitudes women and girls from the East Texas region have towards engineering and physics. We use an online survey and interviews to determine what influences women to choose their career paths. Surprisingly, we find that women have more positive attitudes about physics and engineering than their male counterparts. For the group of students interviewed, self assessment of ability, lack of role models, and confusion about work/life balance issues were some of the determining factors in their choice not to pursue a career in a STEM field.

Saturday, October 8, 2011 12:05PM - 1:05PM —
Session N7 Biological & Chemical Physics II
Science Building 123 - Kelvin Chang, Texas Tech University

12:05PM N7.00001 Adhesion Assay using Nano-Scaffolds for Metastatic Indicator, JAMES MATTHEWS, Dept of Physics, Texas Tech University, RAUL MARTINEZ-ZANGUILAN, Depts of Cell Physiology and Molecular Biophysics, Texas Tech University HSC, SOYEUN PARK, Dept of Physics, Texas Tech University — It is important to determine the metastatic potential of prostate cancer cells because the metastasis seriously affects the survival of prostate cancer patients. Nevertheless, multi-faceted aspects of metastasis hinder its accurate evaluation. Considering the altered cell-to-substrate adhesion in cancer cells, we performed the adhesion assay using our state-of-art nanoscaffolds to determine the metastatic potential. We have used lowly (LnCaP) and highly (CL-1) metastatic human prostate cancer cells. Using the nanosponge lithography, we created the nano-scaffolds with defined spacing and size of nano-islands in 2D array. Subsequent functionalization using the orthogonal chemistry and selective absorption of extra-cellular matrix proteins allows us to control the adhesions. We found that while the cell proliferation of LnCaP is similar to that of normal cells, CL-1 shows the aggressive proliferation even with restricting the adhesions. We concluded that the high metastatic potential of CL-1 cells is attributed from the abnormally enhanced adhesions.

12:17PM N7.00002 Nano-Bio-Mechanics of Neuroblastoma Cells Using AFM, LYNDON BASTATAS, JAMES MATTHEWS, Physics, Texas Tech University, MIN KANG, School of Medicine, Texas Tech University, SOYEUN PARK\textsuperscript{1}, Physics, Texas Tech University — We have conducted an \textit{in vitro} study to determine the elastic moduli of neuroblastoma cell lines using atomic force microscopy. Using a panel of cell lines established from neuroblastoma patients at different stages of disease progress and treatment, we have investigated the differences in elastic moduli during a course of cancer progression and chemotherapy. The cells were grown on the hard substrates that are chemically functionalized to enhance adhesion. We have performed the AFM indentation experiments with different applied forces from the AFM probe. For the purpose of the comparison between cell lines, the indentations were performed only on cell centers. The obtained force-distance curves were analyzed using the Hertz model in order to extract the elastic moduli. We have found that the elastic moduli of human neuroblastoma cells significantly varied during the disease progression. We postulate that the observed difference might be affected by the treatment and chemotherapy.

\textsuperscript{1}Corresponding Author
12:29PM N7.00003 Free energy profile of DNA from single-molecule manipulation experiments\(^1\), ERIC FREY, CHING-HWA KIANG, Rice University — Nonequilibrium work theorems, such as the Jarzynski equality and the Crooks fluctuation theorem, allow one to use nonequilibrium measurements to determine equilibrium free energies. For example, it has been demonstrated that the Crooks fluctuation theorem can be used to determine RNA folding energies. We used single-molecule manipulation with an atomic force microscope to measure the work done on poly(dA) as it was stretched and relaxed. This single-stranded nucleic acid exhibits demonstrated that the Crooks fluctuation theorem can be used to determine RNA folding energies. We used single-molecule manipulation with an atomic force microscope to measure the work done on poly(dA) as it was stretched and relaxed. This single-stranded nucleic acid exhibits

\[^1\text{We acknowledge support from the Alliance for NanoHealth training fellowship NASA/DOE, NSF DMR0907676, and Welch Foundation C-1632.}\]

12:41PM N7.00004 In Vitro Microtubule and Motor Protein Motion on Glass, A.L. LIAO, WPI-Advanced Institute of Materials Research, Tohoku University. Japan and Materials Science and Engineering, Texas A&M University, A. SIKORA, D. OLIVEIRA, K. KIM, M. UMETSU, T. ADSCHIRI, WPI-Advanced Institute of Materials Research, Tohoku University. Japan, W. HWANG, Materials Science and Engineering; Department of Biomedical Engineering, Texas A&M University, W. TEIZER, WPI-Advanced Inst. of Materials Research, Tohoku University, Japan; Mat. Science and Engr. and Dept. of Physics and Astronomy, Texas A&M University — The intracellular microtubule associated protein kinesin uses adenosine triphosphate (ATP) as an energy source for unidirectional and processive motion on a microtubule filament. In a cell, kinesin motor proteins function as transporters for organelles, macromolecules and various particles. To study the related processes \textit{in vitro}, we have performed rhodamine-labeled microtubule gliding assays and kinesin-coated quantum dot motility assays on glass surfaces. Motility is observed by fluorescence microscopy. Results from these two assays, as well as the effect of ATP concentration on kinesin velocity will be presented. We will discuss how we use these assays for the manipulation of microtubules on a surface, thus enabling specific particle distribution by kinesin.

12:53PM N7.00005 Atomistic MD simulations reveal the protective role of cholesterol in dimeric beta-amyloid induced disruptions in neuronal membrane mimics, LIMING QIU, CREIGHTON BUIE, SARA CHENG, GEORGE CHOU, MARK VAUGHN, Texas Tech University, K. CHENG, Trinity University — Interactions of oligomeric beta-amyloid peptides with neuronal membranes have been linked to the pathogenesis of Alzheimer’s disease (AD). The molecular details of the interactions of different lipid components, particularly cholesterol (CHOL), of the membranes with the peptides are not clear. Using an atomistic MD simulations approach, the water permeability barrier, structural geometry and order parameters of binary phosphatidylcholine (PC) and PC/CHOL lipid bilayers were examined from various 200 ns-calculation replicates. Our results suggest that the longer length dimer (2 x 42 residues) perturbs the membrane more than the shorter one (2 x 40 residues). In addition, we discovered a significant protective role of cholesterol in protein-induced disruptions of the membranes. The use of a new Monte-Carlo method in characterizing the structures of the conformal annular lipids in close proximity with the proteins will be introduced. We propose that the neurotoxicity of beta-amyloid peptide may be associated with the nanodomain or raft-like structures of the neuronal membranes in-vivo in the development of AD.

Saturday, October 8, 2011 12:05PM - 1:17PM — Session N8 High Energy Physics V

12:05PM N8.00001 Monitoring the Performance of a CMS Tier3 Cluster for LHC Data Analysis\(^1\), JACOB HILL, JOEL WALKER, Sam Houston State University, DAVID TOBACK, GUY ALMES, STEVE JOHNSON, Texas A&M, MICHAEL KOWALCZYK, Sam Houston State University, VAIKUNTH THUKRAL, DANIEL CRUZ, Texas A&M — Every Tier 3 site is a unique entity composed of a vast array of extremely complicated interdependent hardware and software, extensively cross-networked for participation in the global endeavor of processing LHC data. Successful operation of a Tier 3 site, including performance optimization and tuning, requires intimately detailed, near real-time feedback on how the individual system components are behaving at a given moment, and how this compares to design goals and historical norms. Our monitoring project represents the creation of an array of custom server daemons which harvest data from the excellent existing analysis tools at various locations across the web, collecting the results into a site specific unified display designed extreme visual efficiency and information density. A functioning “Beta” deployment of the monitor for the Texas A&M Brazos Cluster is available online: http://collider.physics.tamu.edu/tier3/mon/.

\[^1\text{DOE and the Norman Hackerman Advanced Research Program}\]

12:17PM N8.00002 The cryogenic performance of opto-electronic components for a liquid argon time projection chamber in neutron physics\(^1\), LIN ZHU, ANDY LIU, JINGBO YE, SMU Department of Physics — A Liquid Argon Time Projection Chamber (LArTPC) has been proposed as a potential far site detector for the long baseline neutrino experiment (LBNE). A cold front-end electronics scheme operates in liquid argon (89 K) is under development. In this talk, I will present functional and reliability studies of opto-electronic components in liquid nitrogen (LN2, 77 K). Components of an optical data link, including a serializer ASIC, laser diodes, optical fibers, and optical connectors, have been tested to function in LN2. One type of Field Programmable Gate Arrays (FPGAs) chip is found to function at 77 K. For an optical link with its transmitting side in LAr without access for maintenance for 15+ years, the challenge lies in the system reliability. To meet this challenge, we need to understand the reliability at component level and based on that knowledge design a system with redundancy so that we do not lose data over the lifetime of the system Preliminary reliability test results on component level, including those from the FPGA chip, will be presented. A methodology is proposed to check the hot carrier issue, the most concerned failure mode in electronics operating in deep cryogenic temperatures.

\[^1\text{SMU Physics}\]
12:29PM N8.00003 Structured Cable for High-Current Coils of Tokamaks, CHRISTOPHER BENSON, PETER MCINTYRE, AKHDIYOR SATTAROV, THOMAS MANN, Texas A&M University — The 45 kA superconducting cable for the ITER central solenoid coil has yielded questionable results in two recent tests. In both cases the cable $T_c$ increased after cycling only a fraction of the design life, indicating degradation due to fatigue and fracture among the superconducting strands. The Accelerator Research Lab at Texas A&M University is developing a design for a Nb$_3$Sn structured cable suitable for such tokamak coils. The superconductor is configured in 6 sub-cables, and each subcable is supported within a channel of a central support structure within a high-strength armor sheath. The structured cable addresses two issues that are thought to compromise opposition at high current. The strands are supported without cross-overs (which produce stress concentration); and armor sheath and core structure bypass stress through the coil and among subcables so that the stress within each subcable is only what is produced directly upon it. Details of the design and plans for development will be presented.

12:41PM N8.00004 Gas Electron Multiplier Detector Characterization with KPiX Readout System Using Particle Beams, SAFAT KHALED, University of Texas at Arlington — Gas Electron Multiplier (GEM) detectors are a type of gaseous ionization detector created in 1997 by the Gas Detector Development Group in CERN. The High Energy Physics Group at the University of Texas at Arlington has been developing and testing double-layer GEM detectors for the digital hadron calorimeters for experiments at future accelerators, such as the International Linear Collider. The group performed a beam test experiment using four 30cmx30cm GEM prototype detectors of which one was read out using the 13bit KPiX chip currently developed by the Stanford Linear Accelerator Center team. In this talk, we present the results of beam test data analysis to understand characteristics and performance of the prototype GEM. More specifically, we present the measured response, efficiency and gain of the prototype detectors.

12:53PM N8.00005 Reconstructing Drell-Yan Data at SeaQuest, TYLER HAGUE, Abilene Christian University and Argonne National Laboratory, SEAQUEST/FERMILAB E-906 COLLABORATION — SeaQuest is a fixed target experiment at Fermi National Accelerator Laboratory. Using the 120-GeV main injector, SeaQuest will study the nucleon sea through proton-proton and proton-deuterium Drell- Yan reactions. The Drell-Yan process occurs when a quark and an antiquark annihilate into a virtual photon that then decays into a lepton pair. From these Drell-Yan cross sections, the ratio of the d-bar to the u-bar quark distributions can be extracted. From measurements on several nuclear targets, the energy loss of fast quarks in the nucleus can be deduced. The MySQL database for SeaQuest and a new approach utilizing database commands for track reconstruction will be described. Reconstruction occurs within the database using dynamically created queries to create temporary tables. These are used to construct partial tracks at each station that can be combined into full tracks. Typically the wire chambers at each station will be used for tracking and the hodoscopes will be used for the trigger. In addition, track reconstruction with only hodoscopes is being developed for monitoring hodoscope efficiencies.

1 This work was supported in part by U.S. Department of Energy, Office of Nuclear Physics, under contract No. DE-AC02-06CH11357.

1:05PM N8.00006 Superconducting Accelerating Structure for High-Current Cyclotrons for Accelerator-Driven Subcritical Fission, NATHANIEL POGUE, PETER MCINTYRE, AKHDIYOR SATTAROV, Texas A&M University — An accelerator driven molten salt fission core is being designed to provide reliable power by subcritical nuclear fission for the next few millennia. Fission is driven by proton beams from a flux-coupled stack of three high-current cyclotrons. A key innovation in attaining the needed beam current and efficiency is a superconducting Niobium rf accelerating cavity that can accelerate bunches in the 200 orbits uniformly. The unique design allows for several cavities to be stacked, and also provides uniform acceleration and eliminates higher order modes in the cyclotron. The design and properties of the superconducting cavity will increase the efficiency of the cyclotron and the overall energy amplification from the molten salt core by an order of magnitude compared to conventional designs.