8:00AM A1.00001 Introduction and Announcements from the Local Organizing Committee –

8:15AM A1.00002 Welcome PERRY MOORE, Provost, Texas State University –

8:30AM A1.00003 Etch-a-Sketch Nanoelectronics JEREMY LEVY, University of Pittsburgh — The popular children’s toy Etch-a-Sketch has motivated the invention of a new material capable of writing and erasing wires so small they approach the spacing between atoms. The interface between two normally insulating materials, strontium titanate and lanthanum aluminate, can be switched between the insulating and conducting state with the use of the sharp metallic probe of an atomic-force microscope. By “sketching” this probe in various patterns, one can create electronic materials with remarkably diverse properties. This material system shows promise both for ultra-high density storage and as possible replacements for silicon-based logic (CMOS). This work is supported by the National Science Foundation, Defense Advanced Research Projects Agency, Army Research Office and Air Force Office of Scientific Research.

9:06AM A1.00004 Polarization Electronics – A Path to Multifunctional Materials THOMAS MYERS, Texas State University — Multifunctional materials are those which will lead to new and innovative devices that can serve multiple functions within a given system. An oft-overlooked parameter in devices is the presence of induced or spontaneous polarization which provides an added degree of freedom for fabrication of structures for electronics and photonics. We present two approaches — spontaneous polarization in GaN for nanoscale photonic structures, and the integration of complex oxides with GaN for induced polarization electronics. The Group III-Nitrides lack inversion symmetry that leads to a large crystal polarization resulting in both spontaneous and piezoelectric polarization. This has been viewed as a problem since built-in fields due to polarization can produce Stark shifts in devices, or charge build-up at heterojunctions. However, this also brings the potential for designing new device types. Polarization discontinuities can be used to produce regions of localized charge, allowing electronic devices to be fabricated without the need for adding extrinsic doping impurities. Combination with other materials such as ferroelectrics provides an induced polarization discontinuity that can be tunable, leading to variable and controllable polarization charge densities.

Friday, October 23, 2009 10:00AM - 12:00PM — Session B1 Condensed Matter Physics I —

10:00AM B1.00001 Origins and Properties of Uncompensated Magnetization in FeF$_2$ KARIE BADGLEY, Department of Physics, Texas A&M University, MIKHAIL ZHERNENKOV, MIKAEL R. FITZSIMMONS, LANSCe, Los Alamos National Laboratory, IGOR V. ROSCHCHIN, Department of Physics, Texas A&M University — Recent studies of exchange bias demonstrated uncompensated magnetization in an antiferromagnet. To further investigate the properties and the origin of this magnetization, two types of 36nm thick samples of FeF$_2$ on MgF$_2$ were prepared: with and without a 3nm top layer of Al used to prevent possible oxidation. SQUID VSM measurements on these samples showed uncompensated magnetization. Samples coated with Al were found to have larger magnetic susceptibility. These findings are in agreement with neutron scattering measurements, which also showed the uncompensated magnetization primarily at the top surface of FeF$_2$ for the Al-coated sample. The temperature dependence and possible origin of the uncompensated magnetization will be discussed. Funded by Texas A&M University and Texas A&M University — CONACyT Collaborative Research Grant Program.


10:12AM B1.00002 High Coverage Oxidation of the Cu(001) Surface: A Density Functional Study W.B. MADDOX, N.G. FAZLEEVI, University of Texas at Arlington — The study of oxygen adsorption on transition metal surface is important for the understanding of corrosion, heterogeneous catalysis, and oxide growth. The structures formed on oxidized transition metal surfaces vary from simple adlayers of chemisorbed oxygen to more complex structures which result from the diffusion of oxygen into sub-surface regions. In this paper, an ab-initio investigation of oxygen adlayer stability and associated electronic structures of different adsorption phases of oxygen on the Cu(001) missing row reconstructed surface using density functional theory in the generalized gradient approximation, is presented. Results of calculations regarding geometrical as well as electronic properties including changes in electron work function, difference electron density and density of states as a function of oxygen coverage are also discussed. Furthermore, the chemistry of metal-adsorbate bonding is studied with primary interest being paid to high coverage oxygen adsorption.

1 This work was supported in part by The National Science Foundation (DMR-0907679).

10:24AM B1.00003 Electronic Properties of the Prussian Blue Analog Co$_3$[Os(CN$_6$)$_2$]$_2$ at Low Temperatures T. WELLINGTON, A. FORD, W. TEIZER, M. HILFIGER, C. AVENDANO, K. DUNBAR, Department of Physics, Texas A&M University, College Station, TX 77843 — The prussian blue analog Co$_3$[Os(CN$_6$)$_2$]$_2$ exhibits photoinduced changes of magnetic behavior as well as charge transfer induced spin transitions at low temperatures (5-10K). Magnetic measurements on the bulk material show an increased magnetic susceptibility after illumination with red light, as the analog exhibits an abrupt spin transition due to enhanced cooperativity. We are studying the electronic interactions between this prussian blue analog and gold films of varying thickness at temperature 2K<T<300K, in order to analyze the effect of the introduction of new materials into the prussian blue vacuums. We show that the bilayer of the prussian blue analog Co$_3$[Os(CN$_6$)$_2$]$_2$ and gold exhibits a decrease by an approximate factor of three in the resistance when compared to a thin film gold sample. The exact decrease varies from sample to sample, due to the disordered nature of prussian blue analogs and the existence of water in the interstices of the lattice. However, for each sample the observed decrease is reproducible for up to two weeks.

3 We acknowledge support by the Robert A. Welch Foundation (A-1585).
10:36AM B1.00004 Introduction to Time of Flight Positron Annihilation Induced Auger Spectroscopy (TOF-PAES)\textsuperscript{1}, PRASAD JOGLEKAR, SUSHANT KALASKAR, KARTHIK SHAstry, SUMAN SATYAL, ALEX WEISS\textsuperscript{2}, Department of Physics, U T Arlington — Time of flight- positron annihilation induced auger electron spectroscopy (TOF-PAES) is extremely surface selective with close to 95% of the PAES signal stemming from the top-most atomic layer. In PAES, a beam of low energy (1eV – 26eV) positrons is incident on a surface where they become trapped in an image potential well. A fraction (up to several percent) of the positrons in the surface state annihilate with the core electrons of atoms at the surface resulting in core-holes. Electrons in higher levels can fill these core-hole via an Auger transition in which the energy associated with this filling the core hole is transferred to another electron which can leave the atom and the surface. The energy of the outgoing (Auger) electrons is characteristic of the energy levels of the atom and can be used to identify the specific element taking part in the transition. In this talk I will present a brief review of how the TOF PAES technique can be used to obtain Auger spectra that is completely free of secondary electron background.

\textsuperscript{1}Welsh Foundation, NSF
\textsuperscript{2}Advisor

10:48AM B1.00005 Design of an Operando Positron Annihilation Gamma Spectrometer (OPAGS)\textsuperscript{1}, SUMAN SATYAL, KARTIK SHAstry, SUSHANT KALASKAR, LARRY LIM, VIBEK JOGLEKAR, ALEXANDER WEISS, UT-A, POSITRON TEAM — Surface properties measured under UHV conditions cannot be extended to surfaces interacting with gases under realistic pressures due to surface reconstruction and other strong perturbations of the surface. Many surface probing techniques used till now have required UHV conditions to avoid data loss due to scattering of outgoing particles. Here we describe the design of an Operando Positron Annihilation Gamma Spectrometer (OPAGS) currently under construction at the University of Texas at Arlington. The new system will be capable of obtaining surface and defect specific chemical and charge state information from surfaces under realistic pressures. Differential pumping will be used to maintain the sample in a gas environment while the rest of the beam is under UHV. The Elemental content of the surface interacting with the gas environment will be determined from the Doppler broadened gamma spectra. This system will also include a time of flight (TOF) positron annihilation induced Auger spectrometer (TOF-PAES) for use in combined annihilation induced Auger and annihilation gamma measurements made under low pressure conditions.

\textsuperscript{1}Welsh Foundation Y-1100, NSF DMR 9812682

11:00AM B1.00006 Auger Photo Electron Spectroscopy (APECS) measurement of the low energy tail (LET) of Cu MVV and Ag NVV Auger peak down to 0 eV\textsuperscript{1}, K. SHAstry, A.H. WEISS, Univ of Texas at Arlington, R.A. BARTYNSKI, Rutgers University, S.L. HULBERT, Brookhaven National Labs, RUTGERS UNIVERSITY COLLABORATION, BROOKHAVEN NATIONAL LABS COLLABORATION — The low energy Auger peak sit on large background due to secondary electrons that arise from loss processes unrelated to the Auger process. Auger photoelectron coincidence spectroscopy (APECS) technique was used to probe the surfaces of Cu (100) and Ag (100) to suppress background unrelated to the auger process and obtain the energy distribution of the electrons emitted as a result of the MVV transition in Cu and NVV transition in Ag over the full range of emitted energies (0eV-81eV). The measurements reveal a well formed auger peak at 40 eV and 60 eV for Cu and Ag respectively accompanied by a significant back ground in the low energy region of the spectrum. The origins of the low energy tail (LET) are discussed in terms of extrinsic mechanisms in which the electrons from the peak lose energy as they propagate to the sample surface, as well as intrinsic mechanisms in which multi-electron auger processes distribute the energy gained by filling of the core hole to multiple electrons.

\textsuperscript{1}Welch Y1100, NSF DMR 0907679

11:12AM B1.00007 Search for correlated two electron emission in Auger transition processes\textsuperscript{1}, SUSHANT KALASKAR, University of Texas at Arlington, S.L. HULBERT, Brookhaven National Laboratory, R.A. BARTYNSKI, Rutgers University, A.H. WEISS, University of Texas at Arlington, BROOKHAVEN NATIONAL LABORATORY COLLABORATION — Measurements were performed at the National Synchrotron Light Source Brookhaven National Lab, Upton New York, using Auger Photoelectron Coincidence Spectroscopy (APECS) to investigate the physics of Low Energy region of the Auger spectrum. The measurements were carried out on Ag(100) sample, and the spectrum shows a NVV transition related to Ag 4p excitation consisting of a Auger peak accompanied by a substantial low energy region. We selected photon energy of 465eV, energy slightly above the Ag 4p threshold, in order to emphasize the 4p core production compared to all other energy levels. If the Auger transition energy was shared between two and only two electrons we would expect to observe a peak in the I(E) spectrum of the scanned analyzer at an energy of $E_{\text{Auger}} - E_{\text{fixed}}$. We performed electron-electron coincidence measurements with one analyzer fixed at 175 eV (half the NVV KE) and the other scanned over the energy range 150 to 200 eV. A possible explanation is that the resulting NVV Auger transition is not shared by 2 but, n number of electrons. This reveals why the LET is smeared into a smooth spectrum as in a single channel photoemission.

\textsuperscript{1}Welch Y1100, NSF DMR 0907679

11:24AM B1.00008 Consistent Asymptotic Expansion of Mott’s Solution for Oxide Growth\textsuperscript{1}, MATTHEW SEARS, WAYNE SASLOW, Texas A&M University — Many relatively thick metal oxide films grow according to what is called the parabolic law $L = \sqrt{2At} + \ldots$. Mott explained this by assuming that ions and electrons are the bulk charge carriers, and that their number fluxes vary as $t^{-1/2}$ at sufficiently long $t$. In this model no charge is present in the bulk, and surface charges were not discussed. It can be thought of as a discharging capacitor, with the oxide surfaces as the plates. However, the theory then is inconsistent because the field decreases, corresponding to discharge, but there is no net current to cause discharge. The present work systematically extends the theory and obtains the discharge current. Because the Planck-Nernst equations are nonlinear (although Gauss’s Law and the continuity equations are linear) this leads to a systematic order-by-order expansion in powers of $t^{-1/3}$ for the number currents, concentrations, and electric field during oxide growth. At higher order the bulk develops a non-zero charge density, with a corresponding non-uniform net current, and there are corrections to the electric field and the ion currents. The second order correction to ion current implies a logarithmic term in the thickness of the oxide layer: $L = \sqrt{2At} + B \ln t + \ldots$.

\textsuperscript{1}This work was partially supported by the Department of Energy through grant DE-FG02-06ER46278.
have studied the adsorption geometry and desorption kinetics of CO on the epitaxial Cr(110) (0001)/Cr(110) surface. The adsorption of CO was performed at 120 K and produced a weak (v/3 x v/3) R 30° reconstruction, as monitored by low energy electron diffraction (LEED). To determine the activation energy and desorption kinetics, temperature programmed desorption (TPD) measurements have been performed at heating rates of 5, 10, 25, and 50 °C/min. The results of the TPD measurements indicate that the desorption is approximately 1st order and has an activation energy of 0.52 eV/molecule (50 kJ/mol).
Molecular docking of nanoparticle self-lighting photodynamic therapy (PDT) has been designated as a "promising new modality in the treatment of cancer" since the early 1980s. Light must be delivered in order to activate photodynamic therapy. Most photosensitizers have strong absorption on the ultraviolet (UV) – blue range, therefore, UV–blue light is needed for their activation. Unfortunately, UV-blue light has minimal penetration into tissue and its application for in vivo activation is a problem. Here, we introduce a new PDT system in which the light is generated by afterglow nanoparticles with attached photosensitizers. When the nanoparticle-photosensitizer conjugates are targeted to tumor, the light from afterglow nanoparticles will activate the photosensitizers for photodynamic therapy. Therefore, no external light is required for treatment. More importantly, it can be used to treat deep tumor such as breast cancer because the light source is attached to the photosensitizers and are delivered to the tumor cells all together. This new modality is referred as Nanoparticle Self-Lighting Photodynamic Therapy (NSL-PDT).

This project is funded by the U.S. Army Medical Research Acquisition Activity under Contract No.W81XWH-05-C-0101.

The setup of a physics oriented camp can be quickly thwarted by a deficiency in funds, tools, and toys. Making sure that you have the proper funds and how you get those funds is essential to a successful physics camp. A understanding of proper book keeping and management can be the first ideal step to obtaining fun and exciting pieces to an educational endeavor for the students and teachers.

The development of a broader, more inclusive assessment to be used in introductory physics courses, not just for the assessment of students' understanding, but in order to evaluate our instructional methods will be discussed. There is a need for an exam that can be used across universities to give faculty information on their students' performance on problems designed to assess not just content knowledge, but skills, such as problem solving, modeling, laboratory skills and aspects of critical thinking. We discuss the development of such an exam, which will be particularly useful for the evaluation of courses undergoing reform, the introduction of new teaching methods and other aspects of change, both in traditionally and non-traditionally taught courses.

How to create and maintain a budget for an intermediate youth physics camp. — KYLE SMITH, Texas State University - San Marcos, Physics Dept. — The setup of a physics oriented camp can be quickly thwarted by a deficiency in funds, tools, and toys. Making sure that you have the proper funds and how you get those funds is essential to a successful physics camp. A understanding of proper book keeping and management can be the first ideal step to obtaining fun and exciting pieces to an educational endeavor for the students and teachers.

The development of a broader, more inclusive assessment to be used in introductory physics courses, not just for the assessment of students' understanding, but in order to evaluate our instructional methods will be discussed. There is a need for an exam that can be used across universities to give faculty information on their students' performance on problems designed to assess not just content knowledge, but skills, such as problem solving, modeling, laboratory skills and aspects of critical thinking. We discuss the development of such an exam, which will be particularly useful for the evaluation of courses undergoing reform, the introduction of new teaching methods and other aspects of change, both in traditionally and non-traditionally taught courses.
11:00AM B3.00006 Effect of Interactive Computer Simulations on Elementary Education Teachers’ Understanding of Light Matter Interactions, SIMEON MBEWE, FRACKSON MUMBA, MARY WRIGHT, HARVEY HENSON, VIVIEN CHABALEGULU, Southern Illinois University Carbondale, SCIENCE, MATHEMATICS AND ACTION RESEARCH FOR TEACHERS (SMART) PROGRAM TEAM1 — This study assessed the effect of interactive computer simulations on elementary education in-service teachers’ understanding of light matter interactions. A sample comprised 27 elementary education in-service teachers who were in a Master of Science in Mathematics and Science Education degree program at a mid-sized university in Midwest of the USA. Data was collected through pre and posttests. A t-test showed a significant difference between pre and post-tests. The analysis of pretest responses showed that teachers were not able to define or explain photons and electromagnetic spectrum. However, posttest responses showed that most teachers provided correct descriptions of these concepts and provided examples to explicate their responses. Based on our results, the interactive computer simulations had positive and significant impact on teachers’ understanding of light matter interactions. Detailed results, implications for teacher education and science teaching and learning will be stated and discussed

1This program was funded by Illinois State Board of Education

11:12AM B3.00007 Interpreting Figure 1 of the Michelson-Morley Experiment1, RICHARD SELVAGGI, Texas A&M University-Commerce — Figure 1 of the 1887 Michelson-Morley experiment is utilized to understand the theoretical directional status of the light beam. The velocity of the experimental apparatus’ reference frame relative to the unobserved reference frame is designated and used to draw four theoretical paths of the light beam. Isaac Newton’s definition of inertia is used to describe the inertial reference frame and Tocaci and Kilminster’s definition of the non-inertial reference frame is used. This presentation shows that the Figure 1 light beam’s directional motion remains in the same inertial reference frame as the experimental apparatus. The time and distance concepts of Figure 1 change relative to the experimental apparatus defining this drawing of the light beam’s motion as a mixed reference frame. The final question is “How can a non-inertial reference frame be drawn or described?”

1Special thanks to my mentor Dr. Charles Rogers.

11:24AM B3.00008 Vacuum Energy and Its Consequences, LIONEL HEWETT, Texas A&M University-Kingsville — Intuitively one would think that a perfect vacuum should contain no energy. However, quantum mechanics asserts that virtual particles popping in and out of existence too fast to be observed directly should produce a non-zero average energy density for empty space. This presentation discusses how quantum mechanics predicts too large a value for this energy density, how the Casimir effect correctly predicts the measured value of the vacuum energy between closely spaced objects, how time-symmetric cosmology predicts the energy density of interstellar space, how vacuum energy produces negative pressure, how vacuum energy causes the current universe to accelerate its expansion, and why vacuum energy cannot be tapped so as to produce an inexhaustible source of energy for all mankind.

11:36AM B3.00009 Teaching Relativity and Quantum Mechanics to Non-Science Majors, HEATHER GALLOWAY, Texas State University — A course titled “Relativity and Quantum Mechanics” was offered to a group of honors students from a variety of majors. The curriculum will be described and compared to other class outlines for this type of course. This class included a laboratory component which is not often included in a non-majors course. The response of students from different disciplines gives insight into other ways the course could be improved. While some outcomes of the course were expected, such as the use of history to engage students, other successes and failures of the course were more surprising.

Friday, October 23, 2009 10:00AM - 11:48AM — Session B4 Astronomy and Astrophysics LBJ Student Center 3-9.1

10:00AM B4.00001 Three-body recombination in ultracold plasmas: small energy transfer with large consequences, D. VRINCEANU, Texas Southern University, T. POHL, Max Plank Institute, Dresden, Germany, H.R. SADEGHPOUR, Harvard-Smithsonian Center for Astrophysics — Extensive Monte Carlo calculations of electron-impact induced transitions rates between highly excited Rydberg states, and ionization rate, and particle-in-cell simulation of ultracold neutral plasma evolution and cooling, are presented. While for large energy transfer, our calculations confirm the well known Mansbach and Keck’s rate formulae (P. Mansbach and J. Keck, Phys. Rev. 181, 275(1969)), significant deviations for small energy transfer are found. Comparison of plasma expansion velocity in an strontium Ultracold Neutral Plasma experiment and Rydberg atom recombination in a xenon Ultracold Neutral Plasma are made, illustrating the applicability of such differences. The effects of the corrections introduced to the Mansbach and Keck rates are more pronounced for short time dynamics and almost insignificant for steady state and equilibrium quantities.

10:12AM B4.00002 Quasar Jet Acceleration, NICHOLAS POLITO, DAVID HOUGH, Trinity University — We observed radio jets in six lobe-dominated quasars (LDQs) from 1995 to 2008 using the NRAO VLBA at 8.4 and 15 GHz. These observations have tracked jet component positions and velocities over that time period. There is a correlation between apparent jet speed and projected core distance in these LDQs at greater than 99 per cent confidence levels (Hough 2008, Extragalactic Jets, eds: Rector and DeYoung, ASP, p. 274). Four of our sources show this effect particularly strongly. We only tracked single jet components over relatively short distances, but the assumption of a unique velocity profile allows us to study component motion on an effective timescale of approximately 20-50 years. Results for 3C207 and 3C263 show a good fit using a constant acceleration model. The cause of such acceleration is still unknown, though “magnetic acceleration” by a gradient in magnetic field pressure is one possibility.

10:24AM B4.00003 Investigation of Carbon Abundance in the Crab Nebula1, ANDREA KATZ, TIMOTHY SATTERFIELD, GORDON MACALPINE, Trinity University — As part of a larger program to map elemental distributions in the Crab Nebula supernova remnant, we have carefully investigated the [CI] 9850 emission line as a means for measuring the gaseous carbon mass fraction. Knowledge of the amount of carbon is necessary for understanding the progress of nucleosynthesis in the gas. Whereas this near-infrared line is very weak and not used for abundance determinations in most astronomical nebulae, it is “anomalously” strong in the Crab Nebula. In order to determine whether or not [CI] 9850 is a reliable indicator of carbon abundance, we employed a numerical photoionization code to examine the dependence of [CI] 9850 emission on various factors, including carbon, helium, nitrogen, and oxygen abundances. We also varied the ionization parameter and hydrogen density to gain insight regarding the huge difference in strength of this line in other types of objects. Our calculations show that [CI] 9850 is a robust indicator of carbon abundance in the Crab Nebula, where it is visible because of a high helium mass fraction and a low ionization parameter, which are not found in other nebulae

1This work was supported by Trinity University and an endowment from Mr. Gilbert Denman.
10:36AM B4.00004 Elemental Distributions in a Supernova Remnant1, TIMOTHY SATTERFIELD, ANDREA KATZ, GORDON MACALPINE, Trinity University — Numerical photoionization models, created to match numerous observed spectra, are allowing us to study consistent elemental abundances and associated nuclear processing stages for gas in the Crab Nebula supernova remnant. In order to provide a better understanding of nucleosynthesis in the star that exploded, and also to provide insights into the explosive event, we are mapping spatial distributions for the important elements helium, nitrogen, oxygen, and sulfur over the observed nebular structure. We obtained and calibrated new emission-line images from the McDonald Observatory, and we developed accurate procedures involving grids of photoionization models to map the element mass fractions. These maps illustrate widely distributed and localized evidence of nuclear processing stages, such as the CNO cycle, helium burning, and oxygen burning. Each element map is uniquely different and contains important information about stellar nucleosynthesis and the explosive distribution of elements.

1This work was supported by Trinity University and an endowment from Mr. Gilbert Denman.

10:48AM B4.00005 Testing a New Detection Method for RR Lyrae Variable Stars, TALITHA MUEHLBRAD1, W. LEE POWELL JR., Texas Lutheran University, RONALD WILHELM, University of Kentucky, DYLAN GINN, University of Texas San Antonio, ANDREW JASTRAM, Texas A&M University — We have tested a new means of identifying RR Lyrae variable stars using large survey single-epoch, out-of-phase photometric and spectroscopic observations. The technique utilizes the marked discrepancy between (g – r) color and Balmer-line strengths that are taken out of phase with each other. Using data collected from the 0.8-meter telescope at the McDonald Observatory for 13 halo-field stars this summer (two of which were previously confirmed RR Lyrae stars), we showed a discovery efficiency of ∼92%. There is an overall discovery efficiency of ∼85% using data collected from SDSS Stripe 82. The long-term goal for discovery of halo-field RR Lyrae stars is to probe the galaxy’s halo substructure, and the properties of halo-field RR Lyrae stars in general.

10:00AM B4.00006 Rediscovering Kepler’s Third Law using NASA data, JASON KEITH, PAUL SPRING-STEEN, University of Texas at El Paso, Physics Dept., ASTROPHYSICS TEAM — Kepler’s three laws of planetary motion were discovered around four hundred years ago using data that was meticulously gathered by Tycho Brahe through naked eye observations. Here we will show that the same Kepler’s result illustrated in his third planetary law still holds today, by using modern data from NASA. In addition, we discuss how all three of Kepler’s laws of planetary motion can be derived directly from Newton’s Gravitational law.

11:12AM B4.00007 Chaos and the 3-Body Problem, BILLY QUARLES, MANFRED CUNTZ, UT Arlington — The Circular Restricted 3-Body Problem (CR3BP) has been studied for many years. Classically it has been shown to potentially lead to chaos. However, instability and chaos are not synonymous. In exploring numerically the orbits in the CR3BP, we seek to establish criteria by determining which initial conditions will produce stable orbits, stable chaotic orbits, or unstable orbits. Using Java programming, we produced software based on computational algorithms to calculate and visually animate the orbit of the 3rd smaller body. Our software operates in a rotating reference frame allowing a clear visual representation of the planetary orbit. After establishing criteria for the short term, we look to further establish the long term stability by the use of Lyapunov exponents. By finding long term stable orbits in the CR3BP, we may be able to predict more exotic extra-solar planetary orbital configurations than what has already been observationally established.

11:24AM B4.00008 Astronomical Dating of Edvard Munch’s Summer Sky Paintings,AVA POPE, DONALD OLSON, Texas State University - San Marcos — Norwegian painter Edvard Munch, most famous for The Scream, created many spectacular works depicting the skies of Norway. Our Texas State group used astronomical methods to analyze three of these paintings: Starry Night, The Storm, and Sunrise in Asgardstrand. Astronomical dating of these paintings has some importance because the precise days when Munch visited Asgardstrand are unknown. Our research group traveled to Norway in August 2008 to find the locations from which Munch painted these three works. We then used astronomical calculations, topographical analysis, historical photographs, and weather records to determine the precise dates and times for the scenes depicted in these paintings.

11:36AM B4.00009 Analyzing broadband electromagnetic pulses to geo-locate lightning, THOMAS REMMERT, Texas State University — Lightning discharges are taking place globally on average of 100 times per second. Systems exist to detect the location of cloud-to-ground and cloud-to-cloud discharges, but have disadvantages. Commercial units are generally expensive, have short range, and are densely packed in his third planetary law still holds today, by using modern data from NASA. In addition, we discuss how all three of Kepler’s laws of planetary motion can be derived directly from Newton’s Gravitational law.

Friday, October 23, 2009 2:00PM - 5:00PM –
Session C1 Condensed Matter Physics II LBJ Student Center 3-9.1

2:00PM C1.00001 Magnetic polystyrene-based microbeads for bioassays, MARCELA L. REDIGOLO, GAYTAM HEMANI, STEPHEN ZHOU, DIANDRA L. LESLIE-PELECKY, University of Texas at Dallas — Flow cytometry uses fluorescence to detect specific compounds in a sample; however, the number of different wavelengths that can be detected limits the number of analytes that can be identified. We are adding magnetism as an additional parameter to increase the number of analytes that can be simultaneously screened for. We report the synthesis of polystyrene microbeads loaded with exchange-coupled samarium cobalt (SmCO5) particles. SmCO5 was chosen for its high remanent magnetization, allowing measurement without the need for an applied field. The magnetic-particle-containing polystyrene beads had an average size of 8 μm. Dispersability in water was enhanced by coating them with the triblock copolymer Pluronic F-127, which also facilitates future functionalization. We will present the synthesis of the microparticles and the effect of synthesis parameters on their magnetic and physical properties.
2:12PM C1.00002 Thermal Properties of Metallic Nanowires: Modeling & Experiment1, NENAD STOJANOVIC, JORDAN BERG, Texas Tech University. SANJEEVA MAITHRIPALA, University of Peradeniya, Sri Lanka, MARK HOLTZ, Texas Tech University — Effects such as surface and grain boundary scattering significantly influence electrical and thermal properties of nanoscale materials with important practical implications for current and future electronics and photonics. Conventional wisdom for metals holds that thermal transport is predominantly by electrons and transport by phonons is negligible. This assumption is used to justify the use of the Wiedemann-Franz law to infer thermal conductivity based on measurements of electrical resistivity. Recently experiments suggest a breakdown of the Wiedemann-Franz law at the nanoscale. This talk will examine the assumption that thermal transport by phonons can be neglected. The electrical resistivities and thermal conductivities of aluminum nanowires of various sizes are directly measured. These values are used in conjunction with the Boltzmann transport equation to conclude that the Wiedemann-Franz law describes the electronic component of thermal conductivity, but that the phonon term must also be considered. A novel experimental device is described for the direct thermal conductivity measurements.

1Supported by National Science Foundation and J. F Maddox Foundation.

2:24PM C1.00003 An investigation of wetting phase evaporation from capillary porous matrices1, CURTIS LEE, JESSICA WHITE, AARON SANSM, LORNE DAVIS, APS — Drying of porous materials is important to a wide variety of applications spanning art, architecture, cooking, agriculture, and engineering. To better understand the phenomenon, we used low-field NMR relaxometry to gain insight into the behavior of air and water within the individual pores during drying. We applied a singular value decomposition algorithm to invert low-field NMR CPMG T2 data into apparent pore size distributions and measured the drying rates and the changes in relaxation distributions for alumina matrices of differing pore sizes and for sandstones. We observed two regions of constant drying rate with a large, sharp break in slope when the wetting phase saturation became discontinuous. In both regimes, the surface evaporation rate was controlled by capillary wicking action. Moreover, the drying rate in the early regime was greatly enhanced over evaporation from bulk fluid. The continuous decrease in mean T2 of the sample during drying suggests that air penetrates along the pore centers while leaving water wetting the pore walls.

1This research was supported by a grant from the W. M. Keck Foundation.

2:36PM C1.00004 Automation of the Al anodization used for the fabrication of highly ordered sub-100-nm nanopore arrays, JACOB GONZALES, Department of Physics, Texas A&M University, KARIE BADGLEY, IGOR V. ROSCHCHIN, Department of Physics, Texas A&M University — The anodization of aluminum films grown on silicon substrates under appropriate conditions is used to fabricate porous alumina arrays. Such porous arrays are used as sensors or lithography masks for fabrication of sub-100-nm nanodot arrays. The self-assembly of these pores into ordered arrays is determined by anodization parameters. We report on the automation of the anodization process that allows us to monitor and control these parameters. To improve ordering, two-step anodization is used. Through real-time current integration, computer software determines the depth of the anodized alumina, which allows us to stop the 1st anodization step. Control of voltage and temperature is also important for controlling pore diameters. Voltage and current are plotted in real time and recorded along with other parameters of sample fabrication. We investigate possibilities to automatically stop the anodization, once the Al film is anodized all the way through, using analysis of the rate of change of the anodization current. Control and optimization of other parameters will be discussed. Funded by Texas A&M University and Texas A&M University – CONACyT Collaborative Research Grant Program.

2:48PM C1.00005 Metallic out-diffusion quantification in polymers by x-ray fluorescence, MIGUEL BENCOMO, MIGUEL CASTRO-COLIN, Department of Physics, U. of Texas at El Paso, 500 W. Univ. Ave, El Paso, TX 79968 — X-ray fluorescence is a technique that has sensitivity within parts-per-million elemental content level, which is sufficient to probe trace materials. In this study two X-ray sources were used, copper and silver radiation, to detect metallic additives used to modify the properties of polymers. The technique requires minimal to no sample preparation and is non-destructive. In the present case trace materials of heavy metals are identified in two types of polymers, propylene and poly carbonate, before and after being exposed to energy intake sufficient to detach the metals directly or to promote the formation of hydroperoxide; this last one indirectly produces detachment through re-arrangement of the polymeric matrix. Quantification of heavy metal detachment and out-diffusion is relevant due to possible adverse effects that may arise when such elements make contact with consumables.

3:00PM C1.00006 Zr Doping Effects on LiFePO4 Cathode Materials for Lithium-Ion Batteries, TRAVIS NEELEY, JACOB HILL, JULIO SANCHEZ-BERLANGA, GAN LIANG, HUI FANG — LiFePO4 cathode materials doped with various percentages of Zr on the Fe site are synthesized using both the solution and ball milling methods. X-ray diffraction, cyclic voltammetry, and constant current charge/discharge measurements are employed to characterize the structural, electronic, and electrochemical properties of the samples. The effects caused by Zr doping on Fe site sintered at various temperatures will be discussed and presented.

3:12PM C1.00007 Doping Effects of LiFePO4 Cathode Materials for Lithium-Ion Batteries, JACOB HILL, JULIO SANCHEZ BERLANGA, TRAVIS NEELEY, GAN LIANG, HUI FANG, Sam Houston State University — The effects of doping on Fe site of LiFePO4 cathode materials with varying concentrations of W, synthesized by the solution and ball milling methods, will be presented. X-ray diffraction, cyclic voltammetry, and constant current charge/discharge measurements are employed to characterize the structural, electronic, and electro chemical properties of the samples. The effects of varying reaction temperature and environmental composition will also be analyzed.

3:24PM C1.00008 Magnetic Thermal Hysteresis in Dy nanolayers1, AJANI ROSS, ALI KOYMEN, University of Texas Arlington, ARTUR CARRICO, Federal University of Rio Grande do Norte, ANA DANTAS, ROBERT CAMLEY, University of Colorado at Colorado Springs — Magnetic thermal hysteresis is observed when the temperature dependent magnetic properties of a material are reliant on the starting point of the measurement. Samples of pure Dysprosium (Dy) were grown on substrates of glass and sapphire. We observed magnetic thermal hysteresis in these thin film Dy samples at low values of constant external magnetic field strengths. The temperature is swept from 20K to 300K at constant field, then back (300K to 20K) under the same field. In these temperature sweeps differences in magnetic moment were observed near the low end of the temperature range. Experiments are being done, currently, to confirm the existence of alternate helicity (AH-state) and helical (H-state) states in Dy films, which are believed to be the cause of the observed thermal hysteresis.

1With help from the Weclh Foundation.
3:36PM C1.00009 Synthesis and Characterization of LiFePO₄ Cathode with Fe:P Deficiency for Lithium Ion Batteries. HUILI FANG, TRAVIS NEELEY, JACOB HILL, GAN LIANG, Sam Houston State University, Department of Physics, SAM HOUSTON STATE UNIVERSITY TEAM — LiFePO₄ with Fe:P deficiency has been demonstrated a promising cathode material of lithium ion battery for fast rate, high capacity applications. In this study, LiFePO₄ with various amount of Fe:P deficiency are synthesized using high energy ball milling and temperature controlled sintering under reduced gas. X-ray diffraction, X-ray absorption, cyclic voltammetry and constant current charge/discharge measurements are employed to characterize the structural and electrochemical properties of the samples. The effects brought by Fe:P deficiency on charger/discharge rate and capacity will be discussed and presented.

3:48PM C1.00010 The effects of oxidizing agents in non-contact synthesis of porous silicon. LAUREN BENNETT, Angelo State University Department of Physics, JOE VELASQUEZ, III, Angelo State University Department of Chemistry, TONI SAUNCY, Angelo State University Department of Physics — A variety of different oxidizing agents have been studied for their ability to aid in the synthesis of porous silicon by noncontact photo-etching in a 40% HF solution. A single substrate, n-type Sb-doped silicon was used as the base material. The single crystal was cleaved into 1cm² pieces, which were then processed with a series of different oxidizing agents. The oxidizing agents were selected based upon potential H⁺ contribution during the etching reaction process. The resulting thin film regions on each sample were characterized using Raman spectroscopy to investigate crystallographic information, photoluminescence spectroscopy to confirm light emission from the thin films and surface resistivity, with film thickness determined by spectroscopic ellipsometry measurements. A large range of pore size and structure was achieved, ranging from the nano- to the mesoporous regime.

4:00PM C1.00011 Spectroscopic Ellipsometry: Multilayer and porous structures. STEVE JACKSON, Angelo State University Department of Physics, RAVI DROOPAD, Texas State University, TONI SAUNCY, Angelo State University Department of Physics — Due to its non-destructive nature, spectroscopic ellipsometry has become commonplace in the semiconductor industry as a widely used thin film characterization technique. This model dependent technique exploits polarization states of light to study the structures and compositions of thin films ranging in thickness from just a few angstroms to several microns. In this study, three multi-layered MBE-grown thin film stacks were characterized over a spectral range of 2.0-5.0eV along with the irregular structures of a series of stain-etched porous silicon thin film layers. By using a novel modeling technique, the pore size and distribution were determined and correlated with surface resistivity and Raman measurements of the same structures.

4:12PM C1.00012 NMR Studies of Sn clathrates. XIANG ZHENG, SERGIO RODRIGUEZ, JOSEPH H. ROSS, JR, Department of Physics, Texas A&M University — Clathrates are materials with an open cage structure. Because of the low thermal conductivities these materials may be good choices for thermoelectric applications and energy saving devices. Thus they have become important materials for current study. We report T¹¹Ga NMR experiments on Ba₅Ga₄Sn₃O clathrates, which have particularly low thermal conductivities. We will compare different properties of the two types of Ba₅Ga₄Sn₃O clathrates, type-I and type-VIII, which are different in structure. The NMR lineshapes and relaxation times were measured in temperatures between 295K and 4.2K. For a type-I sample, we observe several different peaks with an unexpectedly large range of Knight shift. Also we observe large changes for the relaxation times at low temperature which are not consistent with the Korringa law, the normal behavior for NMR due to conduction electrons. These results are different from what we observe in other clathrates. Thus we tentatively assign these results to rattling type atomic motion, and will compare the data to models for relaxation due to such motion. This research is supported by the Robert A. Welch Foundation.

4:24PM C1.00013 Magnetoplastic Properties of Thick Films on Nitinol Substrate. AMANDA GREGORY, Texas State University at San Marcos, MARTIN SABLICK, Applied Magnetic and Physical Modeling, San Antonio, Texas, WILHELMUS GEERTS, KYLE SMITH, ANUP BANDYOPADHYAY, Texas State University at San Marcos, FERNANDO LANDGRAF, Universidade de Sao Paulo, Sao Paulo, SP, Brazil, MARCOS DE CAMPOS, Universidade Federal Fluminense, Volta Redonda, RJ, Brazil — Understanding the magnetic properties of plastically deformed thin films is vital to the development of thin film devices that will undergo unavoidable stressing. We covered polished nitinol substrates with Fe and Fe-Si films up to 1 micron thick and subjected them to stress which was performed both laterally and by bending over cylinders. Under extreme lateral straining the films would inhomogeneously detach from the substrate. In samples that underwent strain via bending there was no observed film detachment. The magnetic remanence decreased when applied parallel to the stress axis and increased when applied perpendicularly. The coercivity of the strained films exhibited marked change only when measured perpendicular to the stress axis, where it was observed to decrease. Modeling calculations show that residual compressive stress dominates the magnetoplastic properties of thin films.

4:36PM C1.00014 Introduction of Flux Pinning Centers for Use in Nb₃Sn Superconducting Wire. DAVID RAHMANI, KYLIE DAMBORSKY, PETER MONTYRE, NATHANIEL POGUE, Texas A&M University Department of Physics — Powder metallurgy was used to introduce a homogeneously heterogeneous distribution of nanoscale flux pinning centers in Nb rod for future use in Nb₃Sn superconducting wire. The pinning centers consisted of Y, Y2O3, W, Cu, Zr, and Ti. Flux pinning centers in superconducting wire would prevent a decrease in critical current density in the presence of a high magnetic field. The blended powders were consolidated using Cold Isostatic Pressing (CIP) at 50000 PSI. The samples were analyzed and found to contain a high concentration of oxygen, which was found to be excessive for use in a superconductor and may have contributed to poor performance in CIP. Due to the high level of oxygen found in commercially available Nb powder, future attempts will require the manufacturing of Nb powder with a low oxygen content.

4:48PM C1.00015 Quantum Anomalous Hall Effect with Cold Atoms Trapped in a Square Lattice. XIONG-JUN LIU, XIN LIU, Department of Physics, Texas A&M University, College Station, Texas 77843-4242, CONJUN WU, Department of Physics, University of California, San Diego, California 92093, JAIRO SINNOVA, Department of Physics, Texas A&M University, College Station, Texas 77843-4242 — Realization of quantum anomalous Hall effect (QAHE) [1] not only has the potential applications through the study of topological phases such as the technologically important topological insulators, but also has great interest from a basic physics point of view. In this work we propose the realization of the QAHE in a square optical lattice which can be generated from available experimental set-ups of double-well lattices with minor modifications [2]. A periodic gauge potential induced by atom-light interaction is introduced to give a Peierls phase for the nearest-neighbor site hopping to break time-reversal symmetry. The quantized anomalous Hall conductivity is investigated by calculating the Chern number as well as the chiral gapless edge states of our system. We study in detail the experimental detection of the edge and bulk states with which one can determine the topological phase transition from usual insulating phase to quantum anomalous Hall phase. Reference: [1] F. D. M. Haldane, Phys. Rev. Lett. 61, 2015 (1988). [2] X. -J. Liu, X. Liu, C. Wu and J. Sinova, submitted to PRL for publication (2009).
2:00PM C2.00001 A Universal Mechanism for Ultrafast Laser Pulse Control of Vibrational Excitations1, XIAO ZHOU, Texas A&M University, Wuhuan University, ZHIBIN LIN, Texas A&M University, Colorado School of Mines, REMRSEC, CHENWEI JIANG, Texas A&M University, Xi’an Jiaotong University, ROLAND ALLEN, Texas A&M University — An important task for ultrafast laser techniques is to control the vibrational excitations of materials. Recently off-resonant ultrafast laser experiments show that the vibrational excitation modes and amplitudes depend on the properties of the laser pulses. A numerical-simulation investigation has suggested that the vibrational excitations depend only on the laser pulse duration, but did not provide a clear and satisfactory explanation. Our theoretical investigation for carbon nanotubes shows that there exists a universal mechanism for controlling vibrational excitations by ultrafast laser pulses, which is independently confirmed by our numerical simulations with semiclassical electron-radiation-ion dynamics (SERID).

1Work supported by the Robert A. Welch Foundation, Grant A-0929.

2:12PM C2.00002 Coupled dynamics of electron quasiparticles, the electromagnetic field, and nuclear motion in complex systems1, ROLAND ALLEN, Texas A&M University, XIAO ZHOU, Texas A&M University, Wuhuan University, MENG GAO, Texas A&M University, CHENWEI JIANG, Texas A&M University, Xi’an Jiaotong University, ZHIBIN LIN, Texas A&M University, Colorado School of Mines, REMRSEC — A vast number of problems in physics, chemistry, biology, and engineering involve the coupled dynamics of electrons and ions in materials and molecules, and their interaction with the radiation field. Here we review some recent work by the present investigators in both developing new techniques to address these problems and performing detailed simulations for systems that are currently of intense interest — for example, graphene and carbon nanotubes. The new theoretical ideas focus largely on (1) the inclusion of many-body effects (through e.g. a time-dependent GW self-energy) and (2) the use of the Kadanoff-Baym equations for nonequilibrium Green’s functions. We will derive a time-dependent quasiparticle equation, which is the time-domain and nonequilibrium version of the well-known frequency-domain and equilibrium quasiparticle equation derived by Hedin and subsequently used by many groups (to obtain e.g. the correct band gaps of semiconductors).

1Work supported by the Robert A. Welch Foundation, Grant A-0929.

2:24PM C2.00003 Dynamical simulations of photochemical reactions of trans-stilbene, and coherent control of C=O vibrational response1, CHENWEI JIANG, Texas A&M University, Xi’an Jiaotong University, FULLI LI, RUIHUA XIE, Xi’an Jiaotong University, ROLAND ALLEN, Texas A&M University — Trans-to-cis photoisomerization of stilbene, induced by a femtosecond-scale laser pulse, has been observed in simulations employing semiclassical electron-radiation-ion dynamics (SERID). Our results demonstrate that trans-to-cis and cis-to-trans isomerization involve the same basic mechanism. We also predict that another photochemical reaction, photocyclization of trans-stilbene to 4a,4b-dihydrophenanthrene (DHP), can be achieved using an ultrashort laser pulse. Specifically, the trans-stilbene molecule is observed first to isomerize to cis-stilbene (as an excited-state intermediate) after more than one picosecond, and then to form a new bond to become DHP, after a few hundred additional femtoseconds. For C=O at low temperature, we predict that specific vibrational modes can be excited by optimally choosing the delay between two femtosecond-scale pulses.

1Work supported by the Robert A. Welch Foundation, Grant A-0929.

2:36PM C2.00004 Iron nitride nanoparticles synthesized by inert gas condensation, PRASANNA SHAH, BRENNT FORD, ANDREW DEAN, DIANDRA PELECKY, Department of Physics, University of Texas at Dallas, Richardson TX 75080 — Inert gas condensation (IGC) is a highly versatile technique to synthesize monodisperse nanoparticles (NP). Earlier research done in our group on iron oxide nanoparticles and Fe- and Co-based fluids suggests that these NP’s are well suited for magnetic drug delivery, however, their utility would be dramatically enhanced if they exhibited higher saturation magnetization. Iron-oxide nanoparticles are the most commonly studied system; however, the saturation magnetization (70-90 emu/g) is considerably lower than pure Fe (210 emu/g). Fe NPs tend to oxidize easily, so we are exploring Fe-N and Fe-C alternatives. We have used IGC to synthesize Fe-N nanoparticles (mean sizes ~ 10-20 nm) using Fe deposition followed by gaseous nitrogenation, and via reactive inert-gas condensation. Post-deposition nitrogenation does not form Fe-N phases, nor protect the nanoparticles from oxidation. By reactive sputtering with varying relative concentration of Ar/N2 ratio during sputtering will be reported.

2:48PM C2.00005 Fe/Au Core-Shell Nanoparticles for Biomedical Applications, AMANDEEP SRA, DIANDRA LESLIE-PELECKY, University of Texas at Dallas — The physical properties of nanoparticles, including size, composition and surface chemistry, greatly influence biological and pharmacological properties and, ultimately, their clinical applications. Superparamagnetic iron oxide nanoparticles are widely used for applications such as MRI contrast agents, drug delivery via magnetic targeting and hyperthermia due to their chemical stability and biocompatibility; however, enhancing the saturation magnetization (M_s) of nanoparticles would produce greater sensitivity. Our design strategy involves a bottom-up wet chemistry approach to the synthesis of Fe nanoparticles. Specific advantages of Fe are the high value of M_s (210 emu/g in bulk) coupled with low toxicity; however, Fe nanoparticles must be protected from oxidation, which causes a dramatic reduction in M_s. To circumvent oxidation, Fe nanoparticles are coated with a Au shell that prevents the oxidation of the magnetic core and also provides the nanoparticles with plasmonic properties for optical stimulation. Ligands of various functionalities can be introduced through the well-established Au-thiol surface chemistry for different biomedical applications while maintaining the magnetic functionality of the Fe core. In this presentation, we will discuss the physical, chemical and magnetic properties of our Fe/Au nanoparticles and their resistance to oxidation.

3:00PM C2.00006 Multiple-mode grating-coupled enhancement of fluorescence by gold nanowires, IURI GAGNIDZE, STEPHANIE WIELE1, JENNIFER STEELE, Trinity University — We demonstrate directional enhanced fluorescence emission from a gold wire grating. The dominant enhancement mechanism was shown to be excited fluorophores decaying into surface plasmon modes that radiate via the periodicity of the grating. The emission from fluorophores decaying in this way was strongly directional. The fluorophores efficiently coupled to multiple surface plasmon grating modes on both the top and substrate side of the grating, enhancing a broad spectrum of fluorescence wavelengths. This makes periodic systems more flexible than their nanoparticle counterparts. Coupling to multiple modes also allows gratings to enhance fluorescence at wavelengths smaller than the period of the grating, allowing gratings with micron and larger sized features to enhance fluorescence wavelengths in the visible range. This greatly loosens fabrication requirements for potential applications.

1Author is now at the University of Texas at Austin
3:12PM C2.00007 Reduction Kinetics of Graphene Oxide Determined by Temperature Programmed Desorption, CARL VENTRICE, NICHOLAS CLARK, DANIEL FIELD, HEIKE GEISLER, Dept. of Physics, Texas State University, INWHA JUNG, DONGXING YANG, RICHARD PINER, RODNEY RUOFF, Dept. of Mechanical Engineering, University of Texas — Graphene oxide, which is an electrical insulator, shows promise for use in several technological applications such as dielectric layers in nanoscale electronic devices or as the active region of chemical sensors. In principle, graphene oxide could also be used as a precursor for the formation of large-scale graphene films by either thermal or chemical reduction of the graphene oxide. In order to determine the thermal stability and reduction kinetics of graphene oxide, temperature program desorption (TPD) measurements have been performed on multilayer films of graphene oxide deposited on SiO$_2$/Si(100) substrates. The graphene oxide was exfoliated from the graphite oxide source material by slow-stirring in aqueous solution, which produces single-layer platelets with an average lateral size of $\sim$10 $\mu$m. From the TPD measurements, it was determined that the decomposition process begins at $\sim$80 $^\circ$C. The primary desorption products of the graphene oxide films for temperatures up to 300 $^\circ$C are H$_2$O, CO$_2$, and CO, with only trace amounts of O$_2$ being detected. An activation energy of 1.4 eV/molecule was determined by assuming an Arrhenius dependence for the decomposition process.

3:24PM C2.00008 In-situ dispersion and optical manipulation of magnetic carbon nanoparticles, SUNIL GUSAIN, SAMARENDRA MOHANTY, ALI KOYMEN, UT Arlington — Magnetic carbon nanoparticles are finding increasing use in enhancing contrast of imaging and photo thermal therapy of cancer. However, conventional synthesis of these nanoparticles involves very cumbersome and skillful inter-ventions. We developed a simple method for controlled synthesis of amorphous carbon nanoparticles using dense medium plasma generated in the cavitation field of an ultrasonic horn in Benzene using two metal electrodes. In this method, the electrode (metallic) material is incorporated into the C nanoparticles, as confirmed by hysteresis curve, measured using SQUID magnetometer. TEM images showed that the size of the C nanoparticles is in the range of 8-14 nm and the electron diffraction established that these nanoparticles are amorphous. The absorption spectrum in near-IR region was measured to be of similar value as in the visible region, making it a very useful candidate for photothermal therapy using near-infrared laser in the biological window. These carbon nanoparticles aggregates and tend to form clusters. For in-situ dispersion of these nanoparticles, we made use of the absorption property of these nanoparticles using a focused near-IR cw laser microbeam (1064nm). We believe the magnetic property of these nanoparticles would allow effective localization in the tumor region by application of external magnetic field.

3:36PM C2.00009 The nanoscale grain size of materials of electrodes of AMTEC and its longevity, M.A.K. LODHII, Texas Tech U, JAVID SAMI, Punjab U — The Alkali Metal Thermal-to-Electric Converter (AMTEC) is perhaps one of the most desirable devices for directly converting heat into electrical energy, particularly for space applications. Two major components responsible for power output of AMTEC are the electrolyte and the electrode. In this work we have focused the research on the AMTEC electrodes, which have further reduced the power degradation as the time goes by in using the AMTEC. If the grain size of the electrode material reaches a certain dimension, about 750 nm, the power output starts degrading fast. It is very important because this condition should not occur until after the desirable lifetime of AMTEC and its acceptable fraction of power degradation have reached. We have worked out the parameters for a 15 years of life and 10% of acceptable power degradation factor for various electrode materials. This study aims at improving the performance of the electrode by looking into the changes of the material properties with respect to time. These parameters refer to the grain growth involved in the grain mobility model for electrode materials.

3:48PM C2.00010 A lanthanide complex doped silica thin film for detecting trace chemical toxins, JOHN COMO, LOUISA HOPE-WEEKS, KELVIN CHENG, Texas Tech University — A highly luminescent lanthanide metal–ligand complex was doped into a mesoporous silica sol-gel matrix for the development of a nanosensor to detect trace toxic chemicals. The metal ion Eu$^{3+}$ was coordinated with various organic ligands to produce different self-assembling compounds that exhibit different sensitivity to targeted chemical toxins. Under ultra-violet excitation, the compound exhibited intense, long-lived millisecond phosphorescence with a large Stokes shift. A detector was fabricated by doping a silica sol-gel thin film matrix with the Eu$^{3+}$ compound and was exposed to liquid and gas phase toxins. Upon exposure, the compound underwent fast fluorescence quenching and the emission/source intensity ratio was measured as a function of time for various concentrations of toxins.

4:00PM C2.00011 The formation of silicon nanoparticles at atmospheric pressure by rapid thermal anneal, JUSTIN FRASIER, JONATHAN PREISS, BENEDICT ANYAMESEM-MENSAH, ANUP BANDYOPADHYAY, GREGORY SPENCER, Texas State University — In this study, the formation of silicon nanoparticles by thermal annealing of an initial silicon-on-insulator (SOI) structure is being performed. The SOI samples are synthesized by thermal oxidation of Si (100) wafers followed by magnetron or ion beam sputtering of a thin Si top layer. The thermal anneals are performed in a rapid thermal anneal system at temperatures ranging from 600°C to 900°C under atmospheric pressure of flowing Ar gas. The nanoparticle formation process is being studied as a function of the thermal anneal temperature, anneal time, and Si layer thickness. The annealed samples are measured by atomic force microscopy to determine the resulting nanoparticle size distributions and synthesis details. Electron microscopy is also being used for analysis. Results for these synthesis experiments and comparisons with other methods will be presented.

4:12PM C2.00012 Synthesis and Characterization of Double Metal Hydroxide Nanoparticles, GARY BEALL, SERGIO CROSBY, YELENA VECHERKINA, Texas State University — A series of double metal hydroxide nanoparticles have been synthesized under hydrothermal conditions with varying charge density. The effect on dispersibility and catalytic behavior have been studied for these particles as a function of charge density. Several of the samples have been converted to organophobic forms by ion exchanging the chloride with various carboxylic acids. The stability of these nanoparticles under hydrothermal conditions with varying charge density has also been conducted. All of the samples have been characterized by TGA, SEM, XRD, and DSC and data from all of these techniques will be reported. The catalytic decomposition of these materials will also be report.

4:24PM C2.00013 Aberrated Optical Tweezers For Manipulation Of Nanoparticles, SAMARENDRA MOHANTY, KUNAL TIWARI, UT Arlington — Asymmetry leading to aberrations is the most unwanted parameter in optics, especially while working on a microscopic system such as optical tweezers using high numerical aperture microscope objectives. While considerable efforts are being made to minimize aberrations in optical tweezers for stable trapping, optical tweezers that are asymmetric in size along transverse directions due to astigmatic beams, enabled controlled rotation of microscopic objects. More interestingly, adding further aberrations (such as coma) in the intensity profile of the asymmetrically shaped optical tweezers, even more complex tasks such as parallel transport of microscopic objects has been achieved. Here, we report transport of dielectric nanoparticles of different sizes using aberrated optical tweezers. The aberrated optical tweezers was generated by using Gaussian output from Ytterbium fiber laser which was first stretched using a cylindrical lens and subsequent aberrations were introduced by either tilting the beam with respect to the microscope objective or by use of an additional lens. We could generate the asymmetric potentials selectively in a controlled way in X and Y-directions over an extended spatial region. This development would further facilitate the growing use of optical tweezers for mixing as well as sorting at nano level.
2:00PM C3.00001 Superconducting RF Cavity for Testing Materials and Fabrication Processes at 1.3 GHz at over 3 times the BCS Limit of Niobium¹, NATHANIEL POGUE, PETER MCINTYRE, AKHDYOR SATTAROV, Texas A&M University — A 1.3 GHz test cavity has been designed to test wafer samples of superconducting materials. The surface magnetic field on the sample wafer is 3.75 times greater than anywhere else on the cavity surface. The cavity also facilitates measurement of the rf surface resistance corresponding to a Q of 10¹⁰. The cavity is operated in a TE(01) mode. A high purity sapphire hemisphere is used to enhance the circulating field on the sample and suppress the fields on the remainder of the cavity surface. The sapphire purity must be tested for its loss tangent and dielectric constant. To test these properties a smaller sapphire rod of the same quality will be inserted into a CEBAF cavity operating in a TE(01) mode. This will allow us to measure the temperature of the sapphire as a function of input energy and time, and the dielectric constant through its effect on the resonant frequency.

¹This work is supported by the DOE Grant DE-PS02-09ER09-05.

2:12PM C3.00002 Development of Digital Hadron Calorimeter Using Gas Electron Multiplier (GEM) Technology¹, SEONGTAE PARK, JACOB SMITH, EDWIN BALDELOMAR, CLAYTON WILLS, MARK SOSEBEE, ANDY WHITE, JAEHOON YU, University of Texas at Arlington, KWANGJUNE PARK, KAERI — High Energy Physics Experiments at future International Linear Collider requires high precision jet energy measurements. For this purpose, the University of Texas at Arlington has been developing gas electron multiplier (GEM) based Digital Hadron Calorimeter (DHCAL) over the past few years. Several large and medium sized GEM detectors have been built. In this talk, the detector construction and its performance test results are presented. Detectors have been tested with Ru106, Fe55 and cosmic ray. Data taking has been done using KPIX ASICs (being developed at SLAC) for front-end readout electronics for SiD detector concept. As a future plan, 1x1 m² large GEM detector construction and testing are described.

2:24PM C3.00003 Laser Testing for the ATLAS Forward Proton Time of Flight Detector, IAN HOWLEY, ANDREW BRANDT, University of Texas Arlington — In 10 trillionths of a second light travels 3mm. Our group at UTA is currently developing the most precise time of flight (TOF) detector ever deployed in a collider experiment, with a resolution on this 10 picosecond scale. In conjunction with several other universities we have proposed to install a fast timing system as part of a proton detector upgrade to the main ATLAS detector at the Large Hadron Collider (LHC). Precise measurement of the timing of proton tracks will allow rejection of background to the physics processes of interest, which include the elusive Higgs Boson. Laser based tests at UTA allow us to measure the response of our detectors downstream electronics including constant fraction discriminators, amplifiers and most importantly the microchannel plate photomultiplier tubes, which are at the heart of this fast timing system. By isolating the individual components of the detector in this fashion, we can fully characterize each device’s response. My research is part of the ongoing data analysis using the CERN analysis package ROOT. By closely examining the pulse height, time difference distributions, and transit time spread (TTS) we are be able to understand the performance of the detectors and electronics in laser and beam tests to better prepare ourselves for future test beams and eventually full scale installation and operation. I will present the latest performance test results from data I have analyzed.

2:36PM C3.00004 Results from the Commissioning of the ATLAS Pixel Detector with Cosmic data, MASAYUKI KONDO, University of Texas at Dallas, ATLAS COLLABORATION — The ATLAS Pixel Detector is the innermost detector of the ATLAS experiment at the Large Hadron Collider at CERN with approximately 80M electronic channels, designed to be high-acceptance, high-resolution, low-noise tracking performance providing the desired refinement in charged track pattern recognition capability in order to meet the stringent track reconstruction requirements of ATLAS. Being the last sub-system installed in ATLAS by the end of June 2007, Pixel Detector was successfully connected, commissioned, and tested in situ while meeting an extremely tight operations schedule, and is ready to take data upon the projected turn-on of the LHC. UTD group has successfully deployed and commissioned the environmental controls crucial for stable detector operation. Since fall 2008, Pixel Detector was included in the combined ATLAS detector operation, collecting physics data with cosmic muons. Details from the Pixel Detector calibration procedures and the results obtained with collected cosmic data, are presented along with the current detector status summary.

2:48PM C3.00005 The Monte Carlo Simulation for the ATLAS Experiment, WEI CHENG WONG, University of Texas at Dallas, ATLAS COLLABORATION — The Monte Carlo simulation of physics events and the ATLAS detector has been a critical part of the Atlas experiment operated at the Large Hadron Collider (LHC) at CERN. Large samples of simulated physics events have been produced that are used for physics and the study of the complex detector. The cutting edge techniques and facilities, including the Grid Computing, the operation of the storage system, simulation validations, user access to the simulated events, the ATLAS Experiment Data Management System, and the user experience, will be presented.

3:00PM C3.00006 TAMU3: High-field superconducting dipole development for future hadron colliders, EDDIE F. HOLIK III, TAMU — High-field superconducting dipole magnets suitable for future hadron colliders are being developed at Texas A&M University. Technology advancements are being pursued to enable the use of advanced superconductors Nb₃Sn and Bi-2212. These techniques include stress management, flux-plate control of persistent-current multipole, fine-filament superconducting mixed-strand cable, block-coil geometry for ease of construction and potential suppression of snap-back, and metal-filled bladders to provide uniform surface compliance and coil pre-load. The latest such magnet, TAMU3, is presently under construction. Its design and fabrication will be described.

3:12PM C3.00007 Stress Management and Capacitive Stress Transducers Used in Dipole Magnets, CHRISTOPHER BENSON, PETER MCINTYRE, AL MCINTURFF, ANDREW JAISLE, TREY HOLIK, Texas A&M University — Research in accelerator dipole magnet technology is aimed first and foremost to produce as high a magnetic field as possible. However, stresses in the superconducting coil packages from Lorentz forces limit the maximum field. Future dipole magnets are being designed, built, and tested by the Accelerator Research Lab at Texas A&M University which incorporate unique stress management techniques. Within these magnets, custom capacitive pressure transducers are being developed to monitor the Lorentz forces within the coil package. A brief introduction to stress management techniques used in future TAMU magnets will be given, along with the status of current and future research involving tooling and fabrication techniques used in the production of capacitive pressure transducers.
Using Cosmic Ray Data

Carlos Medina, University of Texas at Arlington — The Large Hadron Collider is the largest and most ambitious experiment in high-energy physics history. It involves the greatest number of scientists from around the world. The first collisions will start being produced in late 2009, and we expect that the information collected will help us understand the physics behind the standard model such as higgs physics and the supersymmetric theories. The high energy physics group in UTA is actively involved with the design, construction and commissioning process of the ATLAS Tile Calorimeter. This work presents an analysis on the inter-calibration of the ITC (intermediate tile calorimeter) cell response to cosmic rays detection. Based on the cosmic data recently taken in the ATLAS detector, while waiting for real collisions, we are able to compare values of energy deposition in individual cells to guarantee the homogeneous performance of the ITC.

3:36PM C3.00009 Petavac: 100 TeV hadron collisions in the SSC tunnel

Peter McIntyre, Akhdiyor Sattarov, Texas A&M University — Nb₃Sn superconductor has been tamed into practical use to make possible high-field dipoles (16 T) and solenoids (25 T). A ring of Nb₃Sn dipoles and quadrupoles could be installed in the SSC tunnel in Waxahachie to make a hadron collider with 100 TeV collision energy - 7 times higher than the design energy of CERN’s LHC. The Petavac would access new physics through boson fusion, making it possible to observe signals from supersymmetry and superstrings up to ~10 TeV mass scale.

3:48PM C3.00010 Study of hadronic W decays in the Jets+MET final state

Kittikul Kovitanggoon, Sung-Won Lee, Texas Tech University, Teruki Kamon, Michael Weinberger, Texas A&M University — We present a systematic study of hadronic W decays in the Jets+MET final state to characterize the supersymmetry signal at the LHC. Because of the complicated end point, the experimental question leads to detection of the Standard Model W bosons (and eventually detecting top quark) in Jets+MET final state. We will discuss a data-driven method to extract W event inclusively in the hadronic decays from a minimal super gravity process, on the basis of Monte Carlo data.

4:00PM C3.00011 ABSTRACT WITHDRAWN

4:12PM C3.00012 Test Chamber for Optimizing a High Pressure Xenon Neutrinoless Double Beta Decay Detector

Paul Robert, Texas A&M University, NEXT Collaboration — The NEXT experiment is designed to search for neutrinoless double beta decay in high pressure xenon gas; the gas is enriched with ¹³⁶Xe which is a double beta decay candidate emitter. It is currently in the research and development phase and is scheduled to be operating in Canfranc Underground Laboratory in Huesca Spain within the next 5 years. High pressure xenon gas is chosen because of its excellent energy resolution and the ability to observe tracks. Observation of the track end points will provide excellent background rejection. The design and principle of a test chamber used to optimize the detector design will be discussed.

4:24PM C3.00013 The Design, Construction, and Goals of the LUX Dark Matter Search Experiment

Rachel Mannino, Texas A&M University, LUX Collaboration — The LUX (Large Underground Xenon) experiment will be the world’s most sensitive search experiment for the dark matter candidate known as the WIMP (Weakly Interacting Massive Particle). It is currently under construction and will be deployed in the Davis Cavern at Homestake Mine in South Dakota later this fall. The design, construction, and physics reach will be discussed.

4:36PM C3.00014 Low-Background Screening for Rare Event Experiments Using a Multi Parallel Plate Chamber

Clement Sofka, Texas A&M University — Rare event searches, such as double beta decay and direct dark matter (DM) detection, present a host of challenges for detector design and implementation. One of the most limiting factors is the presence of background radiation which originates from radioactive impurities in the materials used to construct the detector. We present a unique method for detecting ultra-low levels of contamination by placing voltages of alternating polarity on several stacked parallel plates separated by a narrow gap in a pressurized gas. Our design exploits the geometry of the well-known single-layer parallel plate chamber (PPC), but uses multiple plates made out of the material being measured. The design, efficiency, and anticipated sensitivity will be discussed.

4:48PM C3.00015 Under what conditions do accelerating charges radiate? An examination of recent literature

Edward Butterworth, Paul Cox, Texas A&M University-Kingsville — The process by which accelerated charges emit electromagnetic radiation remains surprisingly obscure: even at the advanced level, most textbooks do not treat it in detail, and published reports show a wide variety of descriptions of the process, some of which have led to paradoxes. Three situations receive particular attention in the literature: a static charge in a gravitational field, a uniformly accelerated charge and a charge in uniform circular motion. Some of the paradoxes reported may relate to terminological confusion: Shariati & Khorami (1999) identify three distinct ways in which the word “radiation” is commonly used. Against published claims that uniformly accelerated charges do not radiate, Boulware (1980) and de Almeida & Suss (2006) propose that they do, but into a region of spacetime inaccessible to a comoving observer. Piazzese (2003) obtains the result that charges in uniform circular motion do not radiate, subject to particular constraints that limit orbital size; with the result that electrons in Bohr orbits do not radiate, while synchrotron radiation is allowed. The present paper provides an overview of the body of literature on this topic, and identifies several significant themes that seem appropriate for further development.

Friday, October 23, 2009 2:00PM - 4:00PM
Session C4 SPS and Women in Physics

2:00PM C4.00001 Women of the Manhattan Project

Jill Marshall, University of Texas — In the book Their Day in the Sun, Ruth Howes and Caroline Herzenberg documented more than 1000 women who worked on the Manhattan Project, preserving their legacy for generations to come. At the 2009 Chicago meeting, the AAPT Committee on Women in Physics celebrated the accomplishments of these women and the men who worked beside them. Howes presented an overview of the contributions of women to the development of the first nuclear weapon, and the session was honored with talks from two Manhattan project veterans, Ellen Clemshaw Weaver, who worked at Oak Ridge, and Dorothy Marcus Gans, who worked as a technician in the Metallurgical Laboratory in Chicago. I will present a summary of the session, analyzing the effect of working on the project on the career trajectories of the women involved, and point listeners toward additional documentation of this history.
2:36PM C4.00002 Student Observation Driven Astronomy at Trinity¹, GARETH JONES, DAVID HOUGH, Trinity University — Trinity University is part of a consortium of institutions in the Associated Colleges of the South that is developing new Student Observation Driven Astronomy (SODA) labs. The emphasis in these labs is on using data obtained by the students themselves to investigate astrophysical problems. We have focused our effort on three new labs: measurements of lunar features, transiting exoplanets, and stellar spectra. The lunar lab, while fairly conventional, is comprehensive in terms of visual observing procedures and analyses to measure feature characteristics. The exoplanet lab combines CCD transit observations and information from the literature to determine several exoplanet properties. The stellar spectra lab uses CCD spectra with absolute wavelength calibration and normalized flux calibration based on a standard star, and covers the full range of spectral classes. With each lab write-up, we include our own data obtained with Trinity’s teaching observatory as examples and for potential use in indoor labs.

¹We thank the Mellon Foundation and Trinity for financial support.

2:48PM C4.00003 Electrical characterization of thin films¹, SEBASTIAN REQUENA, DAVID BIXLER, TONI SAUNCY, Angelo State University Department of Physics — A low level electrical characterization system has been constructed and software developed which allows the system to make high precision Van der Pauw measurements of bulk and thin film materials, with focus on materials with relevance for nano and microelectronic device application. The Van der Pauw technique, which is the standard used for the measurement of the resistivity of bulk material samples of arbitrary shapes has been used to examine crystalline doped silicon. For the bulk semiconductors used as a calibration test, (resistivity < .001 Ohm-cm), the system reliably reports surface resistivities within 4% of the accepted values. For bulk semiconductors (Resistivities >10⁹ Ohm-cm), the system can produce measurements to within ± .0001 Ohm-cm.

³This work was supported by NSF EEC REU # 0648761.

3:00PM C4.00004 Angelo State Physics Peer Pressure Team: Road Tour 2009¹, ETHAN GULLY, TONI SAUNCY, Angelo State University Department of Physics — The Angelo State University Society of Physics Students chapter has a strong history of science outreach to the local community. For the fourth year, the outreach team has undertaken a week-long trip visiting middle school teachers and children and presenting physics demonstrations on a round trip of over 900 miles. The goal of the outreach program is to informally educate and excite students about physics and science in general. The demonstrations vary from simple hands on activities to more complicated experiments that most public school science teachers do not have resources to present. Each presentation engages undergraduate student volunteers in explaining underlying physical principles. A new assessment feature was added to the demonstration program to gauge the effectiveness of the program in changing attitudes about science. The results have been overwhelming as the subsequent requests for further visits are too numerous for us to accommodate.

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

3:12PM C4.00005 Lifetime expectancy and characterization of MEMS chevron actuators¹, ARMANDO NAVA, Angelo State University Department of Physics, GANAPATHY SIVAKUMAR, TIM DALLAS, Texas Tech University Department of Electrical and Computer Engineering, STEPHEN JOHNS, Baylor University Department of Electrical Engineering — This work will present a detailed reliability and lifetime expectancy study of electrothermal micro-actuators under different actuation scenarios. The actuators are designed using the topmost poly-silicon layer of Sandia National Laboratories’ SUMMiT V process. The legs of the actuator are ~ 395 μm in length, 2.25 μm in thickness, with an offset angle of 5°. A custom made optical characterization setup was built to conduct the reliability and lifetime testing of the device. The test involved first identifying key power levels and then actuating the devices until the onset of plasticity. The entire test setup was automated by use of custom built LabView virtual instruments (VIs).

³This work was supported by NSF EEC REU 0648761.

3:24PM C4.00006 The Summer Nuclear Engineering Institute at The University of Texas at Austin¹, JUAN OLVERA, Angelo State University Department of Physics — The Summer Nuclear Engineering Institute (SNEI) at the University of Texas is a four week course that provides an opportunity for undergraduates to experience the field of nuclear engineering. This experience is especially important if you are a sophomore or junior and are not majoring in nuclear engineering as an undergrad, but would like to explore what nuclear engineering is like. Students will study fundamental nuclear engineering concepts, gain hands-on experience at UT’s research reactor and receive six transferrable college credits. The SNEI program was first held in July of 2009, and will be held once again in the summer of 2010; it is funded by the U.S. Nuclear Regulatory Commission Nuclear Education Grant Program which covers housing, meal plan, a travel and textbook allowance and a $1000 stipend.

¹U.S. Nuclear Regulatory Commission Nuclear Education Grant Program

3:36PM C4.00007 Creating a Successful Summer Physics Camp, AMANDA GREGORY, Texas State University at San Marcos — The summer physics camp hosted by the Texas State University San Marcos Society of Physics Students chapter is geared toward middle school children aged 9 to 12 years. Camp administrators aim to create an environment that is both conducive to learning and fun. Our overarching goal is to provide local youth a basic knowledge of physical concepts as well as encourage their continued interest in physics. Physical concepts are taught through a combination of short lectures, group activities, and entertaining demonstrations. This presentation will discuss the basic curriculum, activities and demonstrations that have been performed in past camps, as well as plans for future curricula and expansions.

3:48PM C4.00008 What the heck is a Theremin?, KEN LAMBDIN¹, Stephen F. Austin State University — This talk will introduce the Theremin, one of the first electronic musical instruments. The inner workings of the instrument will be examined, explaining how this bizarre instrument can be played without any physical contact!

³SPS Session
4:12PM C5.00002 Vlasov Evoluton of a Gravitational System via a Spectral Method. JOSH ALVORD, BRUCE MILLER, Texas Christian University — There are open questions concerning the distribution of clusters in the expanding universe. The coupled Vlasov-Poisson equations govern the evolution of density in position-velocity space. In the comoving frame, the evolution of the μ-space density $f$ for a one-dimensional gravitational system is governed by the Vlasov-Poisson continuity equation where $a$ is the local acceleration:

$$\frac{\partial f}{\partial t} + \frac{\partial f}{\partial x} + \frac{\partial f}{\partial v} = 0$$

Here we introduce a spectral method to obtain a coupled set of ordinary differential equations governing the time dependence of the coefficients. For the bounded position space we utilize a Fourier expansion, whereas for the infinite velocity space we utilize a Hermite expansion. The resulting equations are bilinear and govern the coefficients $\psi_{m,n}(t)$, where $m$ represents the Fourier index and $n$ the Hermite index. By truncating the doubly infinite series they can be integrated numerically to model and simulate the system evolution of $f$, in our case using a traditional fourth-order Runge-Kutta method. We will present the important derivations and preliminary results of the numerical integration.

4:24PM C5.00003 Computing energy spectra for quantum systems using the Feynman-Kac path integral method. J.M. REJCEK, N.G. FAZLEEV, Department of Physics, University of Texas at Arlington — We use group theory considerations and properties of a continuous path to define a failure tree numerical procedure for calculating the lowest energy eigenvalues for quantum systems using the Feynman-Kac path integral method. Within this method the solution of the imaginary time Schrödinger equation is approximated by random walk simulations on a discrete grid constrained only by symmetry considerations of the Hamiltonian. The required symmetry constraints on random walk simulations are associated with a given irreducible representation and are found by identifying the eigenvalues for the irreducible representations corresponding to the symmetric or antisymmetric eigenfunctions for each group operator. The numerical method is applied to compute the eigenvalues of the ground and excited states of the hydrogen and helium atoms.

4:36PM C5.00004 Derivation of Boltzmann’s Principle. DONALD H. KOBE, University of North Texas, MICHELE CAMPISI. University of Augsburg — Using a classical mechanical model of thermodynamics, we derive Boltzmann’s Principle for the entropy $S = k_B \ln W$, where $k_B$ is Boltzmann’s constant and $W$ is the number of microstates compatible with an energy $E$. The argument is based on the heat theorem which is the combined first and second laws of thermodynamics. It dates back to the work of Helmholtz and Boltzmann, but the argument has remained almost unknown. We first discuss a one-dimensional model. The phase-space volume entropy, microcanonical distribution, and ergodic theorem naturally emerge for one dimension. The argument is then generalized to an arbitrary number of particles. Using the ergodic hypothesis, we show that the entropy is $S = k_B \ln \Phi$ in $\Phi$, where $\Phi$ is the phase-space volume enclosed by a hypersurface of energy $E$. For very large systems with $N \gg 1$, the volume entropy approaches the surface entropy $S \approx k_B \ln(Nw)$, where $W = \frac{\partial n}{\partial E}$ is the density of states on the hypersurface of energy $E$ and $dE$ is an irrelevant constant. For cells in phase space the size of Planck’s constant $h$ the density of states $\Omega \approx W$, which proves Boltzmann’s Principle. However, the correct entropy for any number of particles is the phase-space volume entropy $S$.

4:48PM C5.00005 The J-Matrix formalism applied to noisy data series: universal properties of noise. LUCA PEROTTI, DANIEL BESSIS, DANIEL VRINCEANU, Texas Southern University — We developed a new method in the spectral analysis of noisy time-series. From the Jacobi recursive relation for the denominators of the Padé Approximants of the Z-transform of an infinite time-series, we build a J-Operator where each bound state (inside the unit circle) is associated to one damped oscillator while the essential spectrum, which lies on the unit circle, represents noise. Damped signal and noise are thus clearly separated in the complex plane. For a finite time series, the J-operator is replaced by a finite order J-Matrix $J_N$. Eigenvalues (poles of the Padé Approximant) corresponding to noise are each correlated to one of the zeros of the Padé Approximant and can be cleaned, thus exposing constant amplitude signals. Different classes of noise are analyzed, our formalism allowing efficient calculation of hundreds of poles of the Z-transform. Evidence of universal behaviour in the statistical distribution of poles and zeros of the Z-transform was found: poles and zeros tend, when the time series goes to infinity, to a uniform angular distribution on the unit circle. The roots of unity thus appear to be noise attractors. We show that the Z-transform allows lossless undersampling and that this property can be used to increase signal detection. We give examples to suggest the power of our method, and discuss the relative importance of (uncorrelated) noise and background signals in practical applications.

5:00PM C5.00006 High Performance Computing with CUDA. BILL MAIER, None — The use of CUDA programming using inexpensive, off-the-shelf hardware for high performance computing is discussed. An introduction to the technology is given, along with a brief overview of the requirements for creating a CUDA-enabled system. Advantages and disadvantages of using CUDA for creating physical simulations is presented.

4:40PM - 4:00PM Session D1 Poster Session (4:00-6:00PM) LBJ Student Center 3-11.1 and 3-12.1

D1.00001 Dynamic Response and Locking of Optical Resonators for LIGO. SERGIO H. CANTU, LILIANA RUIZ-DIAZ, ALAN FARRELL, MALIK RAKHMANOV, University of Texas at Brownsville — The Laser Interferometer Gravitational Wave Observatory (LIGO) is a large-scale detector capable of direct observation of gravitational waves from various astrophysical sources. The detector utilizes a highly stabilized laser beam which requires a high-purity mode content. The spatial filtering (modecleaning) of the laser beam is done by a triangular ring resonator (Fabry-Perot cavity), which is made of a monolithic fused-silica spacer and low-loss mirrors bonded to it with precision alignment. We fabricated and characterized 3 such ring resonators at the LIGO Hanford Observatory. Several measurement techniques have been applied to measure the optical losses in these resonators. In this poster we present the results of these measurements and provide physical explanation of the resonator filtering properties.

D1.00002 Evaluating Molecular Hyperpolarizabilities with MOPAC. SEAN SMITH, STEVEN ALEXANDER, Southwestern University — Molecules with high second-order nonlinearities have a number of industrial applications including high-speed low-power electronics. Accurate calculations can help identify molecules that have these properties. We have used the MOPAC semiempirical molecular orbital program to calculate the first order hyperpolarizabilities for several molecules and we compare these results to the experimental values reported in the literature. There is good correlation between these two data sets for most of the molecules though some have hyperpolarizabilities that differ by several orders of magnitude.
D1.00003 Quantum Description of Diffraction of Light by a Multiple Slit: The Heuristic Value of the Correspondence Principle. DANIEL DOMINGUEZ, LUIS GRAVE-DE-PERALTA, Department of Physics, Texas Tech University — We explore the classical limit of the quantum description of the multiple-slit interference phenomena. We present a detailed and quantitative quantum description of the diffraction patterns obtained in multiple-slit experiments with relatively intense light. This is achieved with no more mathematical complexities than the required by a classical description. We have based our quantum description of interference on seminal ideas first introduced by Dirac and Feynman combined with the application of the Bohr’s correspondence principle, i.e., the classical description of the interference phenomena should be in some way a limit case of the quantum theory.

D1.00004 Near-Infrared Quantum Cascade Laser Based on the Intra-Cavity Second Harmonic Generation1. YONG HEE CHO, ALEXEY BELYANIN, Department of Physics, Texas A&M University, College Station, Texas 77843 — We propose and theoretically analyze quantum cascade lasers operating in the near-infrared range due to the intra-cavity second harmonic (SH) generation. The latter process involves high lying subbands in the conduction band. Thus it requires an accurate description of the mode structure above ~1eV from the bottom of the conduction band. Here we adopted a multiband k-p model to achieve this. The fundamental laser power is converted to the second harmonic laser power due to large resonant nonlinearity in the properly designed heterostructure. We show that the modal phase matching between EH00 (fundamental) and EH20 (second harmonic) modes is possible in ridge waveguides and their output powers are predicted based on the density matrix formalism. At current density J = 8.5kA/cm2, the second harmonic power of 0.14 mW is obtained with the conversion efficiency of 0.2mW/W2 in GaNAs/AlGaSb/InP heterostructures.

1We acknowledge the support from NSF grants ECS-0547019 and EEC-0540832.

D1.00005 Simulation of transpolar potential saturation for northward IMF1. SHREE BHATTARAI, RAMON LOPEZ, ROBERT BRUNTZ, ELIZABETH MITCHELL, SOPHIA COCKRELL, UT Arlington, JOHN LYON, Dartmouth College, MICHAEL WILT-BERGER, NCAR/HAO — When the Interplanetary Magnetic Field (IMF) is strongly southward, the potential across the ionosphere reaches a saturation value and does not increase substantially, even of the IMF becomes much more strongly negative. Recent observations have indicated that the same thing happens for strongly northward IMF. We will present global MHD simulations of this phenomenon using the Lyon-Fedder-Mobarry simulation code and make comparisons to observations from the DMSP spacecraft. We also will show that the behavior of the saturation effect is consistent with a recent explanation for saturation based on the forces on the flow in the magnetosheath.

D1.00006 Testing a New Method of Detecting RR Lyrae Variable Stars. W. LEE POWELL JR., TALITHA MUEHLBRADT, Texas Lutheran University, RONALD WILHELM, University of Kentucky, DYLAN GINN, University of Texas at San Antonio, ANDREW JASTRAM, Texas A&M University — We have submitted for publication a new method of selecting candidate RR Lyrae stars using out-of-phase single epoch photometric and spectroscopic observations contained in SDSS Data Release 6 (DR6). The technique detects variability by exploiting the large disparity between the (g - r) color and the strength of the Hydrogen Balmer lines when the two observations are made at random phase. The SDSS Stripe 82 allowed us to show that our method has a discovery efficiency of ~85%. This technique has yielded over 1,000 candidates fainter than g = 14.5. We present the results of observations of several of these candidate stars made on the 0.8m telescope at McDonald Observatory, with 10 of 11 confirmed as variable and one labeled as a likely RRC. We also examine the use of clumping in the suspected variables to probe galactic structure, both known and new.

D1.00007 Plausible Explanation of Quantization of Intrinsic Redshift from Hall Effect and Weyl Quantization. FLORENTIN SMARANDACHE, The University of New Mexico, Gallup Campus, VIC CHRISTIANTO, Sciprint.org — Using phonon condensate model as described by Moffat, we consider a plausible explanation of (Tiff) intrinsic redshift quantization as described by Bell as result of Hall effect in rotating frame. We also discuss another alternative to explain redshift quantization from the viewpoint of Weyl quantization, which could yield Bohr-Sommerfeld quantization.

D1.00008 Casimir Effect and its Applications to Biophysics. PHU NGUYEN, University of Houston Clear Lake, MIKE CABRERA, Univ. of Houston Clear Lake, CHANNING MOELLER, SAMINA MASOOD, University of Houston Clear Lake — The Casimir Effect is re-examined at finite temperature and density. The Casimir force is computed with different parameters to study its applications to physical systems like carbon nanotubes and even the protein folding. In the protein folding we compare the Casimir force with the Vander Waals forces and the hydrophobic interaction.

D1.00009 Prefibrillar Formation Conditions of β-Lactoglobulin by Titration and Chaotropes Urea and KSCN Under Thermal Load. JEREMIAH BABCOCK, ROLANDO VALDEZ, LORENZO BRANCALEON, University of Texas at San Antonio — The harmful form of toxic oligomers in the formation of protein amyloid fibrils have been connected to degenerative diseases like Alzheimer’s and Huntington’s diseases. Understanding the fundamental mechanisms behind protein unfolding and subsequent fibrillogenesis may provide a way to stop the process from occurring. The purpose of this study was to identify favorable fibril growth conditions for a globular protein model β-lactoglobulin using the chaotropes urea and KSCN, along with titration of a pH 7.04 phosphate buffer solution at 40 °C over five days. Time-resolved and steady-state fluorescence was used to examine the shift in emission of the tryptophan amino acids over the applied denaturation ranges. BLG, a dimer in native form, monomerized and partially unfolded at 5 M Urea, 2 M KSCN and at pH 2 in phosphate buffer in vitro. Exposure of the solutions to continuous heat over time caused a increase in the lifetimes and red shift in the emission spectra, indicating the possible beginning of nucleation. The study has provided a base for continuation of the study of oligomerization and subsequent fibrillation of BLG, which may provide a fundamental mechanism of formation transferable to other proteins in vivo.

D1.00010 Photophysical Characterization of DMOP, DOOP, and PDO After Irradiation1. SARAH ROZINEK, JORGE PALOS-CHAVEZ, LORENZO BRANCALEON, Physics, UTSA, MARK A. PENICK, MATHEW P.D. MAHINDARATNE, GEORGE R. NEGRETE, Chemistry, UTSA — The photophysical properties of perylene and its derivatives are remarkably useful for organic photovoltaic systems including organic solar cell photoconverters, molecular sensors, and fluorescent labels for analytical applications. A series of uncharacterized novel 3,9-di (fundamental) and EH00 (second harmonic) modes is possible in ridge waveguides and their output powers are predicted based on the density matrix formalism. At current density J = 8.5kA/cm2, the second harmonic power of 0.14 mW is obtained with the conversion efficiency of 0.2mW/W2 in GaNAs/AlGaSb/InP heterostructures.

1Funded in part by NIH/NIGMS MARC U*STAR GM07717 and NIH/NIGMS MBRS-RISE GM6065.
D1.00011 Growth and Characterization of Multilayer Structures\textsuperscript{1}, KUNAL BHATNAGAR, Angelo State University - Department of Physics, RAVI DROOPAD, Texas State University, TONI SAUNCY, Angelo State University - Department of Physics — Molecular Beam Epitaxy (MBE) is an advanced atomic precision epitaxial deposition technique that utilizes Ultra High Vacuum conditions for optimal crystal growth. Recently, new MBE facilities have been installed at Texas State University. The facility includes growth chambers for III-V compound semiconductor, Si, II-VI semiconductors and analysis chambers for SEM, XPS, LEED and other characterization techniques. Several novel structures have been produced and analyzed using characterization facilities at Angelo State University, namely Spectroscopic Ellipsometry(SE). SE is a non-destructive thin film characterization technique used for determining film thickness, interfacial roughness and optical properties of multilayered structures. Gadolinium Gallium Oxide(GdGaO\textsubscript{3}) is one material that is important as a high-k dielectric in compound semiconductor MOSFET application and has not been characterized very well using ellipsometry. Ellipsometric data will be presented for GaGdO3 on GaAs and optical properties will be discussed.

\textsuperscript{1}This work supported by the Office of Naval Research.

D1.00012 Desorption Kinetics of Dodecanethiol Self-Assembled Monolayers Grown on Cr\textsubscript{2}O\textsubscript{3}(0001)/(Cr(110)). CHRISTOPHER CUMBY, JENNIFER WALTERS, NICHOLAS CLARK, HEIKE GEISLER, CARL VENTRICE, Dept. of Physics, Texas State University — The most common method of growing self-assembled monolayers (SAMs) is by immersion of the substrate in solution, which limits the experiment to inert surfaces such as gold or silver. In this experiment, SAMs of dodecanethiol were grown under ultra-high vacuum (UHV) conditions on Cr\textsubscript{2}O\textsubscript{3}(0001)/(Cr(110)). The adsorption geometry of the SAM was monitored with low energy electron diffraction (LEED) and the desorption kinetics were measured via temperature programmed desorption (TPD). For SAM growth on substrates held at 120 K, a multilayer peak is observed at 240 K and the monolayer peak at 480 K for a heating rate of 25 °C/min. TPD measurements at different heating rates are being performed to determine the activation energy for desorption.

D1.00013 Measurement of the Adsorption Kinetics of CO and CO\textsubscript{2} on Cr(110). JENNIFER WALTERS, ALAN HARRISON, CHRISTOPHER CUMBY, GABRIEL ARELLANO, HEIKE GEISLER, CARL VENTRICE, Dept. of Physics, Texas State University — Previous studies of the adsorption of CO on the catalytically active Cr(110) surface have found that the CO molecule dissociates upon adsorption at 300 K. One aspect of the CO adsorption process that has not been studied in detail is the temperature dependence of the dissociation and the influence of oxygen on the dissociation process. Therefore, we have performed temperature programmed desorption (TPD) and low energy electron diffraction (LEED) studies of the adsorption of CO, CO with oxygen, and CO\textsubscript{2} on the Cr(110) surface. Deposition of CO was performed at 120 K on either the clean or oxygen dosed Cr(110) surface before performing the TPD measurements. For deposition below 0.5 Langmuir (L), no CO is detected with TPD, which indicates that all of the CO is dissociating and reacting with the Cr(110) surface. As the CO dose is increased, a broad peak centered at 300 K is first observed, followed by a second peak at 200 K. Oxygen coadsorption increases the rate at which the CO desorption is observed but does not result in CO\textsubscript{2} desorption. For comparison, TPD measurements have also been performed for adsorption of CO\textsubscript{2} at 120 K.

D1.00014 Investigation of the positron Doppler broadening for rubber samples below the glass transition temperature, AMANDA TOWRY\textsuperscript{1}. New Mexico State University, C.A. QUARLES, Texas Christian University — Previous research [K. Sato, et al., Phys. Rev. B71 (2005)012201; C. Quarles, et al., Nucl. Inst. Meth. Phys. Res. B 261(2007)875-878] has demonstrated a correlation between the Doppler broadening S parameter and the intensity of the ortho-positronium lifetime component in polymers which depends on the composition of the polymer. On the other hand, rubber polymers do not show this correlation and behave more like liquids for which the S parameter is essentially independent of the ortho-positronium intensity. The difference between the rubber samples and most polymers studied is that the rubbers were all above the glass transition temperature (T\textsubscript{g}) at room temperature. The bubble model in the rubber has been suggested as an explanation of this behavior in analogy with liquids. This research reports the measurement of the S parameter for seven rubber samples below T\textsubscript{g}, where the bubble model would not be expected to work. The results were obtained by immersing the samples and a Na-22 source in liquid nitrogen. We will discuss how the results below T\textsubscript{g} impact the hypothesis of bubble formation in the rubber above T\textsubscript{g}.

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

D1.00015 Characterization of functionalized carbon nanotubes and their composites, Z.P. LUO, Texas A&M University, L. CARSON, L. ADAMS, N. SOBOYEJO, A. OKI, E.G.C. REGISFORD, Prairie View A&M University — Carbon nanotubes (CNTs) have received considerable attention due to their extraordinary properties of strength, toughness, as well as thermal and electrical conductivities. They are ideal fillers for polymer nanocomposites to enhance the composite physical and mechanical properties. In order to overcome the problems of tangling caused by intrinsic van der Waals forces during the composite fabrication, chemical functionalization process has been introduced. In this work, we characterized the chemical coating on the functionalized CNTs and their composites using analytical electron microscopy. It was observed that the CNT surfaces were coated with reactants from the chemical reactions. In the CNT/epoxy nanocomposites, such a coating significantly improved the CNT dispersion. In the CNT/chitosan composite, it was observed that the unfunctionalized CNTs without coating did not bond with the chitosan particles, while the functionalized CNTs could bond with the chitosan particles through the surface adhesive coating, which is an ideal medium to make the CNT/chitosan composites.

D1.00016 Losses in Particle Photovoltaic cells, HECTOR VALDEZ, WILEHLMUS GEERTS, Physics, Texas State, LAWRENCE LARSON, Electrical Eng., Texas State — The power output of a Si photovoltaic cell is limited by the optical and electrical losses amongst several other effects. Reflection out of the Si and shading by the electrical contacts will limit the number of photons that will be able to generate electron hole pairs near the pn-junction. Recombination of charge carriers in and near the depletion area will decrease power resulting in an effective shunt resistance. The contact- and spreading resistance of the electrodes further reduce the power output. In this paper we will theoretically compare the efficiency of a PV cell configuration consisting of an array of silicon particles with the efficiency of a conventional style PV Si cell.

D1.00017 Entangled States and Quantum Causality Threshold in General Theory of Relativity, DMITRI RABOUNSKI, FLORENTIN SMARANDACHE, University of New Mexico — This article shows, Synge-Weber’s classical problem statement about two particles interacting by a signal can be reduced to the case where the same particle is located in two different points A and B of the basic space-time in the same moment of time, so the states A and B are entangled. This particle, being actual two particles in the entangled states A and B, can interact with itself radiating a photon (signal) in the point A and absorbing it in the point B. That is our goal, to introduce entangled states into General Relativity. Under specific physical conditions the entangled particles in General Relativity can reach a state where neither particle A nor particle B can be the cause of future events. We call this specific state Quantum Causality Threshold.
D1.00018 jSynthesizer: A Java based first-motion synthetic seismogram tool. MARK SULLIVAN — Both researchers and educators need software tools to create synthetic seismograms to model earthquake sources. We have developed a program that generates first-motion synthetic seismograms that is highly interactive and suited to the needs of both research and education audiences. Implemented in the Java programming language, our program is available for use on Windows, Mac OS X and Linux operating systems. Our program allows the user to input the fault parameters strike, dip and slip angle, numerically or graphically using a lower hemisphere equal-area stereographic projection of the focal sphere of the earthquake. This representation is familiar to geologists and seismologists as the standard way of displaying the orientation of a fault in space. The user is also able to enter the relative location of the seismograph and the depth and crustal velocity structure in the vicinity of the earthquake. The direct P wave along with reflections off of layer boundaries near the source are generated using a constant ray-parameter approximation. The instrument response functions used by the Worldwide Standardized Seismogram Network and the attenuation response of the Earth’s mantle are generated in the frequency domain and applied to generate the synthetic seismogram. Planned enhancements to this program will allow the simultaneous generation of seismograms at many stations as well as more complicated crustal structures.

D1.00019 Characterization of Electronics and Software in QUARTIC Detectors for High-Energy Physics, RYAN HALL, University of Texas — Precision timing is necessary in detector systems for high-energy physics applications, specifically, experiments conducted in large accelerators. The capabilities of the microchannel-plate photomultiplier tubes (MCP-PMTs) proposed for use in much of this research as sensing devices are not fully known, and several models exist only at a prototype level. Our group is testing various configurations of electronics and software, including constant-fraction discriminators and high-frequency amplifiers, in order to establish a time-of-flight precision on the order of 10 ps (10e-12 s). In that amount of time, light travels 3mm. The experiment focuses on the QUARTIC detector design, which utilizes an array of quartz bars as a medium to generate and collect photons emitted by incident particles travelling faster than the local speed of light. By simulating this Cerenkov radiation using a picosecond pulse laser of controlled intensity and frequency, we intend to design and improve a system to assist in screening for possible Higgs signatures in events observed in the ATLAS experiment at the Large Hadron Collider (LHC). Currently, our best results give a spread in measured time values on the order of 28 ps, but using statistical methods over multiple simultaneous measurements can reduce the uncertainty to approximately 16 ps.

D1.00020 Finite element analysis of bridge steel pedestal anchor bolts in reinforced concrete, B. LOGAN HANCOCK, Angelo State University Department of Physics, MONIQUE HITE HEAD, Texas A&M University Department of Civil Engineering — Steel pedestals are short, column-like structures currently being used to elevate highway bridges to reduce the risk of collisions with over-height vehicles. Previous full-scale experimental research has been done to examine the efficacy of these steel pedestals and their components under quasi-static loading to evaluate any added instability in the event of an earthquake. As part of the Undergraduate Summer Research Grant (USRG) program at Texas A&M University, this specific project was focused on observing the behavior of the post-installed steel pedestal anchor bolts under applied shear and tensile loading using the finite element (FE) software Abaqus. The results from some of the preliminary analyses are compared to theoretical anchorage calculations with the aim of producing a benchmark for future steel pedestal anchor bolt embedment design. Future research improvements regarding FE modeling and structural design suggestions are proposed as well.

D1.00021 The Center for Nanostructured Materials: A User Facility at The University of Texas at Arlington, MUHAMMED YOUSUFUDDIN, University of Texas at Arlington — The Center for Nanostructured Materials (CNM) located at the University of Texas at Arlington is a fully equipped user facility that houses a variety of instrumentation for the characterization of nanomaterials. Several state-of-the-art characterization techniques are available including Atomic Force Microscopy (AFM), X-ray Photoelectron Spectroscopy (XPS), Electron Paramagnetic Resonance (EPR), Raman Spectroscopy, Superconducting Quantum Interference Device (SQUID), and X-ray Diffraction of thin films, powders, and single crystals. The range of instrumentation supports interdisciplinary collaborations in physics, chemistry and materials science and provides an excellent resource for training undergraduate and graduate students. The primary goal of CNM is to foster interdisciplinary collaborations for a wide range of researchers and as such we welcome all potential users. In this presentation I will discuss CNM’s capabilities and user access policies.

D1.00022 Effects of radiation on the electro-optical properties of nanoparticle-polymer-dispersed liquid crystal structures, ALFONSO HINOJOSA, CECIL SHIVE, SURESH SHARMA, University of Texas at Arlington — Polymer dispersed liquid crystals (PDLCs) are composite materials consisting of submicron-size droplets of liquid crystal (LC) embedded within a polymer. By using holographic techniques, PDLCs can be transformed into periodic structures with spatial periodicity (HPDLCs), which can be controlled within reasonable limits by experimental parameters. Consequently, the optical properties of HPDLC-based devices, e.g., diffraction efficiency can also be controlled [1]. These periodic structures are used in numerous electro-optical devices, e.g., switchable holographic gratings and photonic bandgap structures. We have shown previously that the light transmission through PDLCs changes upon irradiation by gamma-rays [2]. In order to evaluate the means by which the sensitivity of these materials to radiation can be improved, we have synthesized hybrid materials consisting of nanoparticles and HPDLC periodic structures. By utilizing a high sensitivity optical characterization technique, we have carried out measurements of the luminescence properties of these materials with/without irradiation. Here, we present the resulting data and discuss the consequences of embedding nanoparticles into these structures. [1] R. A. Ramsey et al., Appl. Phys. Letts. 88, 051121 (2006). [2] S. C. Sharma et al., Phys. Rev. Letts, 87, 105501 (2001)

D1.00023 Chemical vapor deposition of nanodiamonds and study of their structural, optical, and electronic properties, RAJARSHI CHAKRABORTY, KYLIE LA ROQUE, SURESH SHARMA, University of Texas at Arlington — Diamond thin films were grown on silicon substrates by hot-filament assisted chemical vapor deposition technique utilizing CH4 and H2 mixtures. During our investigations of diamond thin films in the 1990’s, the emphasis was on the growth of continuous thin diamond films with exceptional structural, electronic, and electrical properties [1]. However, there is now renewed interest in the growth and unique properties of nanometer-size diamond [2]. We have, therefore, re-examined some of our previously grown diamond samples with emphasis on delineating the structural and optical properties of nanometer-size diamond particles in these samples. The nanoparticles are characterized by using AFM, SEM, XPS, and Raman spectroscopy. The optical properties of the nanoparticles are further studied by carrying out photoluminescence measurements. In this contribution, we briefly review different growth techniques and present our results on the structure and optical properties of nanodiamonds.


D1.00024 Growth of Single-Layer Graphene on Pt(111) by Thermal Decomposition of Propylene , GREGORY HODGES, HEIKE GEISLER, CARL VENTRICE, Dept. of Physics, Texas State University — Graphene, which is a one-atom-thick layer of sp²-bonded carbon, has sparked keen interest within the scientific community because it is predicted to have a wide range of unique properties. In particular, it has one of the highest known mobilities of all the semiconducting materials. Since its discovery in 2004, there have been several studies of the growth of graphene by various techniques. We have performed studies on the growth of graphene on the catalytically active Pt(111) surface by thermal decomposition of propylene in an ultra-high vacuum (UHV) chamber. Two methods have been used: deposition of a monolayer of propylene followed by annealing in UHV and growth of graphene in an atmosphere of 10⁻⁶ Torr of propylene at 500 °C. The crystal structure of the graphene films was monitored using low energy electron diffraction (LEED). In addition, we are currently performing high resolution electron energy loss spectroscopy (HREELS) measurements of the electronic structure of the graphene films.

D1.00025 Design and Construction of a Scanning Tunneling Microscope for Atomic Scale Imaging of Surfaces in Ultra-High Vacuum , ROBERT KILBOURNE, CARL VENTRICE, Dept. of Physics, Texas State University, STEN THORNBURG, JAMES BURST, Dept. of Physics, University of New Orleans, VINCENT LABELLA, College of Nanoscale Science and Engineering, University at Albany — The outer layer of atoms of most materials either relax or reconstruct, which often results in a change in the electronic, magnetic, and/or chemical properties. Therefore, we have designed and constructed a scanning tunneling microscope (STM) for use in an ultra-high vacuum (UHV) based surface analysis system in the Surface Science Laboratory at Texas State. The instrument is capable of producing atomic-scale images on single crystal samples and allows transfer of samples to the horizontal manipulator of the system for surface preparation and high-resolution electron energy loss spectroscopy (HREELS) measurements. The main body of STM is constructed from Macor, which is UHV compatible and has a high strength to weight ratio, low thermal expansion coefficient, and low thermal conductivity. The instrument is mounted with springs with a 16° expansion length and has a resonant frequency of ~1 Hz. The tube scanner is mounted to a UHV compatible inchworm for coarse approach. Custom designed analog electronics and software are used to control the instrument.

D1.00026 Spectroscopic analysis of urinary calcium and inhibition of their growth ¹, FELICIA MANCIU, WILLIAM DURRER, JAYESH GOVANI, LAYRA REZA, LUIS PINALES, Department of Physics, University of Texas at El Paso, El Paso, Texas 7996 — We present here a study of kidney stone formation and growth inhibition based on a traditional medicine approach with Aquatica Lour (RAL) herbal extracts. Kidney stone material systems were synthesized in vitro using a simplified single diffusion gel growth technique. With the objective of revealing the mechanism of inhibition of calcification formation, extracts, samples prepared without the presence of extract, and with the presence of extract, were analyzed using Raman, photoluminescence, and XPS. The unexpected presence of Zn revealed by XPS in a sample prepared with RAL has sparked keen interest within the scientific community because it is predicted to have a wide range of unique properties. In particular, it has one of the highest known mobilities of all the semiconducting materials. Since its discovery in 2004, there have been several studies of the growth of graphene by various techniques. We have performed studies on the growth of graphene on the catalytically active Pt(111) surface by thermal decomposition of propylene in an ultra-high vacuum (UHV) chamber. Two methods have been used: deposition of a monolayer of propylene followed by annealing in UHV and growth of graphene in an atmosphere of 10⁻⁶ Torr of propylene at 500 °C. The crystal structure of the graphene films was monitored using low energy electron diffraction (LEED). In addition, we are currently performing high resolution electron energy loss spectroscopy (HREELS) measurements of the electronic structure of the graphene films.

D1.00027 Spectroscopic analysis of WO₃ for sensor applications ¹, JOSE LUIS ENRIQUEZ, FELICIA MANCIU, WILLIAM DURRER, Department of Physics, CHINTALAPALLE RAMANA, SATYA GULLAPALLI, Department of Mechanical Engineering, The University of Texas at El Paso, El Paso, TX 7996 — Samples of WO₃ thin films for use in gas sensors were grown using RF magnetron sputtering at a number of different substrate temperatures and Ar:O₂ pressure ratios. The structural properties of the samples were investigated, both experimentally and theoretically, with the goal of determining how variations in the above preparation parameters effect structural changes in the sensor materials. Such structural changes are of crucial importance to the question of improving the sensitivity, specificity, and durability of WO₃ based gas sensors. Experimental characterization was performed using the techniques of FT-IR, Raman, AFM, and XRD. The theoretical work involved software simulation techniques using Gaussian 09W. ²

D1.00028 Cylindrical Organic Solar Cells with Carbon Nanotube Charge Collectors ¹, DANTE ZAKHIDOV, RAYMOND LOU, NAV RAVI, TAMS at UNT, KAMIL MIELCZAREK, ALEXANDER COOK, UTD, NANOEXPLORERS TEAM — Traditional organic photovoltaic devices (OPV) are built on a flat glass substrate coated by ITO. The maximum area covered by the solar cells is limited to a two dimensional plane. Moreover the light absorption is not maximized for a very thin photoactive layer. We suggest here a cylindrical design which has a vertical structure of optical fiber coated by OPV with light incident from the side and from edge. The sunlight, entering via a smaller area is captured into optical fiber, which allows more sunlight to be absorbed by a cylindrical OPV overcoating with multiple reflections inside the optical fiber. Instead of using brittle ITO as a hole collecting layer in the cylindrical OPV, transparent sheets of multi-walled carbon nanotubes are applied. Their highly conductive nature and 3-D collection of carriers from the P3HT/PCBM photoactive layer allows for increased efficiency over a planar geometry while keeping the device transparent. Aluminum is used as the electron collecting layer and as a cylindrical mirror.

¹This work was supported by the NSF-MRI grant # 0723115. The authors are also thankful to Dr. Mihir Joshi from Saurashtra University, Rajkot 360005, India.

D1.00029 Femtosecond Electron Diffraction and Shadow Imaging ¹, DAVID MCPHERSON, University of Texas at El Paso; National High Magnetic Field Laboratory, Florida State University — Using femtosecond electron pulses as an imaging tool, we can probe ultrafast dynamics by taking snapshots at different time delays. By using femtosecond electron diffraction (FED), we can examine structural dynamics at the atomic level in real time, and study the structure–excitation correlation. Additionally, femtosecond electron shadow imaging (FESI) can explore the dynamics of laser induced plasmas off the surfaces of conductors, semiconductors, and insulators.

¹NHMFL, FSU, and NSF

D1.00030 Simple setup for hybrid coherent Raman microscopystroscopy , KAI WANG, Texas A&M Univ, JIAHUI PENG, DMITRY PESTOV, MARLAN SCULLY, ALEXEI SOKOLOV, TEXAS A&M UNIV, INST QUANTUM STUDIES TEAM — We demonstrate a femtosecond-oscillator-based system for coherent anti-Stokes/Stokes Raman scattering microscopy, wherein impulsive Raman excitation is combined with narrowband, time-delayed, and therefore, background-free probing. We show that this simple technique can be used to identify chemicals. This work is supported by the Office of Naval Research, the Army Research Office, the Texas Advanced Research Program (Grant No. 010366-0001-2007), the National Science Foundation (Grants No. PHY 354897 and 722800), and the Robert A. Welch Foundation (Grants No. A-1261 and A-1547).
D1.00031 Entanglement in Jaynes Cummings Model\(^1\) , SAMINA MASOOD, Univ. of Houston Clear Lake — We study the entanglement in a two atoms two photon system using Schmidt decomposition. The results are compared with already existing results of entanglement of this system. With the detailed quantitative analysis of entanglement for such systems, we discuss the possible applications of these results.

\(^1\)FRSF grant from University of Houston System

D1.00032 ABSTRACT WITHDRAWN

D1.00033 MBE Growth and Structural Characterization of Si-SiO\(_2\)-Si Films , RYAN COTTIER, TEXAS State University, WEERASINGHE PRIYANTHA, NADER ELMARHOUMI, RAVI DROOPAD, TERRY GOLDING — Since the idea of a Si-SiO-Si superlattice was first proposed, two main groups have been associated with investigations of Si-SiO-Si superlattices - Tsu\(^1\) and Lockwood\(^1\). Both groups have synthesized Si-SiO-Si structures on the technologically important Si (100) orientation. Lockwood has demonstrated visible light emission using photoluminescence (PL), and Tsu has demonstrated visible light emission using both electroluminescence and PL. The results of both groups show that the light emission can be tuned via quantum confinement within the Si quantum wells. We present the initial stages of an investigation into the synthesis and utility of Si-O layers as barriers. TEM and depth profiling XPS are presented as evidence of the crystalline growth of Si on ultrathin SiO\(_2\) layers.


Friday, October 23, 2009 7:30PM - 8:30PM —
Session E1 After-Dinner Talk  LBJ Student Center Ballroom

7:30PM E1.00001 Van Gogh’s Starry Nights, Lincoln’s Moon, Shakespeare’s Stars, and More: Tales of Astronomy in Art, History, and Literature , DONALD OLSON, Texas State University - San Marcos — How do astronomical phenomena inspire artists? I will discuss the work of several famous artists who have depicted astronomical subjects in their work. I will also discuss the role of art in our culture and how it can be used to promote public interest in astronomy.

Saturday, October 24, 2009 8:30AM - 9:42AM —
Session F1 Invited Session  LBJ Student Center Teaching Theatre (4-16.1)

8:30AM F1.00001 Profiting from the Inflationary Universe with the Hobby-Eberly Telescope Dark Energy Experiment , KARL GEBHARDT, University of Texas at Austin — Observations over the next decade will be focused on studying the expansion history of the universe, given that we have little conception for what drives the expansion either at late times (i.e., the nature of dark energy) or early times (i.e., inflation). I will describe an observational approach to studying both epochs of expansion that relies on measuring the power spectrum of galaxies as obtained from a large redshift survey: the Hobby-Eberly Telescope Dark Energy Experiment (HETDEX), a ground-based study already taking data.

9:06AM F1.00002 The Observable Universe , KIM-VY TRAN, Texas A&M University — This is a tour of the universe as we have come to understand it through observations taken at many different wavelengths. Stunning images from the Hubble Space Telescope and surprising observations from other space telescopes like Spitzer and Chandra have given us a deeper understanding of the universe, both near and far. Equally important have been observations taken with ground-based observatories such as the Very Large Telescope in Chile. I will describe the most recent advances astronomers have made using these observatories and what we hope to learn in the near future.

Saturday, October 24, 2009 10:00AM - 11:48AM —
Session G1 Condensed Matter Physics III  LBJ Student Center 3-9.1

10:00AM G1.00001 Friction effects on force measurements at the bottom of a granular column , SAM MCKENZIE, RANDY BACK, The University of Texas at Tyler — We report on systematic force measurements at the bottom of a silo for several granular materials. We look at the dependence of the force measurements on the coefficient of friction. We compare our results to theoretical predictions.

10:12AM G1.00002 Temperature dependence of the internal piezoelectric field in a single InGaAs strained quantum well\(^1\) , MATTHEWS JAMES, TONI SAUNCY, Angelo State University Department of Physics — In this work, the photoluminescence (PL) emission from a <111>-grown InGaAs/GaAs quantum wells which contains a strain-generated piezoelectric field in the quantum well active area has been investigated as a function of temperature over the range of 35K to 175K. At each temperature, changes to the PL spectrum as a function of incident excitation intensity were examined. The PL data indicated that the standard empirical models are inadequate for use in fitting the PL vs. T data and implying that the complications of strain and internal field must be included in understanding the emission temperature dependence. In order to experimentally determine the value of the internal field, the PL excitation intensity-dependence data full width at half maxima were examined. Using the relationship between potential difference, well width and the standard definition of the electric field, the internal field in this well was determined to vary from 36.7kV/cm(35K) to 11kV/cm(85K). This indicates that the electric field within the quantum well is not constant over this temperature range.

\(^1\)This work supported by the Office of Naval Research.
phonon images are sensitive to small angular variations in the phonon flux, and can provide phonon group-velocity data along symmetry and non-symmetry
a few percent accuracy. Determination of the amount of energy deposited depends upon details of the non-equilibrium heat flow in the absorber crystals. Our
over the first Brillouin zone. Theoretical results show excellent agreement with experimental Kerr spectra. Our studies prove antiferromagnetic character of p-d
method with the exchange interaction between Mn spins and itinerant holes. The dielectric tensor and Kerr spectra were calculated for the interband transitions
ferromagnetic (Ga, Mn)As over a broad spectral range with varying Mn concentration and hole density. The full band structure was obtained with a 30 band k.p

1Supported in part by NSF grant DMR 0421404 and IGERT 0549487.

Development of Etch Processes for High-k Dielectric CMOS Devices with LaO$_x$/HfO$_2$ and LaO$_x$/HfSiO Gate Oxides , KELLY RAber, CARL VENTRICE, Dept. of Physics, Texas State University, PATRICK
SEMATECH — High-k dielectric CMOS devices for low standby power applications require a low workfunction oxide on the n-MOSFET side of the
mosfet device to reduce the threshold voltage and gate leakage. A promising candidate for this application is LaO$_x$. However, a process for etching the LaO$_x$
from the p-MOSFET, which leaves the n-side intact, is required. A wet etch study, which enables the creation of a simplified process flow for CMOS devices
using LaO$_x$ on the n-side intact, is presented. The oxidation states and stoichiometry of the LaO$_x$ films is investigated via x-ray photoelectron spectroscopy (XPS).

10:48AM G1.00005 Hyperfine Spectroscopy and Characterization of Muonium Centers in ZnGeP$_2$, PATRICK MENGYAN, B.B. BAKER, R.L. LICHTI, Texas Tech University, K.H. CHOW, University of Alberta, Edmonton, Y.G. CELEBI, Istanbul University of Physics, Yinatzi, K.T. ZAWILSKI, P.G. SCHUNEMANN, BAE Systems — We have recently initiated a study of the defect states formed when positive muons are implanted into chalcopyrite structured II-IV-V$_2$ compounds to extend our investigation of the neutral muon defect centers as an experimentally accessible analog of isolated hydrogen defect states in semiconductors. In this presentation, I will discuss some of the initial observations of neutral muonium defect centers in ZnGeP$_2$: specifically, the hyperfine characterization of the neutral muonium centers observed in ZnGeP$_2$ using the Muon Spin Relaxation technique (MuSR). The spin precession frequencies in a field of 4.0 Tesla yield a zero-temperature hyperfine constant of $\sim$1962 MHz for the promptly formed Mu$^0$ state. Subsequently, we performed T$_m^{-1}$ longitudinal depolarization measurements in low magnetic fields. Decoupling curves show a different anisotropic
Mu$^0$ with $A_2=3185$ MHz and $D=374$ MHz, where the D is the dipolar contribution. I will report on the spectroscopic hyperfine characterization of the neutral muonium centers observed in ZnGeP$_2$.

11:00AM G1.00006 Characterization of the Motion of Muonium centers in II-IV-V$_2$ Semiconductors , BRITTANY BAKER, PATRICK MENGYAN, ROGER LICHTI, Texas Tech University Department of Physics, GURKAN CELEBI, Istanbul University Department of Physics, KIM CHOW, University of Alberta Department of Physics, KEVIN ZAWILSKI, PETER SCHUNEMANN, BAE Systems — Recent Muon Spin Research (MuSR) has been done to investigate properties of II-IV-V$_2$ chalcopyrite semiconductor materials. This work has shown that some of the materials appear to have only diamagnetic muonium centers while ZnGeP$_2$ has multiple neutral muonium centers along with the diamagnetic muonium center. Results for ZnGeP$_2$ show two distinct interstitial tetrahedral sites (T-sites). At low temperatures, neutral muonium hops between sites by quantum tunneling. Thermally activated hopping takes place from about 100K to 220K and at higher temperatures ionization occurs. Hop rates have been obtained from longitudinal field MuSR depolarization measurements. Preliminary results of motion in II-IV-V$_2$ samples with diamagnetic muonium centers will be presented.

11:12AM G1.00007 Measuring Phonon Velocities in CaWO$_4$ with Phonon Imaging , TIMOTHEY HEAD, Abilene Christian University, MADELEINE MSALL, Bowdoin College — A recent search for dark matter by the CRESST experiment seeks to observe dark matter collisions with nuclei of CaWO$_4$ using low temperature bolometric detectors which are sensitive to energy deposition on the order of 10 eV with a few percent accuracy. Determination of the amount of energy deposited depends upon the non-equilibrium heat flow in the absorber crystals. Our phonon images are sensitive to small angular variations in the phonon flux, and can provide phonon group-velocity data along symmetry and non-symmetry directions.

11:24AM G1.00008 Borozene: A Building Block of Boron Nanostructures , NEVILL GONZALEZ SZWACKI, Texas Southern University, VALERY WEBER, University of Zurich, CHRISTOPHER J. TYMCZAK, Texas Southern University — Bulk boron exhibits a complex crystal structure due to its electron-deficient bonds, and in all known forms is semiconducting. However, there is little known about the properties of boron at the nanometer scale. For example, it has been experimentally reported that boron can form nanotubes while ZnGeP$_2$ has multiple neutral muonium centers along with the diamagnetic muonium center. Results for ZnGeP$_2$ show two distinct interstitial tetrahedral sites (T-sites). At low temperatures, neutral muonium hops between sites by quantum tunneling. Thermally activated hopping takes place from about 100K to 220K and at higher temperatures ionization occurs. Hop rates have been obtained from longitudinal field MuSR depolarization measurements. Preliminary results of motion in II-IV-V$_2$ samples with diamagnetic muonium centers will be presented.

11:36AM G1.00009 Magneto-Optical Kerr Spectra in (Ga, Mn)As$^1$, YONG HEE CHO, ALEKSANDER WOJCIK, ALEXEY BELYANIN, Department of Physics, Texas AM University, College Station, Texas 77843, USA, CHANJUAN SUN, JUNICHIRO KONO, Department of Electrical and Computer Engineering, Rice University, Houston, Texas 77005, USA, HIRO MUNEKATA, Imaging Science and Engineering Laboratory, Tokyo Institute of Technology, Yokohama, Kanagawa 226-8503, Japan — We theoretically and experimentally investigated the magneto-optical Kerr effect (MOKE) in ferromagnetic (Ga, Mn)As over a broad spectral range with varying Mn concentration and hole density. The full band structure was obtained with a 30 band k.p method with the exchange interaction between Mn spins and itinerant holes. The dielectric tensor and Kerr spectra were calculated for the interband transitions over the first Brillouin zone. Theoretical results show excellent agreement with experimental Kerr spectra. Our studies prove antiferromagnetic character of p-d exchange interaction between holes and Mn moments. They confirm that the Fermi level in our GaMnAs samples lies in the valence band and the Kerr rotation originates from the interband transitions, and not from the impurity band-related transitions. Also, the strain and the spin-orbit band effects on MOKE are discussed.

$^1$We acknowledge the support from NSF grants ECS-0547100 and OISE 0530220.
10:00AM G2.00001 A Computer Based Synthetic Telluric Line Atlas, CHARLES ALLISON, Texas A&M University Kingsville — Earth’s atmosphere provides a substantial blanket of gases surrounding our planet that has a definite effect upon the spectrum and intensity of incoming light from astronomical objects. The effect is molecular absorption lines imposed upon the incoming signal which are referred to as telluric lines. While space based instruments such as the Hubble are placed well above Earth’s atmosphere, there are far more telescopes and equipment in use which are located on Earth and are subject to the problems of telluric lines. This article describes the implementation of a computer-based, synthetic atlas for telluric lines based upon data from the HITRAN molecular database. This atlas differs from others created by direct measurement in that it permits custom tailoring of parameters to fit the specific needs of an observer. Uses include telluric line identification, wavelength calibration, filter selection analysis, and in some cases, photometric intensity correction.

10:12AM G2.00002 Correlation between propagated solar wind and the response of Jupiter’s Magnetosphere observed by Galileo, YANSHI HUANG, University of Texas, Arlington, KENNETH HANSEN, University of Michigan, Ann Arbor, YUE DENG, University of Texas, Arlington — For the magnetosphere of Jupiter, the internal processes including rapid rotation, strong mass loading from Io, play major roles, however, solar wind driving is also important. We used a one-dimensional simulation of solar wind, with all variables as a function of the radius propagating from Earth out to Jupiter to compare with the measurements from Galileo Magnetometer(MAG). With the limitation in the heliographic longitude that we can model, the simulated solar wind represents the actual solar wind well along the Sun-Earth line, i.e., through those Sun-Earth-Jupiter oppositions. The correlation between changes of dynamic pressure in the solar wind and corresponding changes of magnetic field magnitude, orientation and lag angle observed by Galileo, will help us to understand the role of solar wind forcing on the magnetosphere system. The correlation result shows different responses at different locations in Jupiter’s magnetosphere.

10:24AM G2.00003 Saturation of Transpolar Potential for Large Y-component Interplanetary Magnetic Field1, ELIZABETH MITCHELL, RAMON LOPEZ, UT Arlington — This study examines the response of the transpolar potential to a large Y-component interplanetary magnetic field (B_y). The transpolar potential responds nonlinearly, saturates, for large IMF in the LFM global MHD simulation. This response occurs for both large B_x and large B_z. DMSP satellites data and AMIE results confirm the saturation of the transpolar potential during large B_y. The magnitude of the IMF at which the transpolar potential becomes nonlinear is the same for the large B_x cases as for the large B_z cases. The magnitude of the transpolar potential at which it becomes nonlinear is significantly smaller for the large B_x cases than for the large B_z cases. This indicates transpolar potential saturation does not depend on the strength of the region 1 current. Rather, these results suggest region 1 current may be limited by the transpolar potential.

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.

10:36AM G2.00004 Simulating the viscous interaction under a variety of solar wind conditions, with some comparisons to satellite data1, ROBERT BRUNTZ, RAMON LOPEZ, MICAH WEBERG, UT Arlington, JOHN LYON, Dartmouth College, MICHAEL WILTBERGER, NCAR/HAO — The viscous interaction is a mode of energy transport between the solar wind and Earth’s magnetosphere. Its effects are often difficult to isolate from other effects in in-situ measurements. Therefore, it can be useful to simulate the viscous interaction under a variety of solar wind conditions, especially since those conditions are often impossible to find in satellite data. We have used the Lyon-Fedder-Mobarry simulation to look at the viscous potential in Earth’s ionosphere for a variety of solar wind velocities, densities, and magnetic field strengths. Where possible, we have compared those results to low and high altitude satellite measurements.

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.

10:48AM G2.00005 Looking for polar cap potential saturation under strong northward Bz using DMSP satellite data1, SOPHIA COCKRELL, ROBERT ALLEN, SHREE BHATTARAI, RAMON LOPEZ, UT Arlington — The ability to predict the effects of the solar wind on the near-Earth space environment is receiving attention due to the ever increasing use of satellites and aircraft by consumers and governments. The cross polar cap potential is one way of measuring interaction between the solar wind and Earth’s magnetosphere. Recent simulations and ground based radar measurements have shown that the polar cap potential responds less and less to high values of northward interplanetary magnetic field (IMF), an effect known as saturation. To study this effect, we use data from a DMSP satellite, which flies at low altitude directly over Earth’s polar caps. This data, gathered in situ, provides a more direct measurement of the polar cap potential. We will present an analysis of this data and compare it to simulation and radar results.

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.

11:00AM G2.00006 Searching for evidence of convective cells within Earth’s magnetotail1, MICAH WEBERG, ROBERT BRUNTZ, UT Arlington, RAMON LOPEZ — The solar wind flows continually out from the sun, carrying energy and momentum in its stream of plasma, and shaping the Earth’s magnetosphere. The magnetosphere is defined as the region of space dominated by the Earth’s magnetic field. Viscous interactions have been suggested as one of the ways momentum and energy can be transferred from the solar wind, across a boundary called the magnetopause, and into the magnetosphere. Current models indicate that this phenomenon should cause a cell of circulating plasma to form just inside the magnetopause. This flow pattern, sometimes likened to a convection cell, produces an electric potential which is transmitted along magnetic field lines into the ionosphere near the polar cap. Using data from the THEMIS satellites, we will explore the motion of plasma near the magnetopause within the magnetotail to look for evidence of these “convective cells.” We will compare some THEMIS observations to our expectations of convective cells and discuss some implications it may have for ionospheric physics.

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.
11:12AM G2.00007 The Effect of Large $B_y$ on Currents in the Polar Cap$^1$. ROBERT ALLEN, SOPHIA COCKRELL, RAMON LOPEZ, DUSTIN BREWER, ELIZABETH MITCHELL, UT Arlington — In the polar cap, plasma flow is driven primarily by $E \times B$ drift. The two-cell convection pattern flows anti-sunward on the noon-midnight line and returns sunward on the equatorward edges of the polar cap. As the magnitude of the dawn-dusk interplanetary magnetic field (IMF $B_y$) grows, one of the cells enlarges as the other shrinks. During these times, we predict that a current will flow out of one pole, travel along the Earth’s bow shock, and then into the other pole along open field lines. This current should create a small cell of convection entirely on open field lines. We have used the electron flux instruments and plasma drift meters on DMSP satellites to locate the open-closed field line boundaries and the convection reversal boundaries for comparison with each other. We will present statistics and cases showing how the polar current depends on IMF $B_y$.

$^1$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-0129950.

11:24AM G2.00008 Plasma On the Rocks: DC Atmospheric-Pressure Normal Glow Plasma Enhanced by Natural Basalt Microdischarges$^1$. KARL STEPHAN, School of Engineering, Texas State Univ., SAGAR GHIMIRE, Dept. of Engrg. Technology, Texas State Univ. — DC normal glow discharges at atmospheric pressure in air and other gases are of interest in plasma processing, since they eliminate the need for low-pressure technology and vacuum-compatible materials. We have found that a DC normal glow discharge in air is stabilized and enlarged by passing it through a thickness of low-porosity rock such as basalt or granite. We observe a stable positive column in air up to 15 mm long with stable striations that depend on current. The airborne portion of the discharge shows characteristics of a normal glow discharge, including relatively constant voltage as current varies. A 13-kV, 5 mA discharge between a tungsten electrode 30 mm away from the surface of a basalt sample enlarges to over 15 mm diameter at the surface. We will present still and motion photography, spectra, and I-V measurements of this phenomenon, along with a simplified theory.

$^1$Partially supported by grants from the Julian Schwinger Foundation and Texas State University-San Marcos.

Saturday, October 24, 2009 10:00AM - 11:48AM — Session G3 Atomic, Molecular, and Optical Physics LBJ Student Center 3-10.1

10:00AM G3.00001 The photon, RUSSELL L. COLLINS, U T Austin, retired — There are no TEM waves, only photons. Lets build a photon, using a radio antenna. A short antenna (2L << \lambda) simplifies the calculation, letting B fall off everywhere as 1/r^2. The Bet-Savart law finds $B = (\mu_0/4\pi)(L_0/r^2) \sin \theta \sin \omega t$. The magnetic flux thru a semi-circle of radius \lambda/2 is set equal to the flux quantum h/e, determining the needed source strength, $L_0$. From this, one can integrate the magnetic energy density over a sphere of radius \lambda/2 and finds it to be 1.0121hc/\lambda. Pretty close. A B field collapses when the current ceases, but the photon evades this by creating a $\epsilon_0 \omega \mathbf{E} / \partial t$ displacement current at center that fully supports the toroidal B assembly as it moves at c. This $\mathbf{E} = \mathbf{v} \times \mathbf{B}$ arises because the photon moves at c. Stopped, a photon decays. At every point along the photon’s path, an observer will note a transient oscillation of an E field. This sources the EM “guiding wave”, carrying little or no energy and expanding at c. At the head of the photon, all these spherical guiding waves gather “in-phase” as a planar wavefront. This model speaks to all the many things we know about light. The photon is tiny, but its guiding wave is huge.

10:12AM G3.00002 Characterization of Guided Mode Resonance Filters for Wavelength Stabilization of Thulium Fiber Lasers$^1$. TANY DAX, Angelo State University Department of Physics, MARTIN RICHARDSON, ANDREW SIMS, University of Central Florida-College of Optics and Photonics — Stable, eye-safe lasers are important for use in medical environments and atmospheric propagation. A Guided Mode Resonance Filter (GMRF) consists of a waveguide between a layer of substrate and a diffractive layer. The GMRFs are produced at UNC Charlotte. The Thulium (Tm) doped fiber used consists of an octagonal undoped fiber with a doped core, and is the gain medium of the fiber laser. The Laser Plasma Laboratory at the UCF College of Optics and Photonics performed the necessary characterization of the output spectra and damage thresholds of the GMRF when used as the feedback element of the Thulium fiber lasers. This summer’s research project helped students to perfect in this characterization. The laser reached 10W of stabilized output. Further, the GMRFs withstood thermal changes and focused power with no damage or change in output spectra.

$^1$This work was supported by NSF REU.

10:24AM G3.00003 A Comparative Study of a New Computational Technique for Determining Optical Properties of Biological Samples Utilizing the Discontinuity Theory Described by the Dahm equation$^1$. BRIAN YUST, LAWRENCE MIMUN, DHIRAJ SARDAR, The University of Texas at San Antonio — Due to inhomogeneities inherent in biological samples, such as tissues, the current theories which are used to determine their optical properties can only result in an estimate whose accuracy is dependent on how well the approximation applies to the geometry and specific details of each sample. Specifically, in the regime of extremely thin biological samples, the usual techniques for determining optical properties, such as Kubelka-Munk, Inverse Adding-Doubling, and Inverse Monte Carlo, are no longer valid. A new computational technique utilizing the Dahm equation has been developed to determine the optical properties of samples which can be described under the representative layer theory. The main differences, strengths, weaknesses between this new technique and conventional ones will be discussed. A statistical comparison will also be made using experimental data sets previously obtained.

$^1$This work was supported in part by the NSF sponsored Center for Biophotonics Science and Technology (CBST) at UC Davis under Cooperative Agreement No. PHY 0120999.

10:36AM G3.00004 Electromagnetically induced transparency inside the laser cavity: Switch between first-order and second-order phase transitions$^1$. QINGQING SUN, Department of Physics and Institute of Quantum Studies, Texas A&M University, SELIM SHAHRIAR, Department of Electrical Engineering and Computer Science, Northwestern University, SUHAILE ZUBAIRY, Department of Physics and Institute of Quantum Studies, Texas A&M University, DEPARTMENT OF PHYSICS AND INSTITUTE OF QUANTUM STUDIES, TEXAS A&M UNIVERSITY TEAM, DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, NORTHWESTERN UNIVERSITY COLLABORATION — We investigate the effect of electromagnetically induced transparency (EIT) inside a laser cavity. By changing the intensity of an external drive field, we can control the absorption to the laser field. A semiclassical analysis shows that the system undergoes switch between first-order and second-order phase transitions. Around the tricritical point there could be a second-order phase transition followed by a first-order phase transition.

$^1$This research was partially supported by Qatar National Research Fund (QNRF).
10:48AM G3.00005 Optical precursor in Rb Vapor, WENLONG YANG, ALEXEI SOKOLOV — Picoscosecond pulses with center wave length 780nm are directed through a hot Rubidium cell. The input pulse are shaped with dazzler to be Gaussian, modulated Gaussian or square shape pulses. The output pulses are detected by streak camera. Simulation results of output pulse shape are presented. Optical precursors are observed in the simulation results. Some issues in the simulations are also discussed.

11:00AM G3.00006 A Complete Discharging Solution for LIGO1, QUENTIN FUNK, DENNIS UGOLINI, Trinity University — Surface charge on LIGO interferometer optics creates a changing electric field that exerts an oscillating pull on the optics, creating a fake signal. Replacing viton earthquake stops with fused silica reduced charging from \((6 \pm 1) \times 10^{-12}\) C/cm\(^2\) to \((-4 \pm 1) \times 10^{-14}\) C/cm\(^2\) per contact. We also investigated three ways to discharge an optic in vacuum. UV light removes negative charge via the photoelectric effect with a time constant of \((9 \pm 3) \times 10^{-6}\) s\(^{-1}\), and neutralizes positive charge by liberating electrons from a reaction mass at a rate of \((-9.89 \pm 0.2) \times 10^{-4}\) C/s. Both polarities are discharged faster at lower wavelengths. The energy to reduce negative surface charge by 1/e is \((3 \pm 1) \times 10^{-2}\) J/cm\(^2\), which could damage the reflective optic coatings over time. A Kimball Physics electron gun eliminates positive charge within seconds, but we believe that a modified Bayard-Alpert gauge could be a complete, less expensive, and more robust discharging solution.

11:12AM G3.00007 Wide-Field Microscopy Based on Leakage of Plasmon-Coupled Fluorescence, JACOB AJIMO, Department of Physics, Texas Tech University, STEPHEN P. FRISBIE, Department of Electrical and Computer Engineering, Texas Tech University, ANANTH KRISHNAN, CATHERINE CHESTNUTT, ALEX A. BERNUSSI, LUIS GRAVE DE PERALTA, DEPARTMENT OF PHYSICS, TEXAS TECH UNIVERSITY TEAM, DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING TEAM — Recent developments in wide-field leaky plasmon-coupled fluorescence (WFLPCF) microscopy are presented. We present pictures of nanostructures taken with a WFLPCF microscope. We discuss the general relationship existing between the lateral pattern stamped in the sample surface and the Fraunhofer diffraction pattern formed in the Fourier plane by the plasmon-coupled fluorescence leaked to the high numerical aperture objective lens of the microscope. In addition, we demonstrate that adding a linear polarizer in the optical path of the microscope permits to identify the polarization state of the guided wave polarization modes exited in the asymmetric metal/dielectric/air slab waveguide of the samples.

11:24AM G3.00008 Heterodyne effect in Hybrid CARS, XI WANG, AIHUA ZHANG, MIAOCHAN ZHI, ALEXEI SOKOLOV, GEORGE WELCH, MARLAN SCULLY, Department of Physics and Institute for Quantum Studies, Texas A&M University, College Station, TX 77843, USA, INSTITUTE FOR QUANTUM STUDIES TEAM — We study the interaction between the resonant Raman signal and non-Raman field, either the concomitant nonresonant four-wave-mixing (FWM) background or an applied external field, in our recently developed scheme of coherent Anti-Stokes Raman scattering, a hybrid CARS. Our technique combines instantaneous coherent excitation of several characteristic molecular vibrations with subsequent probing of these vibrations by an optimally shaped, time-delayed, narrowband laser pulse. This pulse configuration mitigates the non-resonant FWM background while maximizing the Raman-resonant signal, and allows rapid and highly specific detection even in the presence of multiple scattering. We apply this method to non-invasive monitoring of blood glucose levels. Under certain conditions we find that the measured signal is linearly proportional to the glucose concentration due to optical interference with the residual background light, which allows reliable detection of spectral signatures down to medically-relevant glucose levels. We also study the interference between the CARS field and an external field (the local oscillator) by controlling their relative phase and amplitude. This control allows direct observation of the real and imaginary components of the third-order nonlinear susceptibility \((\chi^{(3)})\) of the sample. We demonstrate that the heterodyne method can be used to amplify the signal and thus increase detection sensitivity.

11:36AM G3.00009 Raman’s Classical Theory of the Compton Effect, JAMES ESPINOSA1, Rhodes College, JAMES WOODWARD, West Texas State University — The Compton effect is one of the key experiments that convinced physicists to accept the photon concept. One of the few notable dissenters was C.V. Raman. After a brief overview of his life, we will describe the physical model that he used to reproduce the Compton formula for scattering. It combines a quasi-free elementary atomic model with classical wave principles. We will show the theory predicts two kinds of radiation from this atom when a light wave interacts with it. One of them will be determined by the motion of the electrons and will produce the Compton scattering predicted by quantum theory. We will slightly modify his argument to make it compatible with an earlier work by Hugh Callendar that described Blackbody radiation classically, demonstrating that the photon concept is not needed to explain Compton’s experiment.

1Supported by the National Science Foundation Grant No. PHY-0757801.

Saturday, October 24, 2009 10:00AM - 11:48AM
Session G4 Nuclear Physics LBJ Student Center 3-13.1

10:00AM G4.00001 Improving the Accuracy of Neutron Multiplicity Counting, SCOTT STEWART, Abilene Christian University — Neutron Multiplicity Counting is an assay method used in non-destructive analysis of plutonium for safeguards applications. It is will focus on how these detector response modules are produced and used.

10:12AM G4.00002 Simulations for the NIFFTE Time Projection Chamber, REMINGTON THORNTON, Abilene Christian University, NIFFTE COLLABORATION — The Neutron Induced Fission Fragment Tracking Experiment (NIFFTE) collaboration’s Time Projection Chamber (TPC) is designed to make high precision fission cross-section measurements. These measurements have long-term applications for future generations of nuclear power plant designs. An important component of this project is accurate simulation of the active volume including the physical features of the tracks and the electronics. Tracks are generated using the Geometry And Tracking (Geant4) simulation code, while the detector response simulation is custom written. After reading in tracks, from the Geant4 simulations, the detector response simulation transforms the data using a series of modules with the technique is being studied in detail. The accuracy of a neutron multiplicity measurement can be affected by a number of variables. Monte Carlo neutron transport simulations with MCNP have been done to understand how the density, isotopic composition, chemical composition and moisture in the material affect the count rate. These calculated count rates have been analyzed with the “point model” in order to determine the effect on the deduced plutonium mass. In practice, dead time in the electronics affects the count rate. Uncorrelated neutron sources have been measured in order to determine optimum settings for dead time compensation.

1Present Employer:TGS-NOPEC

1Martyn Swinhoe, Los Alamos Nati. Lab; N-1, Safeguards Science and Technology Group
thorium are sufficient to provide the world’s energy needs for a thousand years. GW electric power, eat its own long-lived waste, run for 7 years between core accesses, operate below criticality, and be stable against melt-down. Reserves of

University — A flux-coupled stack of superconducting isochronous cyclotrons could be used to drive thorium-cycle fission power. The 800 MeV proton beams

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Pb which has been a problem in most previous interactions. Work on implementing, extension, and modification of the form of the EDF is on-going.

— SARVAGA SHARMA, Abilene Christian University, ABILENE CHRISTIAN UNIVERSITY COLLABORATION — The Time Projection Chamber (TPC), being constructed by the NIFTTE (Neutron Induced Fission Fragment Tracking Experiment) collaboration will be used for high-precision fission cross-section measurements. These measurements will aid in the design of future generation nuclear power plants. The track reconstruction effort has employed various machine-based image processing algorithms. One of the methods investigated, the Hough Transform is a brute force attempt at finding tracks that isolates features in the TPC space by populating histograms. The dimensions of these histograms represent the unknown track parameters. The second, Binary Space Partitioning (BSP), recursively divides the TPC volume until all tracks are segregated. To determine track fit parameters, an iterative Kalman Filter has been implemented that accounts for multiple scattering and kinks in the track. The final tracks obtained from the reconstruction routines are traced back to the origin for vertex reconstruction. Comparing simulated and reconstructed tracks have shown the validity of these track reconstruction methods. This talk shall illustrate these techniques intended for track finding and fitting.

10:36AM G4.00004 Charmonium Production in Heavy-Ion Collisions - Revisited1, XINGBO ZHAO, RALF RAPP, Physics Department and Cyclotron Institute, Texas A&M University — We revisit the traditional picture of charmonium suppression as a signature of the Quark-Gluon Plasma (QGP) formation in heavy-ion (A − A) collisions. Our quantitative calculations are based on a kinetic rate-equation approach which includes both suppression and regeneration mechanisms in a thermal fireball. Initial conditions are obtained from experimental data in p+p and p−nucleus collisions. Specifically, we study transverse momentum (p_{T}) and longitudinal momentum (rapidity y) spectra of charmonia in A−A collisions. These are expected to provide a valuable discrimination power of suppression and regeneration mechanisms, and thus reveal properties of charmonia in the QGP. We present the numerical results and compare to experimental data at SPS and RHIC energies and give predictions at LHC energy.

1This work is supported by a US National Science Foundation CAREER award under grant No. PHY-0449489.

10:48AM G4.00005 Gamma-Jet Measurements in Au+Au Collisions with the Solenoidal Tracker At RHIC (STAR) , MARTIN CODRINGTON, Texas A&M University, STAR COLLABORATION — One of the most intriguing results from RHIC experiments thus far, is the observed suppression of hadrons at high transverse momentum; which is attributed to final state medium-induced energy loss of hard scattered partons. To quantify the energy loss, and the response of the medium to the deposited energy and momentum; a probe is needed that has negligible interaction with the medium itself, and thereby can provide a calibration of the momentum scale of the underlying process. One such probe is a prompt photon (i.e. produced from the initial hard-scattering process). Studying correlations of a prompt photon with a jet (γ−Jet), should allow one to study the attenuation and modification of a jet with well-defined energy quantitatively. And thus promises to provide a wealth of information about the energy-loss process. There is, however, a large background of photons from the decay of neutral mesons (mainly the π0). Ideally, a large fraction of these decay photons are rejected before a correlation study is undertaken. In the STAR experiment, this can be done using the transverse shower profile measured in the Shower Maximum Detector (SMD) of the Barrel Electromagnetic Calorimeter (BEMC). The latest results of this analysis will be presented.

11:00AM G4.00006 A Sensitivity Analysis of Dose Calibrator Linearity Assessment1, MARIO BENCOMO, University of Texas El Paso, Ex Paso TX, USA, MARVIN FRIEDMAN, St. Luke’s Roosevelt Hospital Center, New York, NY, USA — A total of eight variations of least squares fitting, both unweighted and (log-transformation and instrument errors) weighted, were applied to data arising from (simulated) exponential radioactive decay measurements in an ionization chamber dose calibrator during its linearity-of-response assessment. The fitting techniques were subjected to a study of the effect of modification of a selected low-activity data point prior to fitting. The increased robustness of the weighted techniques was demonstrated by the sensitivity analysis. A relatively large (10%) change in a low activity (imprecise) measurement value had only minimal effect in the best-fit curve parameters with the weighted techniques, but significantly changed the parameters with the unweighted techniques. These analyses shed new light on the inadequacies of the accepted methodology when transformation bias and measurement-dependent variation of instrument precision are taken into account.

1MARC, MUSE

11:12AM G4.00007 A New Skyrme Type Energy Density Functional , CARSON FULS, Texas A&M University — The quest for a modern energy density functional (EDF) with enhanced predictive power for properties of nuclei is one of the major problems in modern nuclear theory. We have recently constructed a new EDF starting with the Skyrme type EDF and taking into account effects of ground state correlations. We have used an extensive set of data on properties of nuclei in our fit to determine the parameters of the EDF. The set includes binding energy, charge rms radii, spin-orbit splitting of single-particle orbits, rms radii for valence neutrons and centroid energies for the isoscalar giant monopole resonance (ISGMR) for many different nuclei ranging from very light 16O to very heavy 208Pb. We have used the simulated annealing method in addition to an advanced least square method to search the hyper-surface of the Skyrme parameter space for the global minima. The new interaction named KDEX better predicts the rms radii of 16O and 208Pb which has been a problem in most previous interactions. Work on implementing, extension, and modification of the form of the EDF is on-going.

11:24AM G4.00008 Discrete Character of Meson Masses , M.A.K. LODHI, NORMAN REDINGTON, Texas Tech U — Regge plots have played an important role in the study of mesons for nearly half a century. The success of quark model reduced interest in this approach, but predicting the existence and shape of Regge trajectories remains as a test of success of a phenomenological meson model. Approximately linear Regge trajectories have been shown to arise from one of the earliest string models of the meson, and their existence is still regarded as an evidence for a meson as a pair of quarks. Regge expressed mesons of a family as trajectories in the mass squared-angular momentum plane as a multiple set of curves. These lines are analogous to the hydrogen atom energy level-angular momentum relationship. Further investigation shows that these sets of multiple lines can be reduced to a single line representing an entire meson family. In this work, the entire set of multiple lines representing the light meson family is replaced by a single line, which arises naturally when the squared mass of each meson depends linearly on the squared mass of the pion. This relation is analogous to the Rydberg formula for the hydrogen spectrum, with the electron mass replaced by the pion mass.

11:36AM G4.00009 Accelerator-driven thorium-cycle fission power, AKHDiyor SATTAROV, Texas A&M University — A flux-coupled stack of superconducting isochronous cyclotrons could be used to drive thorium-cycle fission power. The 800 MeV proton beams produce fast neutrons through spallation, then the fast neutrons transmute the thorium into uranium and drive fission. The thorium reactor would provide GW electric power, eat its own long-lived waste, run for 7 years between core accesses, operate below criticality, and be stable against melt-down. Reserves of thorium are sufficient to provide the world’s energy needs for a thousand years.

10:00AM - 10:00AM —

Session H1 Women in Physics Poster Session (10:00AM-12:00PM) LBJ Student Center 3-11.1
H1.00001 Wise Words on Physics and Life as a woman, TONI SAUNCY, LAUREN BENNETT, TANYA DAX, Angelo State University Department of Physics — This poster highlights a few key women who participated in physics over the last century with some humorous and not so humorous quotes about being a female being a physicist. The tenacity and resolve of women who faced challenges as they pursued their passion for science is obvious in only a few short words. Their words of wisdom will undoubtedly stimulate discussion, reflection and awe.

H1.00002 Physics Teachers and Students: A Statistical and Historical Analysis of Women, AMANDA GREGORY, Texas State University at San Marcos — Historically, women have been denied an education comparable to that available to men. Since women have been allowed into institutions of higher learning, they have been studying and earning physics degrees. The aim of this poster is to discuss the statistical relationship between the number of women enrolled in university physics programs and the number of female physics faculty members. Special care has been given to examining the statistical data in the context of the social climate at the time that these women were teaching or pursuing their education.

H1.00003 Dorothy Crowfoot Hodgkin, JESSICA MONTALVO, SPS Southwest Texas Junior College — Born in 1910 in Cairo, Egypt, Dorothy Crowfoot Hodgkin would later be known as the third woman in history to win the Nobel Prize in Chemistry for her research on the structure of vitamin B-12. Her X-ray crystallography work also included discovering the molecular structure of penicillin and insulin. Dr. Hodgkin’s work has aided in determining the structures of molecules for others to expand the technology necessary for today’s medicine.

H1.00004 Cecilia Helena Payne-Gaposchkin, ANTONY BRADEN, ADELSO CONTRERAS, SPS-Southwest Texas Junior College — This project will briefly tell the story of one of the 20th century’s most prominent astronomers, who through perseverance triumphed at the center of astrophysics. It also tells the story of the rough times in which Cecilia Helena Payne-Gaposchkin lived in as women then were held to much lower standards than they are today and endured unjust conditions. It also provides an analysis of the evolution of the astrophysics of stellar composition over a lengthy and prosperous career.

H1.00005 Dr. Yvonne Pendleton: A Prestigious Role Model of the 21st Century, GUSTAVO FLORES, HILARY PRADO, SPS — This project embodies the progression of Dr. Yvonne Pendleton through the beginnings of her fascination with science, her achievements in astrophysics, and contributions to scientific communities as a whole. As a woman of authority in a male-dominated field of study, Dr. Yvonne Pendleton has challenged the misconception that society attains of women in physics. As Senior Advisor for Research and Analysis for NASA, she recently investigated the organic component of the interstellar medium and the incorporation of that material into the early solar nebula. Through various obstacles, she continues to devote much of her free time to the encouragement of students at the high school, collegiate, graduate, and post-graduate levels.

H1.00006 Jocelyn Bell Burnell, MELANIE SANDOVAL, Southwest Texas Junior College — This project explores how the life of Jocelyn Bell Burnell, a British astrophysicist who, as a postgraduate student, discovered the first four pulsars. Her discovery was given credit to Antony Hewish, her thesis supervisor; Hewish was awarded the Nobel Prize without the inclusion of Burnell as a co recipient. The complexity of pulsars will be addressed through schematic views as well as exemplars including the cycles in which the pulsars go through. Burnell’s understanding of rapid set pulses occurring at regular intervals and position of unusual radio sources with respect to the stars was considered the greatest astronomical discovery of the twentieth century.

H1.00007 Read Between the Lines, LYNNY MOORE, Texas State University Physics Dept — When viewing it is best to have another person standing behind you reading the list of names of some of the women in the physical sciences that are placed “between the lines”. It creates a profound contrast to the written words of the author of the letter, Robert A. Millikan. My mother-in-law, Dr. Isabelle Ganz, said she attended a physics conference during her freshman year of college at the University of Rochester and personally “waited” on Robert Oppenheimer. She noted that there were no women present. They were most likely in the lab.