Joint Fall 2013 Meeting of the Texas Sections of the APS, AAPT, and Zone 13 of the SPS
Brownsville, Texas
http://www.aps.org/meetings/meeting.cfm?name=TSF13
Large Hadron Collider (LHC). This 200-500 GeV (extendable to 1 TeV) center-of-mass energy, high luminosity, linear electron-positron collider will be based on 1.3 GHz superconducting radio-frequency (SCRF) accelerating technology. The technical and political status of the project will be presented.

Discussion of some of the more interesting material, electrical and spectroscopic aspects of carbon networks based upon the hexagonal lattice of graphene. Much of the presentation will be concerned with carbon nanotubes.

The DC power source causes problems in final experiment’s result due to water electrolysis, double-layer capacitance, Ohmic resistance and electrolytic saturation effects. This results in the potential variation in the water during the time, causing a time dependent measurement. Our study demonstrates that the application of this AC experiment setup is much closer to theoretically expected curves compared to the experiment with DC supply.

Surfaces and Electric Fields is a well-known experiment in most Physics, electricity and magnetism labs. This experiment provides a clear understanding of equipotential surfaces around charged electrodes in a conducting solution. In many universities, the salt and water solution is used as the conducting solution and a DC power supply is used as the excitation voltage. Our study shows that the students plotted equipotential curves bend and deviate from the desired form and it makes them confused. The study proposes a developed setup for the experiment using a proper AC excitation signal with appropriate frequency and amplitude ranges. The result with this AC experiment setup is much closer to theoretically expected curves compared to the experiment with DC supply.

Astronomy Awareness and Personalization, WAHLTYN RATTRAY, University of Texas at Brownsville — For the amateur astronomer or simple astronomy enthusiast, I aim to establish a solid base of technical knowledge and skills when conducting observational astronomy using telescopes. The spectrum of these knowledge and skills ranges from setting up the telescope to knowing what objects are in the sky and where they are in the sky, ultimately making a personalized photo album of the objects they are looking at. I wish to guide a new astronomer through this and equip that person with a manufactured attachment piece that connects a standard telescope eyepiece with a personal device such as a camera phone, with the prospect of taking images of a few of the first fifty Messier objects, and creating a personal album containing these objects. The end goal is to standardize the astronomy experience and make it an enjoyable learning project carried out from the youngest of astronomers to the more senior, allowing virtually any astronomer to learn and have a desire to keep questioning their environment for the betterment of themselves and science.

Celebrating Einstein is a truly interdisciplinary effort including art, film, dance, music, physics, history, and education. Scripts, scores, animations, and films have been commissioned and produced for a Black (W)hole immersive art installation, A Shout Across Time original film and symphony score, a danced lecture on gravitational wave astronomy, and K-12 classroom lessons. The Celebrating Einstein products are available to any party interested in hosting gravitational wave education and outreach events. A full report and analysis of Celebrating Einstein audience learning gains will be presented.

1Supported by Montana Space Grant, Montana State University, and NSF.

University-Kingsville — Homework is an essential part of learning physics. But if the homework is not graded, the students will not learn. And no one has the time to grade in detail the necessary homework assignments for a class of some 75 students. Therefore, this author has continually been trying to find an effective homework method that does not require extensive grading time. His latest evolving iteration consists of requiring students to turn in 30 appropriate physics homework problems using a specified writing format for every one-hour lecture class. The type of problems, the required format, the amount of grading time, and a preliminary analysis of the effectiveness of this learning process are all discussed in this presentation.
11:30AM B1.00006 Instrumentation and Implementation of High Temperature Electrical Contact Resistivity. JOSE PUENTE, None — High Temperature Electrical Contact resistivity is a method by which current is applied to a thermocouple sample, and a tungsten probe is dragged across the sample to measure resistance variations across it. This method is very destructive, and often results on damaging the sample. Dragging a probe across a thermocouple sample under high temperature, and pressure creates micro cracks in the material that compromises the structure integrity of the sample. Using this method it is difficult to accurately estimate the material distribution over the sample due to the low resolution of the system. A more accurate, and nondestructive method needs to be develop to improve the efficiency of the testing method. We will achieve a higher resolution by adding a servo motor that can accurately probe the sample using an up, and down motion. The probe will be lifted, and moved horizontally every ten microns to avoid dragging, and to increase the resolution of the testing. We will develop and automate the new testing using mechanical fixtures, high resolution servo motors, and LabVIEW software.

11:42AM B1.00007 Constructing a Magneto-Optical Trap for an Atomic Interferometer1, DALLAS AKINS, DENNIS UGOLINI, Trinity University — Recent observations have revealed that the Universe is expanding at an accelerating rate! The source of this acceleration has been dubbed “dark energy.” If there are different densities of dark energy within the universe we can detect them using an atomic interferometer. The first stage of developing an atomic interferometer is constructing a magneto-optical trap (MOT) to capture atoms. The MOT consists of four key components: a source of cesium atoms, two coil magnets that position the atoms, two lasers that suppress atomic motions, and a vacuum system to house it all. In this talk I will describe the construction of the coil magnets and tunable lasers for our cesium atom MOT. The magnetic field is generated by two 150-turn coils with opposite currents. The laser diode emits a range of frequencies, but the atoms require a specific frequency for trapping. A diffusion grating is used to pick off a single frequency based on the grating’s angle from and distance to the laser diode. This distance is adjusted with a piezoelectric transducer (PZT) on which the grating is mounted. With these elements and the vacuum system complete, all that remains is to find a practical cesium source and finish the optical layout.

1Supported by the Murchison Summer Undergraduate Research Fellowship.

11:54AM B1.00008 Development of Room Temperature Detectors for Neutron Tagging, CAITLIN CAMPBELL, WILLIAM BAKER, Texas A&M University, DR. RUPAK MAHAPATRA TEAM — The Cryogenic Dark Matter Search (CDMS) uses silicon and germanium detectors in the search for Weakly Interacting Massive Particles (WIMP), a candidate for dark matter. Although these detectors are heavily protected with lead and polyethylene, high energy neutrons may penetrate through the shielding and cause nuclear recoils on the detector that may be mistaken for a WIMP. The purpose of this project was to create a detector that shields as well as tags incoming neutrons to measure the background neutron noise. In the design a polyethylene cylinder slows fast neutrons to thermal that are captured by either a gadolinium or boron source, both of which have high thermal neutron cross sections. Boron neutron capture has decay products of gammas and alphas while gadolinium releases only gammas. A plastic scintillator converts the resulting gammas into visible light to be readout by an avalanche photodiode. Each signal read out by the electronic circuit corresponds to gammas released from a neutron capture. Because outside gammas and gammas decay products are indistinguishable in this project, detection of neutrons will not be absolute until the system is tested inside a lead casing in which outside gammas will be shielded.

12:06PM B1.00009 Long Baseline Neutrino Experiment simulation studies on Offset of Detector and Proton Beam1, AMIT BASHYAL, JAEHOON YU, SEONGTAE PARK, TIMOTHY WATSON, YVONNE YING WUNG NG, University of Texas at Arlington, UTA HEP TEAM — The Long Baseline Neutrino Experiment(LBNE), hosted by Fermilab is a world class physics program aiming to probe our understanding on neutrino physics and look for physics beyond Standard Model. While LBNE is still under development, the LBNE beam simulation group performs the simulation using the G4LBNE simulation software and packaged geometry. The simulation studies are done by shifting and offsetting several parameters (which represent the physical components of the real experiment). The results obtained were analyzed graphically and statistically. In this talk, I will explain the effect of beam offset and detector shifting on parameters like pion production in the decay pipe, intensity of neutrino flux, variation on the number of neutrinos in specific energy ranges. Simulation experiment results will help to simplify the complex nature of neutrinos itself to a small extent and the collective work from the beam simulation group can provide a raw guideline for the experiment itself in the long run.

1All the works are done as part of UTA collaboration with Fermilab.

Friday, October 11, 2013 10:30AM - 12:30PM
Session B2 Atomic, Molecular and Optical Physics EDBC 1.508 - Malik Rakhmanov, University of Texas at Brownsville

10:30AM B2.00001 Discharging Fused Silica Optics Occluded by an Electrostatic Drive1, DENNIS UGOLINI, Trinity University — Charge accumulation on test masses is a potentially limiting noise source for gravitational-wave interferometers, and may occur due to exposure to an electrostatic drive (ESD) in modern test mass suspensions. In this talk I will show that an ESD can cause charge accumulation on a fused silica test mass at a rate of 8 * 10⁻¹⁶ C/cm²/hr. I will also describe a charge mitigation system consisting of a stream of nitrogen ionized by copper feedthrough pins at 3750 VAC. This system can neutralize positive and negative charge from 10⁻¹² C/cm² to 3 * 10⁻¹⁴ C/cm² in under two hours.

1This work is supported by the National Science Foundation under grant PHY-1068760.

10:42AM B2.00002 Spectroscopic and Theoretical Determination of the Structure of 2,6-Difluoropyridine in Its Ground and Excited Electronic States. JAAN LAANE, HONG-LI SHEU, Texas A&M Univ, SUNGHWAN KIM, Hanyang University — The infrared and Raman spectra of 2,6-difluoropyridine (2DFPy) along with ab initio and DFT computations have been used to assign the vibrations of the molecule in its S₀ electronic ground state and to calculate its structure. The ultraviolet absorption spectrum showed the electronic transition to the S₁(n,π*) state to be at 37,820.2 cm⁻¹. With the aid of ab initio computations the vibrational frequencies for this excited state were also determined. TD-B3LYP and CASSCF computations for the excited states were carried out to calculate the structures for the S₁(n,π*) and S₂(n,π*) excited states. The CASSCF results predict that the S₁(n,π*) state is planar and the S₂(n,π*) state has a barrier to planarity of 256 cm⁻¹. The TD-B3LYP computations predict a barrier of 124 cm⁻¹ for the S₁(n,π*) states, but the experimental results support the planar structure. Hypothetical models for the ring-puckering potential energy function were calculated for both electronic excited states to show the predicted quantum states. The changes in the vibrational frequencies in the two excited states reflect the weaker π bonding within the pyridine ring.
10:54AM B2.00003 Calculating Relativistic Atomic and Molecular Properties Using Monte Carlo Methods, STEVE ALEXANDER, Southwestern University, R.L. COLDWELL, University of Florida — There are a number of computational methods that can be used to calculate the energies and properties of nonrelativistic atoms and molecules. Fully relativistic calculations of these systems are much less common and more complicated. In part, this is because each relativistic particle generates four coupled components and the presence of negative energy states prohibits the use of most variational techniques. In this talk I will describe how variational Monte Carlo methods can be used to calculate the energy and properties of fully relativistic atoms and molecules. Results for both one electron and two electron systems will be presented.

11:06AM B2.00004 Frequency stabilization of a Planar Waveguide External Cavity Laser, OLIVER PUNCKEN, GREGORIO TELSEZ, STEVEN SHOEN, VOLKER QUETSCHKE, University of Texas at Brownsville, CGWA TEAM — Narrow linewidths and high stability in frequency and intensity are important laser properties in fields as optical communication, laser cooling, and atomic frequency standards. In the context of space based gravitational wave astronomy, it is assumed that the lasers must have a frequency stability of $30 \, \pi \, Hz / \sqrt{Hz}$ over a frequency-band from $3 \, MHz$ to $30 \, MHz$. Planar-Waveguide External-Cavity lasers might provide an alternative to nonplanar ring oscillators or fiber lasers. To achieve this requirement, frequency stabilization to an external reference is necessary. We present our initial experimental results of the intensity and frequency stabilization setup for a Planar Waveguide External Cavity Laser at 1550 nm to a high finesse ultra low expansion (ULE) cavity. The stabilization to the sub-Hertz level can be accomplished by using a Pound-Drever-Hall stabilization technique. The injection current is used as a fast actuator and the laser temperature as a compensator for slow drifts. The setup is isolated from the environment by using a radiative shield inside a vacuum tank in order to decouple it from thermal and acoustical disturbances. We build two identical setups, which allows for measuring the sum frequency noise of the systems by investigating the beat note.

11:18AM B2.00005 Experimental and Theoretical Determination of the Structures and Molecular Vibrations of Benzocyclobutane in Its Ground and Excited Electronic States, JAAN LAANE, ESTHER OCOLA, HEE WON SHIN, Texas A&M Univ, SUNGHWAN KIM, Hanyang University — The infrared and Raman spectra of vapor-phase and liquid-phase benzocyclobutane (BCB) have been recorded and assigned. The structure and molecular vibrations of BCB were also computed using theoretical calculations. The ring-puckering, ring-twisting, and ring-flapping vibrations were of particular interest and reflect the rigidity of the bicyclic ring system. The frequencies of vibration spectra of jet-cooled BCB have also been recorded and together with its ultraviolet absorption spectra were used to assign the vibrational frequencies for this molecule in its $S_1(\pi,\pi^*)$ excited state. Theoretical calculations were carried out to compute the structure of the molecule in its excited state and this was compared to that of the molecule in its electronic ground state as well as to the structures of five related molecules in their $S_0$ and $S_1(\pi,\pi^*)$ electronic states. In each case the decreased $\pi$ bonding resulted in longer carbon-carbon bonds in the benzene ring in the electronic excited states. The vibrational frequencies in the electronic excited state were readily assigned and these were compared to the ground state and to the frequencies of similar molecules. The decreases in the frequencies of the out-of-plane skeletal modes also reflect the increased floppiness of these bicyclic molecules in their $S_1(\pi,\pi^*)$ excited state.

11:30AM B2.00006 Transport coefficients from the Boson Uehling-Uhlenbeck Equation, ERICH GUST, LINDA REICHL, Univ of Texas, Austin — We derive microscopic expressions for the bulk viscosity, shear viscosity and thermal conductivity of a quantum degenerate Bose gas above $T_C$, the critical temperature for Bose-Einstein condensation. The gas interacts via a contact potential and is described by the Uehling-Uhlenbeck equation. To derive the transport coefficients, we use Rayleigh-Schrodinger perturbation theory rather than the Chapman-Enskog approach. This approach illuminates the link between transport coefficients and eigenvalues of the collision operator. We find that a method of summing the second order contributions using the fact that the relaxation rates have a known limit improves the accuracy of the computations. We numerically compute the shear viscosity and thermal conductivity for any boson gas that interacts via a contact potential. We find that the bulk viscosity remains identically zero as it is for the classical case.

11:42AM B2.00007 Modeling of Error Signal and Locking of Laser to Photonic Crystal Nanocavity, DARKHAN TUYENBAYEV, BENJAMIN FROST, MALIK RAKHMANOV, Univ of Texas, Brownsville — In many applications of silicon nanophotonics, lasers are brought to resonate in photonic crystal nanocavities. We analyze the possibility of locking a laser to a photonic crystal nanocavity using computer simulations. The nanocavity is formed by a single point defect in a 2-d square lattice of holes in a silicon slab. We couple light to the cavity through a line-defect waveguide and detect the leakage light from the cavity through an auxiliary waveguide. The resonance is achieved by choosing the frequency at the guided mode within the band gap of the photonic crystal. Detuning the light from perfect resonance gives rise to intensity beats in two waveguides which generate the error signal. This error signal is then used in feedback control loop to lock the laser to the cavity. The calculations are performed with the Finite-Difference Time-Domain (FDTD) model and the numerical analysis of the photonic band structure.

11:54AM B2.00008 Solutions of the Harmonic Oscillator Equation in a B-polynomial basis, MUHAMMAD BHATTI, The University of Texas-Pan American — A method to construct approximate solutions for a quantum mechanical system has been introduced in a Bernstein-polynomial (B-polynomial) basis. The B-polynomial-Galerkin method is applied to produce the energy spectrum of quantum harmonic oscillator equation. The discrete eigenstates are produced after applying the initial condition to the generalized eigenvalue problem which was extracted from the exact analytic matrix elements in the basis. The numerical discrete eigenvalues and the corresponding eigenstates are in excellent agreement with the exact results of the harmonic oscillator. However, the accuracy of the results depends on the number of B-polynomials chosen to construct the approximate solutions. To check the quality of the spectrum and the wave functions, the resulting basis set is used to evaluate the Thomas-Reiche-Kuhn (TRK) sum rules. In addition, perturbations through $5^{th}$ order are calculated to first excited state of harmonic oscillator using a perturbation potential and excellent agreement has been observed with exact results.

12:06PM B2.00009 A Dual Locking Scheme for Measurement of Long-Term Stability of a Triangular Ring Resonator, JOHNATHAN AGUILAR, OLIVER PUNCKEN, MALIK RAKHMANOV, University of Texas at Brownsville — The triangular ring resonator is an optical cavity that filters the higher order Hermite-Gaussian modes of a laser beam. One particular interest as these reflect the robustness and performance of the resonator. The spectra of a ring resonator using a dual-locking scheme based on the Pound-Drever-Hall (PDH) method. The resonator is locked to the fundamental mode of a 1064-nm Nd:YAG Laser using the PDH error signal to drive the piezo-mouted curved mirror of the resonator. The laser is then locked to the transition line of a stable atomic reference (Iodine vapor cell). Once the frequency of the laser is stabilized, the PDH error signal pertains only to the intrinsic noise of the resonator. The proposed scheme is intended for measurement of long-term stability of the ring resonator and its limiting noise performance at very low frequencies.
The simulation code will be discussed. SPH and/or the previous implementation of GSPH will be shown as well. Plans to implement tcGSPH in a new public-release accretion disk configuration of the particles in the density estimation. With the consistency and the satisfaction of the entropy condition, the convergence of particles, but also with the compression (or expansion) of the numerical volume of the particle, while standard SPH considers only the spatial components of the particles, it has been introduced to fix the incompatibility. The fluid density around a particle is estimated not only with the number density of particles, but also with the compression (or expansion) of the numerical volume of the particle, while standard SPH considers only the spatial configuration of the particles in the density estimation. With the consistency and the satisfaction of the entropy condition, the convergence of the tcGSPH is guaranteed. Several tests showing the performance of the tcGSPH will be presented. The comparisons with the standard SPH and/or the previous implementation of GSPH will be shown as well. Plans to implement tcGSPH in a new public-release accretion disk simulation code will be discussed.

10:42AM B3.00002 Black hole X-ray binaries in globular clusters, THOMAS MACCARONE, Texas Tech University — I will discuss the observational evidence for black hole X-ray binaries in globular clusters. Over the past few years, evidence for such objects has begun to be found in globular clusters in both the Milky Way and in nearby galaxies. I will discuss, in particular, the first such object, which shows a bizarre optical spectrum with strong, broad oxygen lines and no Balmer emission, suggesting that its donor star is a carbon-oxygen white dwarf.

10:54AM B3.00003 Tidal interactions during neutron star mergers: equation of state considerations, WILLIAM NEWTON, FARRUKH FATTOYEV, Texas A&M University, JOSE CARVAJAL, BAO-AN LI, Texas A&M University, SHU-ICHIRO INUTSUKA, Department of Physics, Nagoya University — GodunovSPH (GSPH) is a consistent numerical method based on particle hydrodynamics, while the standard SPH shows an unphysical numerical surface tension when there is a density contrast due a numerical inconsistency. However, an entropy violation has been observed in some test results of GSPH. In order to fix the violation, the thermally compatible GodunovSPH (tcGSPH) has been implemented. tcGSPH can reproduce the entropy solution even in the expansion wave region. The thermal incompatibility of the continuity and energy equations has been identified as the cause of the entropy violation, and the numerical volume of a particle has been introduced to fix the incompatibility. The fluid density around a particle is estimated not only with the number density of particles, but also with the compression (or expansion) of the numerical volume of the particle, while standard SPH considers only the spatial configuration of the particles in the density estimation. With the consistency and the satisfaction of the entropy condition, the convergence of the tcGSPH is guaranteed. Several tests showing the performance of the tcGSPH will be presented. The comparisons with the standard SPH and/or the previous implementation of GSPH will be shown as well. Plans to implement tcGSPH in a new public-release accretion disk simulation code will be discussed.

11:06AM B3.00004 Globular Cluster Simulation by N-body code and MOCCA code, DONGMING JIN, University of Texas at Brownsville — N-body6++ is a descendant of the family of NBODY codes initiated by Sverre Aarseth, which has been extended to be suitable for parallel computers. MOCCA is an improved code combines Monte Carlo method for simulations of star clusters evolution and Fewbody code to perform scattering experiments. I use the model NGC 6397 from Mirek Giersz's work to compare MOCCA code with N-body6 and N-body6++. I analyze the structure of these codes and figure out a way to calibrate to same initial conditions. With the newly-assembled Kepler Cluster in Germany, N-body6 code takes less than 3 days to reach 4000 N-body. Time for NGC 6397 model with 1 knot. From my first run, N-body6 and MOCCA have a good agreement with the binary mass & radius distribution and eccentricity distribution, not with N-body6++. For semi-major axis, all the codes don't get a good match.

11:18AM B3.00005 Spectroscopic Analysis of ROTSE Supernovae, GOVINDA DHUNGANA, Southern Methodist University — We present the results from spectroscopic analysis of several of the recent SNe found by the 0.45m ROTSE-IIb telescope, located at McDonald Observatory, Texas. The spectra are obtained from the 9.2m Hobby-Eberly Telescope (HET) located at the same site. Our analysis includes the identification of the SNe, study of spectral features and develop the understanding of possible inherent physical phenomenon that affects the evolution. Occasionally, we take multiple spectra of relatively interesting objects to better understand the evolution. We use SNID code (Blondin and Tonry 2007, Ap. J. 666, 1024) for preliminary identification and redshift estimation, and later generate the synthetic spectrum using Syn++ code (Thomas, R. C., Nugent, P. E., & Meza, J. C., 2011, PASP, 123, 237) to identify and understand the spectral features. Often, we are able to infer some of pre-explosion properties also.

11:30AM B3.00006 Ultraviolet Spectroscopy of X-ray Binary Systems, CYNTHIA FRONING, Univ of Texas, Austin, THOMAS MACCARONE, Texas Tech University, EDWARD ROBINSON, Univ of Texas, Austin, ROBERT HYNES, Louisiana State University, KEVIN FRANCE, University of Colorado at Boulder, LISA WINTER, Atmospheric and Environmental Research, FRASER LEWIS, Faulkes Telescope Project, University of South Wales — We have obtained the far-ultraviolet spectroscopy of the X-ray binaries A0620-00, Swift J1753.5-0127, 4U0614+091, and 1S1603.6+2600 using the Cosmic Origins Spectrograph on the Hubble Space Telescope. The UV observations have been accompanied by contemporaneous multiwavelength X-ray, optical/IR, and (for A0620-00) radio observations. The data provide constraints on the structure of the accretion disk and disk outflows, the evolutionary histories of the systems, and the physical properties of the accreting material. We will present the observations and analysis of the multiwavelength data.
11:42AM B3.00007 HD314884: A Slowly Pulsating B star in a Close Binary. CHRISTOPHER B. JOHNSON, Louisiana State University — We present the results of a spectroscopic and photometric analysis of HD314884, a binary system with detected soft X-ray emission. A reclassification of the optical counterpart reveals a BSV-B6V star with $T_{\text{eff}} = 15,490 \pm 310$ K, $\log g = 3.75 \pm 0.25$ dex, and a photometric period of 0.889521(12) days. A spectroscopic period search reveals an orbital period for the system of $P_{1} = 1.3654(11)$ days. The discrepancy in the two periods and the identification of a second distinct frequency in the photometric fourier transform at $P_{2} = 3.1347(56)$ days provides evidence that one of the stars is a slowly pulsating B star (SPB) with at least two oscillation frequencies. Using the dynamical parameters obtained from the radial velocity curve, we find the most probable companion mass to be $M_{1} = 0.8 M_{\odot}$. We conclude that the X-ray source in HD314884 is most likely a coronally active G-type star or a white dwarf (WD), with no apparent emission lines in the optical spectrum. The probability distribution of the companion star mass spans 0.6-2.3 $M_{\odot}$ at 99% confidence which allows the possibility of a neutron star companion. Our analysis does rule out a black hole as the primary X-ray source unless it is of a very low mass.

11:54AM B3.00008 Cataclysmic Variables in the Kepler Field1. MATT WOOD, Texas A&M University-Commerce, MARTIN STILL, STEVE HOWELL, NASA-Ames, JOHN CANNIZZO, ALAN SMALE, NASA-Goddard, THOMAS BARCLAY, NASA-Ames, GAVIN RAMSAY, Armagh Observatory — The NASA Kepler mission has been monitoring the SU UMa cataclysmic variables V1504 Cyg and V344 Lyra continuously at short cadence since June 2009. These systems both display dwarf nova outbursts as well as superoutbursts. Signals indicating positive and negative superhumps are observed - sometimes simultaneously - indicating an oscillating disk precessing in the prograde direction and a tilted disk precessing in the retrograde direction, respectively. The most remarkable finding from the V1504 Cyg data is that the year-long display of negative superhumps reveals period changes between and during dwarf nova and superoutbursts, providing a probe of the radial mass distribution of the tilted, precessing accretion disk. The eclipsing system V447 Lyra shows evidence for a larger disk during outburst and outburst orbital humps. These and other highlights of the Kepler CV data will be discussed.

1This work is supported in part by NSF through grants AST-1192332 and AST-1305799, and by NASA through grants 10-KEPLER10-0013 and 11-KEPLER11-0038.

12:06PM B3.00009 Seeing the Evolution of Cataclysmic Variables for the First Time. BRADLEY SCHAFFER, Louisiana State University — Cataclysmic Variables are expected to have long term cycles, where the accretion rate changes greatly on time scales of centuries to millennia. For the first time, I and my colleagues can test the prediction by constructing century-long light curves for many cataclysmic variables. (1) Nova Aql 1918 (V603 Aql) is declining at the rate of 0.44±0.04 mag/century from 1938-2013. (2) Nova Cyg 1876 (Q Cyg) has been brightening at the rate of 0.41±0.05 mag/century from 1891-2013. (3) Nova Aur 1964 (QZ Aur) faded from 1980-2009 at a rate of 1.5 mag/century. (4) QZ Aur had its orbital period get shorter by 0.00028. For recurrent nova T CrB, my 110,000 magnitude light curve from 1855-2013 shows a unique and weird structure wherein the star was in a high state (1.5 mag brighter than the usual quiescence) from -8 to -1 year and +0.4 to +5 years, after both the 1866 and 1946 eruption. (5) I have measured changes in the orbital period across the eruptions of T CrB (1946), U Sco (1999 & 2010), CI Aql (1946), and TP yr (2011). All four recurrent novae ejected greatly more mass than they accreted in the prior inter-eruption time interval, so none of these recurrent nova can become Type la supernovae.

12:18PM B3.00010 Pulsar J0453+1559, the 10th Double Neutron Star System in the Galaxy. JOSE MARTINEZ, University of Texas at Brownsville, KEVIN STOVALL, University of New Mexico, PAULO FREIRE, Max Planck Institute for Radio Astronomy, JULIA DENEGA, National Astronomy and Ionosphere Center, FREDRICK JENET, University of Texas at Brownsville, MAURA MCLAUGHLIN, West Virginia University, UNIVERSITY OF VIRGINIA COLLABORATION, UNIVERSITY OF NEW MEXICO COLLABORATION, MAX PLANCK INSTITUTE FOR RADIO ASTRONOMY COLLABORATION, NATIONAL ASTRONOMY AND IONOSPHERE CENTER COLLABORATION, WEST VIRGINIA UNIVERSITY COLLABORATION — Double neutron star (DNS) systems are valuable physical laboratories that open the doors for many precise experimental tests of gravitational theories. PSR J0453+1559 is a pulsar with a spin period of 45.7 ms. It was discovered and is currently being followed up with the world’s largest radio telescope, the Arecibo Observatory. The system has an orbital period of 4.07 days and an eccentricity of 0.1125. The semi-major axis of the orbit is 14.5 light-seconds, which, implies, for a pulsar mass of 1.35 $M_{\odot}$, the minimum and median companion masses are 1.0 $M_{\odot}$ and 1.2 $M_{\odot}$, respectively. This strongly suggests this is a new DNS system, only the tenth discovered in the Galaxy.

Friday, October 11, 2013 10:30AM - 12:30PM – Session B4 Biological and Chemical Physics Gran Salon - Kwan Kelvin Cheng, Trinity University

10:30AM B4.00001 Computational Search for Novel Endohedral Fullerenes1. LUIS BASURTO, TUNNA BARIKAR, RAJENDRA ZOPE, University of Texas at El Paso — Carbon fullerences are often used as electron acceptors due to their large electron affinity, low reorganization energy and three dimensional charge transport property. The open circuit voltage in organic photovoltaics is known to be related to the energy difference of the highest occupied molecular orbital (HOMO) energy of the donor and the lowest unoccupied molecular orbital (LUMO) of the electron acceptor. The use of endohedral fullerenes as electron acceptors offers an alternative way to manipulate its LUMO levels by varying the encapsulating unit. In recent years a few donor-acceptor complexes with endohedral units have been reported. We have recently designed a set of computational tools to search for stable endohedral fullerenes. Using this toolkit, we have optimized all 31924 isomers of C80fullerenes. Using the lowest 3000 and a few other promising candidate structures a set of 2200 endohedral complexes of $\text{Sc}3\text{N}@\text{C}80$ and 10000 complexes of $\text{Sc}4\text{O}2@\text{C}80$ was constructed. This set was subsequently optimized at PM6 level and the lowest few geometries were relaxed at the PBE-GGA level within DFT. These calculations confirm previously assigned fullerenes geometries and report a few new low energy isomers. This procedure is extended to search for novel endohedral fullerenes.

1NSF grants DMR-1205302 and TG-DMR0900971
10:42AM B4.00002 Biomechanical Discrimination of Diseased Cells for Cancer Diagnosis

ZAHAR ILYAS, MUHAMMAD AHSAN, YOUNG-TAE KIM, SAMIR IQBAL, University of Texas at Arlington (UTA), Texas, USA, NANOBIO LAB TEAM, NEUROENGINEERING LAB COLLABORATION — Biomechanical properties (size, shape, stiffness, viscosity, deformability) of cells change significantly in unhealthy cells and can be used to identify the physiological state of the cells. Here, we report a simple and interesting approach to identify cancer cells from biopsy samples. The detection scheme utilized single solid-state microphone as the biological transducer which translated the cell’s viscoelastic behavior into electrical signals. As a model, bladder cancer cells and normal urothelial cells were investigated. The approach didn’t require any staining, functionalization or availability of any biomarkers but relied on merely cellular mechanical properties. Temporal measurements of the ionic current were recorded across the micropore. Cancer cells gave distinctive pulse signals while passing through the micropore. The analysis of the pulses showed clear data clusters for cancer cells in contrast to their normal counterparts. On average, the bladder cancer cells showed one order of magnitude faster translocation time as compared to normal urothelial cells due to their softer nature. The cancer cells were easily identified from a mixture with a detection efficiency of more than 75%. The statistical analysis of each single cell present in the probed sample demonstrated its capability to identify cancerous cells when they were very few in number.

The work was supported by CAREER grant from the National Science Foundation (ECCS-0845669) to S. M. Iqbal.

10:54AM B4.00003 Investigating Protein Conformation changes at a soft surface

AHMED TOUHAMI, University of Texas at Brownsville, MARCELA ALEXANDER, MILENA CORREDIG, JOHN DUTCHER, University of Guelph, Canada — Here we use AFM-single molecule force spectroscopy to probe the conformational changes in Beta-lactoglobulin (BLG) protein adsorbed onto the oil-in-water interface due to variations in pH. Single oil droplets are mechanically trapped in pores of polycarbonate filter and the AFM tip is used to graze and unfolds BLG molecules. The changes in the contour length upon each unfolding event were determined by fitting the WLC model of polymer elasticity to each of the BLG peaks of the force-extension profiles. Our results show clearly that BLG on the same oil droplet adopts different conformations at different pH regions. While at pH 2.5, the unfolded BLG has a contour length similar to the total length of single monomer with two large unfolding barriers, the protein exists mainly as a dimer formed of several smaller domains at pH 6.8. Furthermore, at pH 9 the interactions between the AFM tip and the BLG layer on the oil droplet surface are dominated by an important repulsion due to the highly negatively charged BLG layer. This study demonstrates a novel application of single molecule force spectroscopy to investigate the underlying mechanisms by which proteins can be used to stabilize food products.

11:06AM B4.00004 Novel nanotechnology approach to target cancer disease by switching an alternative splicing

ALEXANDER KAZANSKY, IVAN MENDEZ, KAREN MARTIROSYAN, University of Texas at Brownsville — High levels of activated STAT5B, a specific member of the STAT family, are intimately associated with prostate tumor progression, while the naturally occurring truncated form of STAT5B acts as a tumor suppressor. We have demonstrated that the truncated isoform of STAT5 is generated by insertion of an alternatively spliced exon and results in the introduction of an early termination codon. Recently, we have also demonstrated the feasibility of using steric-blocking splice-switching oligonucleotides (SSOs) with a complimentary sequence to the targeted exon-intron boundary to enhance alternative intron/exon retention. In this work we report the efficacy of the steric-blocking by splice-switching oligonucleotide (SSO) conjugates with pH insertion peptide (pHLIP) to block alternative splicing of STAT5 mRNA in vitro and in vivo. This technology would allow opening new pathways for chemotherapeutic disease intervention strategies based on the combination of pHILIP nanotechnology and a novel approach of switching expression from a proto-oncogene to a tumor suppressor.

11:18AM B4.00005 Probing Conformational Changes in DNA by Force-Induced Melting of Double-Stranded DNA

CARLOS JEZIEL GONZALEZ, AHMED TOUHAMI, University of Texas at Brownsville — The goal of this research is to study the thermodynamics and dynamics of conformational changes in double-stranded DNA (dsDNA) by single molecule stretching experiments using optical tweezers microscopy. Individual dsDNA molecules are attached to a chemically functionalized cover-slip and the force applied to the DNA, as a function of the extension, is measured via the motion of a trapped micromized bead. If a single dsDNA molecule is stretched to forces of about 35 pN, one observes a plateau in the force-extension curve. Very little additional force is required to stretch the molecule from its normal B-DNA contour length by a factor of 1.7 and more. The structural transition that occurs in this plateau is termed “overstretching transition” and is a transition from dsDNA to single-stranded DNA (ssDNA), closely similar to the thermal melting transition. However, the two strands do not separate completely at the end of the overstretching transition, but only at the much larger force of at least 150 pN. Our focus here is to investigate the helix-coil transition in dsDNA under various conditions. Our methodology provides an unprecedented opportunity for quantitative investigation of a wide range of physiologically important phenomena associated with DNA helix-destabilization.

11:30AM B4.00006 Voronoi Tessellations Shell Analysis

SARA CHENG, University of Texas at Austin, CAMPBELL COMPTON, HOA NGUYEN, KELVIN CHENG, Trinity University, TRINITY UNIVERSITY PHYSICS AND TRINITY UNIVERSITY MATH COLLABORATION — In studies of lipid bilayer systems, disruptions caused by interaction of protein with lipid components are difficult to quantify. The purpose of our research project is to develop an analysis suite to analyze molecular dynamics (MD) trajectories of beta-amyloid on lipid bilayer systems containing POPC and cholesterol lipids. Using a combination of Python, Shell, and MATLAB scripts, we analyze multi-component, multi-shell, and multi-frame systems in order to better understand how beta-amyloid affects neuronal membrane mimics. The overall goal of our project is to gain insight on the damage caused by beta-amyloid and its role in the parthenogenesis of Alzheimer’s disease. The focus of our presentation will be on the post-processing shell data generated from running our MD simulation results through a computer program, Voro++. We will describe our method of extracting and analyzing MD simulations, including post-processing the results generated by a combination of GROMACS tools and in-house scripts. The results of our analysis suite, with a focus on density and order parameter, indicate strongest disruption of the lipid bilayer in the first shell surrounding the protein.

11:42AM B4.00007 Physiological Changes in the Bacterial Behavior in Weak Magnetic Fields

SAMINA MASOOD, University of Houston Clear Lake — We study the effects of weak magnetic field on the bacterial growth. We use different type of magnetic field to find out that how the bacterial behavior changes if it grows in the magnetic field. This preliminary study includes a comparative study of different bacterial species to compare their shapes, their gram-staining and other structural differences.
and spatial organization of cells. Mixed populations of Pseudomonas aeruginosa for Nonlinear Dynamics, University of Texas at Austin — Antibiotic resistance is a major issue in public health. Populations of bacteria naturally develop in order to describe inhibition in mixed systems. Investigations into these phenomena will lead to an increased understanding of the development and maintenance of antibiotic resistance in nature.

12:06PM B4.00009 Methodologies for Analyzing Motion Data in Humans, ELIZABETH SIZEMORE, Department of Physics, University of Dallas, CLAIRE SEXTON, CAREY DAVIES, ANNE ALMEDA, S.R. SLAUGHTER, Department of Biology, University of Dallas — Inertial measurement units (IMUs) are used to acquire acceleration, rotation, and magnetic field data in three dimensions. When attached to individual body segments these devices can wirelessly stream this data to computer workstations for analysis. The patterns seen can then be used to evaluate relative movements. In this study, rotation at the knee was analyzed by devices worn on the leg and thigh. Gait was studied over dissimilar surfaces, including flat, railroad ballast, and stairs. Image density, neural network, and fractal analysis techniques were employed to evaluate acquired data. Imaging software contributed to the quantification of rotation data in the X and Z axes. Error propagation neural networks create heuristic problem solvers that excel at analyzing non-linear relationships and capturing associations within a set. Fractal analysis gives us terms to express the degree of self similarity, which was applied to the different surface data. Determinations from these techniques will be presented.

12:18PM B4.00010 Can single-cell behavior predict the structure and rheology of bacterial biofilms?, VERNITA GORDON, BENJAMIN COOLEY, TRAVIS THATCHER, NUMA DHAMANI, University of Texas at Austin, SARA HASHMI, Yale University, WILLIAM WALLER, ROSS TODD, HENRY LEE, DANIEL HURWITZ, University of Texas at Austin, DANIELE PROVENZANO, AHMED TOUHAMI, University of Texas at Brownsville, SHERI DELLOS-NOLAN, DANIEL WOZNIAK, The Ohio State University — Biofilms are surface-mounted, multicellular communities of microbes. Biofilms are often associated with chronic infections that resist treatment, evade the immune system, and damage host tissue. An essential characteristic of the biofilm state is that constituent organisms are bound in a polymeric matrix. This matrix, plus the native motility of bacteria, does much to control the structure that develops in the biofilm. The matrix plus the mechanics of embedded bacteria controls the rheology of the biofilm. Biofilm structure is important for biofilm function because it controls transport; biofilm rheology is important because it controls the response to mechanical removal strategies. Understanding structure and rheology are basic challenges, and measuring rheology of biofilms is itself very experimentally challenging. We present results that show that components of the biofilm matrix influence the single-cell behavior of bacteria on surfaces in component-specific ways. These results suggest that it may be possible to develop metrics that use single-cell behaviors as predictors of biofilms structure and rheology.

Friday, October 11, 2013 10:30AM - 12:30PM — Session B5 Computational and High Energy Physics

10:30AM B5.00001 Quantum Particle on a Lattice: Interaction with a Periodic Potential, MARK O’CALLAGHAN, BRUCE MILLER, Texas Christian University — We study the equilibrium properties of a single quantum particle (qp) interacting with a classical lattice gas for a wide range of temperatures that will explore the system’s behavior in the classical as well as in the quantum regime. A path-integral formalism is developed in which the quantum particle is represented by a closed, variable-step random walk on the lattice. Monte Carlo methods are employed to determine the system’s properties. For the case of a free particle, in earlier work the canonical ensemble was utilized to derive analytical expressions for the energy, its fluctuations, and the qp-qp correlation function. Here the Metropolis algorithm is employed to determine the effects of interactions between each atom and the qp for a specific potential. We consider a striped potential in one dimension, where every other lattice site is occupied by an atom with potential $\delta$, and every other lattice site is empty. An analytical solution was determined in this case by utilizing Bloch’s theorem due to the periodicity of the potential. Comparisons of the potential energy of the qp are made between the results of the Monte Carlo simulations and the analytical calculations.

10:42AM B5.00002 Renormalization of QED Near Decoupling Temperature, SAMINA MASOOD, University of Houston-Clear Lake — We re-examine the renormalization of QED near decoupling temperature and show that the QED perturbative series is convergent, at temperatures below the decoupling temperature. The renormalization constant of QED acquire different values, if a system cools down from a hotter system to the electron mass temperature or heats up from a cooler system to the same temperature. At $T = m$, the first order contribution to $<\bar{\phi}m/m>$ is 0.0076 for a heating system and 0.0115 for a cooling system and the difference between two values is equal to 1/3 of the low temperature value and 1/2 of the high temperature value at $T = m$.

10:54AM B5.00003 Numerical Methods for Multifractal Analysis, YUI SHIOZAWA, BRUCE MILLER, Texas Christian University, JEAN-LOUIS ROUET, Institut des Sciences de la Terre d’Orléans — The discovery of a rather strange type of set, called fractal, led to the extension of the notion of dimension. Fractals play an important role in everything from medical imaging to cosmology. Fractals sets are characterized by self-similarity, and power laws can be associated with them. For a monofractal, the scaling pattern is homogeneous everywhere while it varies over the set for multifractals. By introducing the generalized dimension $D_q$, a spectrum of dimensions can be assigned to the set if it is a multifractal. In finding the generalized dimensions, the box-counting method has been by far the most popular choice among researchers across various fields. However, it is known that the class of methods which deal with partitions of equal size is ill-suited for computing the generalized dimensions on some domain of $q$. Two promising methods which utilize partitions of equal mass and distributed mass, rather than equal size, were investigated. Here we will report the results of our investigation.
11:06AM B5.00004 The Orthogonal Polynomial Projection Quantization Method and Exactly Solvable Quantum Systems: A Moment Representation Shortcut to the Nikiforov-Uvarov Approach. CARLOS HANDY, DANIEL VRINCEANU, Texas Southern University, DONALD KOURI, University of Houston, RAHUL GUPTA1, Texas Southern University, BRENDEN KILLEEN, KUSH PATEL, University of Houston — We show how two formulations of the Orthogonal Polynomial Projection Quantization Method (OPPPQ) recently developed by Handy and Vrinceanu (J. Phys. A: Math. & Theor.: 46, 135202 (2013); J. Phys. B: At. Mol. Opt. Phys. 46, 115002 (2013)) yield exact energies for one dimensional Exactly Solvable Quantum Systems. The second of these yields explicit closed form expressions for the discrete state energies. Our formulation bypasses the intricacies of the Nikiforov-Uvarov approach, popular among many researchers. We review most of these problems outlining their analysis through the two formulations of OPPQ.1

11:18AM B5.00005 Comparison of Correlation Functions for Path Integral Formulation of Ortho-Positronium in Dense Fluids. TERRENCE REESE, Southern University and A&M College, BRUCE MILLER, Texas Christian University — In previous work the Path Integral Monte Carlo (PIMC) technique was used to simulate a quantum particle (qp) in a dense Lennard-Jones 6-12 fluid having the thermodynamic properties of Xenon. Because of the difference in thermal wave-lengths between the qp and the fluid molecules the fluid molecules can be treated classically. This combination using quantum mechanics for the qp and classical mechanics for the fluid molecules is a hybrid model. The path integral formulation represents a qp as a closed chain of P classical particles in which the quantum uncertainty in the position of the qp is manifested in the finite width spread of the polymer chain. The PIMC technique allows standard classical Monte Carlo techniques to be used to compute quantum mechanical equilibrium values like the ortho-Positronium pick-off decay rate. The Correlation Function, C(k), is the mean of the product of the difference of a variable, at the times j and j+k, with the average value of that variable divided by the variance. The correlation length, k, at which C (k) becomes zero, indicates the number of passes before values of the independent variable become statistically independent. The Correlation Function versus the correlation length has been plotted for the decay rate covering different polymer segment lengths, temperatures, densities, and fluid molecule numbers. The number of statistically independent configurations has also been computed for each thermodynamic system.

11:30AM B5.00006 Some Issues of the BCS-BEC Crossover for Dense Quark Matter. ISRAEL PORTILLO VAZQUEZ, EFRAIN FERRER, VIVIAN INCERA, JASON KEITH, University of Texas at el Paso — We explore the possible BCS-BEC crossover on strong-interacting matter and its implications for the system’s equation of state. The study will be focus on different phases of dense quark-matter beyond nuclear density and at vanishing temperatures. We show that in the strongly coupled 2SC phase of color superconductivity no BCS-BEC crossover can take place due to the system’s color neutrality.

11:42AM B5.00007 Search for Heavy, Long-Lived Neutral Particles that Decay to Photons at CDF II using a Nanosecond Photon Timing System. RANDY WHITE, Texas A&M University — New particles can be produced from the high energy proton anti-proton collisions at the Fermi National Accelerator Laboratory (Fermilab). The products of these collisions, recorded by the Collider Detector at Fermilab (CDF), can be measured for the arrival times of photons produced in the decay of particles created in the interaction. Thus we may be sensitive to the production of new, massive particles that decay in flight to photons. Such particles can be produced in versions of Supersymmetry, and even be produced as the decay of a Higgs boson. Since the photons that may have come from such events will arrive at the surface of the detector later than photons produced directly from the primary collision, they can be separated in time and analyzed for significance with a nanosecond timing resolution. New results will be presented.

11:54AM B5.00008 Using RPC Data to Assist CSC Data when Dealing with Pt Assignment. JOHN BREDEMANN, University of Dallas, IVAN FURIC, MATTHEW CARVER, University of Florida, CSM DETECTOR CERN COLLABORATION — The Compact Muon Solenoid’s (CMS) two main detectors used in the endcaps, the CSC and RPC, are positioned closely together [1]. This means that, while the RPC’s main function is one of time synchronization and the CSC’s is one of precise position measurement, the former may be able to be used as a supplement to the latter’s data when assigning the momentum value (Pt) to a muon passing through the two detectors. Using the RPC’s positions variable (Phi), a comparison was made between it and the CSC’s Phi reading in order to determine whether there was sufficient correlation between them to use the RPC’s data where the CSC has gaps. Preliminary results on this analysis will be presented.


12:06PM B5.00009 Search for a new dark matter boson in the ATLAS detector. HARISANKAR NAMASIVAYAM, Univ of Texas, Dallas, ATLAS COLLABORATION — A search is performed for a new dark matter boson decaying to pairs of electron-positron or muon-antimuon in a final state consisting of collimated leptons, known as “Lepton jets.” The analysis was performed on the data collected by the ATLAS detector at the Large Hadron Collider (LHC) with the center-of-mass energy of collision at 7 TeV. The lepton jets (pair of collimated leptons) topology is a proposed signature for the decay of hypothetical, boosted, dark matter particles. The analysis tries to test the dark matter theories that attempt to explain the astronomical observation of energetic particles observed by the PAMELA experiment.

12:18PM B5.00010 MgB2 Beam Transport Channel for a Strong Focusing Cyclotron. KARIE MELCONIAN, KYLE DAMBORSKY, JOSHUA KELLAMS, PETER MCINTYRE, NATHANIEL POEGE, AKHDYOR SATTAROV, SAEED ASSADI, Texas A&M University — A superconducting strong focusing cyclotron is being developed for high current applications. Alternating-gradient focusing is provided by an array of ~6T/m superconducting beam transport channels which lie along the beam trajectories in the sectors of the cyclotron. The ~1T sector dipoles, corrector dipoles, and Panofsky type quadrupoles utilize MgB2 superconductor operating in the range 15-20 K. The quadrupole windings make it possible to produce strong focusing of the transverse phase space throughout acceleration. The trim dipole makes it possible to maintain isochronicity and to open the orbit spacing at injection and extraction. The design, development and prototype progress will be presented.

Friday, October 11, 2013 2:00PM - 4:00PM –
Session C1 Condensed Matter and Materials Research EDBC 1.502 - Heather Galloway, Texas State University at San Marcos
observed at 23 eV, 55 eV, 99 eV and 283 eV which we attribute to the Bi, Se, Te, and C Auger transitions resulting from surface state positrons used to deposit positrons at the sample surface. Peaks in the energy spectrum of electrons emitted as a result of positron annihilation were a series of experiments performed at University of Texas at Arlington on a Bi.

University of Texas at Arlington — We present evidence for the presence of a positron surface state on the surface of a topological insulator. Results from these peaks points to the fact that a significant fraction of positrons annihilate at or very close to the surface (we note that if positrons were trapped at the surfaces of a topological insulator, K. Shastry, P.V. Joglekar, N.G. Fazleev, A.H. Weiss, Univ of Texas at El Paso, Gianpietro Cagnoli, Laboratoire des Matériaux Avancés Bâtiment Virgo, Mario Diaz, University of Texas at Brownsville — Analysis of the GEO600 detector data has not shown any evidence of the existence of creep caused by hydroxide catalysis bonded silica ears. Karla Ramirez, Moses Castillo, University of Texas at Brownsville, ADAM ANCHONDO, University of Texas at El Paso, Gianpietro Cagnoli, Laboratoire des Matériaux Avancés Bâtiment Virgo, Mario Diaz, University of Texas at Brownsville — Analysis of the GEO600 detector data has not shown any evidence of the existence of creep caused by hydroxide catalysis bonds in the mirror suspensions above the measurement sensitivity. Measuring directly the bond creep noise on samples of advanced detectors such as aLigo is a prudent research step. A system for direct detection of creep at a higher sensitivity is being designed and a prototype test mass, which are used to measure any displacement either linear or rotational. This capacitive sensors are based on the electrical capacitance dependence of a conductor due to the distance from a dielectric body. A set of thermistors able to measure changes in temperature also form part of this setup. The goal is to be able to prove the presence of creep on the bonding used in the aLigo suspension test masses, and if such creep noise is present find what produce it.

University of Texas at El Paso, GIANPIETRO CAGNONI, Laboratoire des Matériaux Avancés Bâtiment Virgo, MARIO DIAZ, University of Texas at Brownsville — Analysis of the GEO600 detector data has not shown any evidence of the existence of creep caused by hydroxide catalysis bonded silica ears. Karla Ramirez, Moses Castillo, University of Texas at Brownsville, ADAM ANCHONDO, University of Texas at El Paso, Gianpietro Cagnoli, Laboratoire des Matériaux Avancés Bâtiment Virgo, Mario Diaz, University of Texas at Brownsville — Analysis of the GEO600 detector data has not shown any evidence of the existence of creep caused by hydroxide catalysis bonds in the mirror suspensions above the measurement sensitivity. Measuring directly the bond creep noise on samples of advanced detectors such as aLigo is a prudent research step. A system for direct detection of creep at a higher sensitivity is being designed and a prototype test mass, which are used to measure any displacement either linear or rotational. This capacitive sensors are based on the electrical capacitance dependence of a conductor due to the distance from a dielectric body. A set of thermistors able to measure changes in temperature also form part of this setup. The goal is to be able to prove the presence of creep on the bonding used in the aLigo suspension test masses, and if such creep noise is present find what produce it.

2:36PM C1.00004 Experimental evidence for the trapping of low energy positrons at the surfaces of a topological insulator, J. Shastry, P.V. Joglekar, N.G. Fazleev, A.H. Weiss, Univ of Texas at Arlington — We present evidence for the presence of a positron surface state on the surface of a topological insulator. Results from a series of experiments performed at University of Texas at Arlington on a Bi$_2$Te$_3$Se$_2$ sample. A magnetically guided beam of positrons was used to deposit positrons at the sample surface. Peaks in the energy spectrum of electrons emitted as a result of positron annihilation were observed at 23 eV, 55 eV, 99 eV and 283 eV which we attribute to the Bi, Se, Te, and C Auger transitions resulting from surface state positrons annihilating with the O$_2$, 5d$_{1/2}$, O$_1$, 5d$_{5/2}$, M$_4$, 3d$_{1/2}$, M$_5$, 3d$_{5/2}$, M$_6$, 3d$_{1/2}$, M$_7$, 3d$_{5/2}$ and K 1s core levels respectively. The existence of these peaks points to the fact that a significant fraction of positrons annihilate at or very close to the surface (we note that if positrons were annihilating uniformly throughout the bulk, the Auger signal would not be seen due to the attenuation of electrons leaving from the bulk. This is evidence for the existence of a surface state). Our results are consistent theoretical calculations by Saniz et al that have shown that such a surface state should exist.

2:48PM C1.00005 Positron Doppler Broadening Study of Clays and Shale samples, FNU Amenea, Hayden Morgan, C.A. Quarles, Texas Christian University — A previous detailed positron spectroscopy study of well-characterized reservoir rocks (carbonates and sandstones) has demonstrated the usefulness of positron Doppler Broadening spectroscopy in characterizing rocks [1]. The commonly measured S and W parameter were shown to be reproducible bulk properties of the rocks. A follow-up study has been undertaken to investigate clay and shale samples. While clay and shale are more complex and more heterogeneous than the reservoir rocks, it is believed that positron lifetime and Doppler broadening spectroscopy can help to characterize and distinguish the various samples and perhaps provide new useful insights into these materials. An overview of the Doppler broadening spectroscopy results will be presented and discussed for five well defined clay standards, (Na and Ca Montmorillonite, Smeectite and Kaolinite) and a variety of shale samples, which typically consist of mixtures of carbonate, silica and clay as well as organic carbon. The results include the usual S and W parameters as well as momentum distribution ratios of samples to standards such as Si and SiO$_2$.


3:00PM C1.00006 Effect of morphology on exchange bias in NiCoMnSn and NiCoMnIn magnetic shape memory alloys, Pavel Lapa, James A. Monroe, Brian E. Franco, Ibrahim Karaman, Igor V. Roshchin, Texas A&M University — Exchange bias (EB) which manifests itself as a shift of hysteresis loop is one of puzzling magnetic properties of magnetic shape memory (MSM) alloys. Despite a few attempts to explain the mechanism, there is no comprehensive model describing it. The main obstacle is a lack of information about the magnetic structures in martensitic and austenite phases. In contrast to classical EB systems where the exchange coupling happens at the interface between ferromagnetic and antiferromagnetic layers, the EB coupling in MSM alloys occurs due to coexistence of ferromagnetic and antiferromagnetic regions in bulk martensite state. The purpose of our work is to obtain the information about the size distribution of ferromagnetic and antiferromagnetic regions. We observe a correlation of EB with the secondary heat treatment for NiCoMnIn alloys. Comparative first order reversal curve (FORC) analysis for NiCoMnIn samples with different heat treatments suggests a correlation between morphology and distribution of exchange bias values. To enhance the difference in morphology, we developed a fabrication procedure for a set of NiMnSn samples with varied alloy composition. We report the results of structural analysis obtained using wavelength-dispersive X-ray spectroscopy (WDS) and magnetic characterization of these samples. Work is funded by TAMU and US NSF-DMR MMN program/MWN initiative grant 1108396.
3:12PM C1.00007 Overview of thermoelectric materials and their emerging applications. CAMAS KEY, KAREN MARTIROSYAN, University of Texas at Brownsville — Waste heat derived from any heat generating process: radioisotope decay, fuel combustion, solar thermal energy, geothermal energy, waste incineration, nuclear reactor cooling, industrial manufacturing, etc.; can be converted into electricity through the application of thermoelectric materials. The optimal thermoelectric materials exhibit high electronic conductivity in addition to very low thermal conductivity, two physical properties that are often hard to decouple within a material system. Narrow gap semiconductors prove to be the most suitable thermoelectric materials. Thermoelectric performance depends greatly upon phonon scattering over a wide range of phonon modes, analogous to having structures that scatter phonons on many different length scales. The ability to control material structures on the nanoscale helps in this regard and has been shown to reduce thermal conductivity without degrading electrical properties. Here we review characteristics shared by the best thermoelectric materials and focus on new material synthesis approaches to achieve greater thermoelectric performance.

3:24PM C1.00008 Removing contribution of the inelastically scattered valence band electrons from Ag(100) Auger Photoelectron Coincidence Spectrum1, PRASAD Joglekar, K Shastry, Univ of Texas, Arlington, Steven Hulbert, NSLS, BNL, Alex Weiss, Univ of Texas, Arlington — Ag(100) spectrum is obtained using Auger Photoelectron Coincidence Spectroscopic (APECS) technique. In the spectrum the 4p NVV auger peak is accompanied by high intensity at the low energies referred as the low energy tail (LET). A LET has contributions arising from intrinsic as well as extrinsic to the Auger transition. The LET’s extrinsic contribution is comprised largely of secondary electron background which includes inelastically scattered photoelectrons, valence band electrons and photo excited valence band electron. The inelastically scattered valence band electrons lose energy due to inelastic scattering and end up in the lower energy part of the spectrum. We did a series of APECS measurements to estimate the contribution from the inelastically scattered valence band electron. This contribution was subtracted from the Ag (100) APECS spectrum to obtain a spectrum free of inelastic scattered valence band. Our measurement was the first of its kind and the only one to attempt to remove all the secondary electron background.

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

3:36PM C1.00009 Heat treatment of Textured Powder Bi-2212/Ag Wire, FENG LU, KYLE DAMBORSKY, PETER MCINTYRE, Department of Physics and Astronomy, Texas A&M University, ACCELERATOR RESEARCH LABORATORY TEAM — Bi-2212/Ag conductors are being considered for future very high field magnet technology, beyond the 20 T limit of Nb3Sn magnet technology. Long-length Bi-2212/Ag conductor and coils still yield engineering current density (Je) much less than expected. The main current limit mechanism is residual bubbles in fully-processed wires due to porosity of the as-drawn wire and porosity agglomeration during the melting process. We have demonstrated that the high core density of textured powder (TPC) filaments minimizes the porosity of as-drawn wires. We are investigating three heat treatments to achieve high Je by reducing the bubble size and density in fully processed conductors: Over-Pressure Sintering (OPS), Over-Pressure Melting (OPM), and Current Control Melting (CCM).

3:48PM C1.00010 Charge-transfer with CVD graphene: Recent Progress, LES SHEFFIELD, IGOR LYUKSYUTOV, DUDLEY HERSCHBACH, DAYA RATHNAYAKA, Texas A&M University — The unique electronic, mechanical, and optical properties of graphene, a one atom thick layer of carbon atoms, were reported in 2004 (Science 22 October 2004: 306 (5696)). One obvious property is the large surface area (2630 m²/g) which indicates that every atom of the sample is capable of adsorbing gas molecules — thus providing the largest sensing area per volume. Utilizing this advantage to fabricate gas sensors requires considerable knowledge into the charge transfer effects exhibited by graphene samples with different types and quantities of surface dopants. Resistivity measurements with gate bias, commercially produced, chemical vapor deposited (CVD) graphene samples with large area are not feasible so far due to leakage through the insulating layer. Starting with 1cmX1cm commercially produced CVD graphene sheets we have prepared samples with mm dimensions for electronic transport measurements with gate biasing. Measurements can be made in a temperature range of 100-400K in high vacuum with the exposure of the sample to different gas beams (Rev. Sci. Instrum. B3, 064102) after degassing at 150°C. Preliminary results of our experiment will be presented.

Friday, October 11, 2013 2:00PM - 4:00PM —
Session C2 Nanoscience UBCB 1.108 - Karen Martirosyan, University of Texas at Brownsville

2:00PM C2.00001 Improved Numerical Model of Diffraction Patterns Produced by Synthetic Opals Implementing Finite-Size Sphere Scattering, LILIANA RUIZ DIAZ, MALIK RAKHMANOV, University of Texas at Brownsville — We continue our investigation of diffraction patterns produced by synthetic opals which are self-assembled photonic crystals. These opals consist of domains in which silica nanospheres are arranged in roughly uniform crystalline structures. Our previous experiments showed that these structures produce particular diffraction patterns when light is incident on a single domain. In an attempt to understand these patterns, we created a numerical model in which the nanospheres were represented by lattice points. In order to obtain a more accurate simulation we now replace the lattice points by dielectric spheres which scatter light according to Maxwell equations. This new model leads to a more realistic picture of the diffraction patterns. It allows us to modify the crystalline structure of the opal, change the physical properties of the nanospheres, and include defects.

2:12PM C2.00002 Pressure discharge characteristics in the nanoenergetic systems with hydroxides, TYLER TREVINO, MKHITAR HOBOSYAN, KAREN MARTIROSYAN, University of Texas at Brownsville — The growing demand on energetic materials created a new branch of nanotechnology which utilizes the methods of synthesis and characterization of nano-sized particles to produce so called Nanoenergetic Gas-Generators (NGG), which are alternatives to traditional energetic materials including pyrotechnics, propellants, primers and solid fuels. The thermites systems are pyrotechnic mixtures of metal powders and metal oxides that generate an exothermic oxidation-reduction reaction, releasing large amounts of energy at extremely high temperatures. The intimate contact significantly enhances and gives the ability to build an energetic material in molecular level, which is crucial for the pressure discharge efficiency of nano-thermites. The DTA-TGA, Zeta-size analysis and FTIR technique were performed to characterize the Bi(OH)3 particles. The self-assembly of Aluminum and Bi(OH)3 was conducted in sonic bath with appropriate solvents and linkers. The resultant thermitic pressure discharge values were tested in modified Parr reactor. Overall, the self-assembled thermites give much higher-pressure discharge values than the thermites prepared with conventional roll-mixing technique.
**2:24PM C2.00003 Carbon Nanotubes Forests and Yarns for Nanoenergetic Materials**

, PATRICIA MARTINEZ, ANVAR ZAKHIDOV, University of Texas at Dallas, KAREN MARTIROSYAN, MKHITAR HOBOSYAN, University of Texas at Brownsville, NANO-TECH INSTITUTE UNIVERSITY OF TEXAS AT DALLAS COLLABORATION, NANO-SCIENCE LABORATORY UNIVERSITY OF TEXAS AT BROWNVILLE COLLABORATION — A novel nanoenergetic yarn composite was fashioned by composing multi-walled carbon nanotube (MWCNT) sheets embedded with Al-I₂O₅ clusters, a nanoenergetic material (NM) whose volumetric energy is two orders of magnitude greater than that of Trinitrotoluene (TNT) and with a detonation velocity of approximately 2500 m/s. The NM/MWCNT composites were spin-twisted to create nanoenergetic yarns. MWCNTs were selected as the substrate matrix due to their unique intrinsic properties of high heat dissipation, high tensile stress and elasticity, all of which can be used in the manipulation and distribution of thermal energy during the nanoexplosions of the Al-I₂O₅ clusters. The detonation of the composite showed that MWCNT do not burn, but rather, they direct the explosion of NM along the twisted yarn. The thread-like structure of the composites allows the utilization of textile technologies to create complex weaves which can be used in new industrial and scientific applications as nanoexplosive fabrics with desired energetic properties.

**2:36PM C2.00004 Simulation of Reaction Time in Spherical Aluminum Oxide Nanoparticles During Rapid Oxidation**

, ZAMART RAMAZANOVA, University of Texas at Brownsville, MAXIM ZYSKIN, Rutgers University, KAREN MARTIROSYAN, University of Texas at Brownsville — Kinetics of oxidation of metal nanoparticles acquired practical importance with rapidly developing nanoenegergetic systems and materials. Nanoenergetic thermites include mixtures of Al and metal oxides in nanoscale. Our research focuses on modeling aluminum combustion of nano-sized particles, surrounded by rich amount of oxygen stored by oxides. Oxidation kinetic of spherical aluminum nanoparticles was evaluated by using Cabrera-Mott moving boundary mechanism. The self-consistent Cabrera-Mott electrical potential was determined by solving a nonlinear Poisson equation. Motion of the oxide layer boundary was determined from the gradient of the potential on the boundary (appearing as a Gibbs factor), leading to computation of reaction times. We estimated the reaction time for several different Al nanoparticles sizes and oxide thicknesses, with initial outer/inner oxide layer radius of (a) 5-3 nm; (b) 5-4nm; (c)10-7nm; (d)10-9; (e) 25-22nm; (f) 25-24nm. Our results show dramatic increase of oxidation rate at nanoscale. Nonlinear effects, as well as self-heating, play important role in increased oxidation rates.

**2:48PM C2.00005 Novel Upconversion Nanoparticles for Biomedical Imaging Applications**

, BRIAN YUST, FRANCISCO PEDRAZA, DHIRAJ SARDAR, University of Texas at San Antonio — With the confluence of biology, chemistry, and physics now being a reality in many hot topics of research, nanoparticles are being translated into the realm of biomedicine as novel biomarkers, sensors, and therapeutic agents. In particular, rare-earth ions doped into fluoride, oxide, and oxy sulfide nanocrystals exhibit extraordinary optical properties which are useful for biomedical applications including sharp absorption and emission lines in the visible and near-infrared (NIR) and long fluorescent lifetimes. Rare-earth based nanomaterials are advantageous as biomarkers because they do not photobleach like organic fluorophores, require lower power excitation sources, and do not blink such as quantum dots. Here, we present the optical characterization and upconversion quantum yield of KYbZ2F7:Er, Tm. The strong NIR to NIR upconversion emission is ideal for bio-imaging since light in the NIR regime is not strongly scattered or absorbed by most soft tissues. Finally, the nanoparticles are incubated with monkey retinal endothelial cells in order to determine toxicity, and non-specific cell uptake is imaged using multiphoton microscopy.

1This work was supported by the NSF PREM Grant No. DMR-0934218 and by a grant from the National Institute on Minority Health and Health Disparities (G12MD007591) from the National Institutes of Health.

**3:00PM C2.00006 Highly Efficient Near Infrared to Near Infrared Photoluminescence in GdF₃: Nd³⁺ Nanoparticles for Bioimaging**

, MADHAB POKHREL, Univ of Texas, San Antonio, L. CHRIS MIMUN, chris.mimun@gmail.com, AJITHKUMAR GANGADHARAN, BRIAN YUST, ASHISH DHANALE, LIANG TANG, DHIRAJ SARDAR, Univ of Texas, San Antonio, BIOPHOTONICS COLLABORATION — There is an increasing interest in rare earth (RE) doped nanoparticles due to their sharp absorption and photoluminescence (PL) in the near infrared (NIR) spectral region. These NIR based nanoparticles could allow biological imaging at substantial depths with enhanced contrast and high spatial resolution due to the absence of auto fluorescence in biological samples under infrared excitation. In this conference, we present the highly efficient infrared photoluminescence in GdF₃:Nd³⁺ nanoparticles under 800 nm excitation within the hydrodynamic size limitations for bio-applications. The downconversion (Stokes emission) absolute quantum yield (QY) measurements in powder, poly maleic anhydride-alt-1-octadicene (PMAO) coated powder and colloidal solutions have been investigated. QY measurements have revealed that downconversion QY in an average 5 ± 2 nm sized GdF₃: 1% Nd³⁺ colloidal nanoparticles are 200 times higher than efficient upconversion (UC) particles NaYF₄: 20 % Er/ 2% Yb of same size. Furthermore, the utility of these NIR emitting nanoparticles in infrared bioimaging will be demonstrated by confocal imaging and spectroscopic study.

1The authors would like to acknowledge the financial support from the National Science Foundation Partnerships for Research and Education in Materials (NSF-PREM) grant NO-DMR-0934218. We also would like to acknowledge the partial funding from the NIGMS MBR

**3:12PM C2.00007 Development of self-regulating thermosensitive magnetic nanoparticles**

, ANNA KUKLINA, CHAMATH DANNANGODA, KAREN MARTIROSYAN, The University of Texas at Brownsville — In oncology, the term “magetically induced hyperthermia” refers to the type of cancer treatment in which the heat is generated by the response of administered ferrofluid to alternating magnetic field. Malignant tumors are more susceptible to the damaging effects of heat within the range of 40-44 °C that healthy tissue. However, major limitation associated with hyperthermia cancer treatment is the difficulty of temperature control, due to uneven distribution of magnetic particles and variations in tissue heat conductivity that results in localized overheating of healthy tissue. The focus of this project is the development of self-regulating thermosensitive magnetic nanoparticles, which would lose the magnetic moment when temperature reaches the upper limit of biologically tolerable range. The reduction of the Curie temperature of the magnetic fluid can be accomplished by doping super-paramagnetic iron oxide nanoparticles with various biocompatible oxides, such as zinc, titanium, and magnesium. Described approach would make hyperthermia self-regulating minimally invasive and reduce associated side effects.
3:24PM C2.00008 Automation of alumina nanopore fabrication by anodization. LEONARDO A. BELLO PUENTES, IGOR V. ROSCHCHIN, PAVEL LAPA, Department of Physics and Astronomy, Texas A&M University — To fabricate arrays of nanopores, we use anodization of aluminum films. This process requires monitoring of current, voltage and temperature. We designed a control system that uses Labview, a data acquisition card (DAQ) with a built-in analog-to-digital converter (ADC), and amplification circuits. One of the challenges is to measure a broad dynamic range of current from 1 mA to 10 A. The resolution of our 12-bit ADC, which is inexpensive and commonly used with Labview, does not allow measuring 4 decades of current directly. We implement an amplifier that automatically switches between three ranges of measured currents. The response of the operational amplifier is not linear in the entire range of input voltages, and we establish the linear region of amplification for this operational amplifier chip, with the intention of resolving 1 mA current at the smallest range. Using this linear range, we establish the limits for the three ranges of the measured current and configure the auto-ranging that is controlled by a finite state machine (FSM) implemented in Labview. Since the thickness of the anodized material is proportional to the total charge passed through the sample, the system can stop the anodization process for a preset thickness of the material.

Work is supported by Texas A&M University.

3:36PM C2.00009 Exothermic interaction in the nanostructured system Al$_2$O$_3$-PTFE at various heating rates. MKHITAR HOBOSYAN, KAREN MARTIROSYAN, University of Texas at Brownsville — The interaction in the system Aluminum oxide-polytetrafluoroethylene (PTFE, Teflon TM) is very important for the energetic systems. In this work we attempt to study PTFE-Al$_2$O$_3$ system at heating rates up to 200 °C/min. The thermodynamic analysis by using the thermochemical code HSC-7 confirmed exothermic behavior of reaction. The Differential Scanning Calorimetry (DSC) technique was used to characterize dynamic features of interaction between polytetrafluoroethylene (PTFE) and calcinated Al$_2$O$_3$ under different heating rates. The result shows that there is a transformation from endothermic to the exothermic mode. At heating rates less than 150 °C/min the reaction is mainly endothermic, while at heating rates higher than 150 °C/min we have observed an exothermic reaction behavior. In endothermic mode the activation energy was estimated to be 269 kJ/mol, and at heating rates higher than 150 °C/min the activation energy was 21 kJ/mol. The activation energy of the reaction was calculated based on the peak temperatures of heat flow curves obtained from DSC measurements, using the isoconversional method. Experimental study shows that at the exothermic mode the PTFE reacts with Al$_2$O$_3$ in a single step producing AlF$_3$ and carbon. The study shows that the PTFE can potentially remove the oxide layer from aluminum and increase the direct contact area between oxygen and aluminum, which increases the reaction rate and improves the energy discharge in nanoenergetic systems.

3:48PM C2.00010 Three Dimensional Spatial Recognition Mapping of Magnetic Fields Utilizing Commercial Commodity Hardware. FRANCISCO LOZANO, University of Texas at Brownsville — A three dimensional portable tracking system can be developed using the relatively cheap commodity hardware known as the Wiimote. The Wiimote can be used to track position data, and can be coupled with data from other instruments. This research aims to integrate position and magnetic field strength data to build a virtual map of surrounding magnetic fields.

Friday, October 11, 2013 2:00PM - 4:00PM — Session C3 Astronomy, Astrophysics, Space Science, Cosmology and General Relativity II —

2:00PM C3.00001 Core-halo formation in one-dimensional self-gravitating systems. BRUCE MILLER, Texas Christian University, KENNETH YAWN, Texas Christian University, ERIK NGUYEN, Texas Christian University, JEAN-LOUIS ROUET, Universite d’Orleans — For many decades the one-dimensional self-gravitating sheet system has been studied as the simplest dynamical model for astrophysical systems of masses. The formation of core-halo structures has been of particular interest for astrophysical systems and their evolution. In one-dimensional systems, under the right conditions, similar structures can form in position-velocity space. In this work we study these formations using a dynamical simulation of a one-dimensional system of sheet masses. Specific particles identified in the initial distribution are tracked to the final core-halo distribution, and the evolution of the distribution of these particles in the system is identified and discussed.

2:12PM C3.00002 Detection of gravitational wave signals from NS-NS inspirals in presence of non-stationary noise. WENHUI WANG, SOMA MUKHERJEE, Department of Physics and Astronomy, University of Texas at Brownsville, UNIVERSITY OF TEXAS AT BROWNSVILLE TEAM — This work presents a study of the efficiency of detection of gravitational wave signals from neutron star - neutron star (NS-NS) binary systems as a function of stationarity of the underlying detector noise. A matched filter based search pipeline is used. First, NS-NS inspiral signals are injected in stationary noise and the detection efficiency is noted. Next, non-stationary noise is modeled in a realistic manner by using statistical ARMA models. The reason behind this choice is motivated by the fact that real noise from the LIGO detectors can be modeled (up to the second moment) in the same manner [1]. Detection efficiency of the search pipeline is studied for several non-stationary noise models thus created. Results show that when the noise is non-stationary and the signal-to-noise-ratio (SNR) is low, the matched filter cannot provide a very good detection. We thus develop a variation of the matched filter that improves detection results in presence of non-stationary noise.

2:24PM C3.00003 Black hole binary inspiral and trajectory dominance. RICHARD PRICE, Univ of Texas, Brownsville, GAURAV KHANNA, U. Mass. Dartmouth, SCOTT HUGHES, MIT — Gravitational waves emitted during the inspiral, plunge and merger of a black hole binary carry linear momentum. This results in an astrophysically important recoil to the final merged black hole, a “kick” that can eject it from the nucleus of a galaxy. We had previously shown that the puzzling partial cancellation of an early kick by a late antikick, and the dependence of the cancellation on black hole spin, can be understood from the phenomenology of the linear momentum waveforms. Here we connect that phenomenology to its underlying cause, the spin-dependence of the inspiral trajectories. This insight suggests that the details of plunge can be understood more broadly with a focus on inspiral trajectories.
universe.

signal, which itself provides additional information which can be used in studying the formation and evolution of large scale structure in the universe. The methods we have developed allow us to reconstruct the IA correlations at the level of the spectrum and bispectrum. For this purpose, we have demonstrated the feasibility of implementing the self-calibration for both auto- and cross-correlations. We have demonstrated that the self-calibration approach can reduce the IA bias over most relevant scale and redshift ranges by up to a factor of 10 or more. In the case of auto-correlations, we have demonstrated the feasibility of implementing the self-calibration for geometry and separation dependencies, allowing us to reconstruct the various IA correlations at the level of the spectrum and bispectrum. For this purpose, we have demonstrated the feasibility of implementing the self-calibration for geometry and separation dependencies, allowing us to reconstruct the various IA correlations at the level of the spectrum and bispectrum.

A new approach to the Cosmic Shear Signal

Scales and Implications for Cosmic Acceleration

We are studying the causal structure of spherically symmetric gravitational collapses to find if such singularities formed in a gravitational collapse are hidden inside black holes. Several examples that violate the conjecture have been found, but all of them are either too specialized or unphysical. We are studying the causal structure of spherically symmetric gravitational collapses to find if such singularities form generically.

3:00PM C3.00006 Recent Progress on Testing General Relativity at Cosmological Scales and Implications for Cosmic Acceleration

JASON DOSSETT, Queensland University, Australia, JACOB MOLDENHAUER, The University of Dallas — Cosmic acceleration can be caused by a cosmological constant/dark energy component in the universe or a modification to general relativity that takes effect at cosmological scales. An important question is to be able to distinguish between these two possibilities. We will report about some of our work on this topic including the framework developed and the results obtained using some recent available data sets. We will also report on our recent work to explore the robustness and decisiveness of this type of tests.

3:12PM C3.00007 The Self-Calibration of the Galaxy Intrinsic Alignment Contamination to the Cosmic Shear Signal

M. TROXEL, University of Texas at Dallas — Weak gravitational lensing due to large scale structure (cosmic shear) has been identified as a critical tool in studying the evolution of large scale structure in the universe, as well as shedding light on the nature and influence of dark matter and dark energy. One of the primary systematic biases in weak lensing, the intrinsic alignment (IA) of galaxies, poses a barrier to precision weak lensing measurements, and methods for identifying and removing its effects on cosmological information are key to the success of current and planned lensing surveys. We have addressed this problem by expanding model-independent techniques to indirectly measure and remove the IA contamination from the lensing signal. These self-calibration techniques take advantage of complimentary survey information to self-calibrate the lensing signal, which along with the unique lensing and IA geometry and separation dependencies, allows us to reconstruct the various IA correlations at the level of the spectrum and bispectrum. For cross-correlations, we have demonstrated that the self-calibration approach can reduce the IA bias over most relevant scale and redshift ranges by up to a factor of 10 or more. In the case of auto-correlations, we have demonstrated the feasibility of implementing the self-calibration for conservative estimates of photo-z accuracy in planned surveys. In both cases, the self-calibration has the added benefit of preserving the IA signal, which itself provides additional information which can be used in studying the formation and evolution of large scale structure in the universe.

3:24PM C3.00008 Formation of naked singularities in gravitational collapse

SOURABH NAMPALLIWAR, University of Texas, Brownsville — An important consequence of the cosmic censorship conjecture is that all singularities formed in a gravitational collapse are hidden inside black holes. Several examples that violate the conjecture have been found, but all of them are either too specialized or unphysical. We are studying the causal structure of spherically symmetric gravitational collapses to find if such singularities form generically.

3:36PM C3.00009 Astronomy at Tarleton State University: Photometric Investigation of the Eclipsing Binary Star CygIV-16062

SHAIKAT GODERYA, Tarleton State University — Tarleton State University observatory is located at the Hunnewell Ranch about 10 miles from the campus in Stephenville, Texas. It has the largest telescope of any undergraduate only institution, a 32 inch (.8m) research grade remotely controlled telescope from ACE equipped with a high quality FINGELAKES CCD camera and UBVRi filters from custom scientific. The observatory has been used for a variety of research projects as well as teaching observational astronomy to undergraduate students. A research initiative to obtain detail photometric data on poorly studied and faint eclipsing binary stars was started in late 2011. In addition, new binary systems discovered by the Kepler mission have also been included in this project. This paper presents work that our students have performed on CygIV-16062 (2MASS J19155176+4306271) a new eclipsing binary star discovered in Kepler field of view.

3:48PM C3.00010 Search for Rapidly Varying Eclipsing Binaries with ROTSE-III

FARLEY FERRANTE, ROBERT KEHOE, Southern Methodist University — We present the results of a search for eclipsing binary stars exhibiting rapid optical variations using observations made by the 0.45m RObotic Optical Transient Search Experiment-IIb (ROTSE-IIIib) telescope located at McDonald Observatory in the Davis Mountains of west Texas. For each candidate in a particular field we analyze the time variation of optical light output as recorded in ROTSE-III images to generate light curves for each night of observations. Examination of the light curve shape determines the variable type and magnitude range. Using a cubic spline fit, multiple nights of observations are then phased into one plot to determine the period and amplitude of variation. After analysis of a star field in the constellation Sagittarius originally imaged by ROTSE-IIIib as a gamma-ray burst (GRB) trigger response, we identified a candidate W UMa-type (EW) contact binary star that was previously uncatalogued. We submitted it to The International Variable Star Index (VSX) for review. The discovery was confirmed and the contact binary is now listed in the VSX catalog.
2:00PM C4.00001 ADAM: Destroy transuranics and generate power from spent nuclear fuel for green nuclear energy, PETER MCINTYRE, Texas A&M University, ADAM COLLABORATION — The ADAM collaboration is developing a method to use accelerator-driven subcritical fission in a molten salt core to destroy the transuranic elements in spent nuclear fuel and drive breed-and-burn fission of the uranium in spent nuclear fuel. The method can be used to generate electricity at the same rate the plant operates today for the next century, and at the same time destroy the hazardous long-lived components of that fuel. Advances in the design and first steps to implementation will be presented.

2:12PM C4.00002 Computational Fluid Dynamics using Graphic Processing Units, RUMA DUTTA, The University of Southern Mississippi, FLUID DYNAMICS COLLABORATION, APPLIED PHYSICS COLLABORATION — To Better understand the hydrodynamics flow behavior in turbulence, particle-fluid flow have to studied numerically in dispersed phase based on Navier Stokes equation. Generally detail simulation based on number of grids have been becoming increasingly complex in CFD physics. In today’s super computer scenario, computational approach have been shifted to Graphic processing units. We have approached our two phase simulation using GPU units and developed code using GPU units.

2:24PM C4.00003 Mercury and Selenium concentrations in Fish Samples from the Donna Reservoir and Canal System (Texas)1, MOHAMMAD HANNAN, KAREEM WAHID, GEORGE GARCIA, Department of Physics and Geology, University of Texas - Pan American, MIKAEL NILSSON, Department of Chemical Engineering and Materials Science, University of California Irvine, GEORGE MILLER, Department of Chemistry, University of California Irvine — Mercury and selenium in fish from the Donna reservoir and canal system were studied using instrumental neutron activation analysis at the UC Irvine TRIGA® reactor. The samples contain measurable quantities of Hg and Se, although the amount appears to be within the Department of Health Services Health Assessment Comparison values for trace metals. The samples were analyzed without post-treatment, reducing the risk of errors from losses in the analysis method. Suggestions for improvements using this type of analysis are provided.

1 NSSC-MSI summer fellowship program

2:36PM C4.00004 Hardware Engineering Design for 3D Magnetic Field Mapping, ERIN FERRELL, University of Texas at Brownsville — Creating the design and operation aspects for an apparatus that will create a three dimensional map of the magnetic field surrounding the apparatus. The apparatus will include a Nintendo Wii console remote coupled to a magnetometer, an infrared beacon will also be made to calibrate the Wii console remote. Using the pinhole camera method to transform the data being viewed by the Wii console remote from a two dimensional into a three dimensional perspective. The final prototype should be able to function with high resolution and an accuracy to track small electrical anomalies.

2:48PM C4.00005 Strong-Focusing Cyclotron: High-Current Proton Accelerator for ADS Fission, Medical Isotope Production, and Proton Cancer Therapy, PETER MCINTYRE, Texas A&M Univ — The cyclotron is one of the oldest and simplest particle accelerators, but the beam current that can be accelerated is limited by the overlap of succeeding orbits and by the inability with weak focusing to control the betatron tunes during acceleration. The strong-focusing cyclotron remedies both problems by using superconducting 1/4-wave cavities to provide sufficient energy gain per turn to fully separate orbits and by locating alternating-gradient beam transport channels in the sector dipoles to provide strong-focusing control of betatron motion. It can accelerate ten times more beam current than any existing accelerator: >10 mA CW up to ~ 800 MeV kinetic energy. The SFC provides the performance needed for ADS fission to destroy the transuranics in spent nuclear fuel; to synthesize 99Mo and other isotopes for nuclear medicine, and to provide high-brightness beams for pencil-beam cancer therapy.

3:00PM C4.00006 Compact MRI of the breast: new magnetostatics and new superconducting materials for affordable breast screening, PETER MCINTYRE, KYLE DAMBORSKY, MOHAMMAD HANNAN, KAREEM WAHID, GEORGE GARCIA, AKHDIYOR SATTAROV, Texas A&M University — MRI imaging of the breast has been shown to provide enhanced early detection of breast cancer, but whole-body is not affordable for screening. New magnetostatics and new superconducting materials make it possible to produce homogeneous magnetic field at both breasts using a compact magnet that is suitable for staging in a doctor’s office or mobile van.

3:12PM C4.00007 Gas Electron Multiplier Radiation Detector Prototype Response and Its Latest Long Term behavior Study by Kpix, YING WUN YVONNE NG, JAEHOON YU, SEONGTAE PARK, ANDY WHITE, AMIT BASHYAL, TIMOTHY WATSON, The University of Texas at Arlington — The Gas Electron Multiplier (GEM) technology is one of the next generation radiation detector technologies that utilized the ionization in gaseous medium to detect electrically charged particles from various radiations. University of Texas at Arlington’s advanced detector group has begun its work on GEM technology since the early 2000s to develop a new high precision detector for future particle detections. During the course of the past few years, data has been taken continuously to characterize the 30cmx30cm prototype detector. Statistical method has been developed to study the device's long term behavior. The effect of atmospheric pressure to the detector amplification has been compensated by a correction algorithm. In this talk, I will present the latest result of the long term stability study of the prototype detector and its ramifications to future use. The study would be of a particular interested to researchers working on the sparks studies of the GEM detector.
2:00PM C5.00001 Semi empirical formulae for nuclear single particle energies, ABDULAZIZ AL-MOGEETH, M.A.K. LODHI, Texas Tech University — The nonlocal potential is a crucial property for finite nuclear calculations. Under the effect of a nonlocal potential, the energy of a particle at the point \( r \) depends on the wave function at \( r \) and the wave function at the other point \( r' \) which is a neighbor of point \( r \). The Morse function has been used to represent the nucleon-nucleus nonlocal potential to generate single particle energies in nuclei. From these data of single particle energies of neutrons and protons thus generated semi empirical formulae have been constructed for the entire periodic table. These formulae may not give the exact values for each and every single particle state but provide a general trend giving broad features like magic numbers. These formulae yield level crossing at the right place, which will be illustrated in cases of s-d and p-f levels.

2:12PM C5.00002 Nuclear spin polarization of \(^{37,41}\text{K}\) by optical pumping, BENJAMIN FENKER, Texas A&M University — Precision measurements of observables in nuclear \( \beta \)-decay are capable of imposing meaningful constraints on physics beyond the standard model complementary to those obtained at high-energy collider experiments. In particular, measuring the \( \beta \)-asymmetry parameter \((A_\beta)\) in the \( \beta^-\)-decay of spin-polarized \(^{37}\text{K}\) constrains the possible admixture of a hypothetical \( V+A \) current in the weak interaction. At TRINAT (TRIUMF’s Neutral Atom Trap), atoms are confined and cooled in a magneto-optical trap and highly spin-polarized by optical pumping. I will show that we have determined the average nuclear polarization of optically pumped \(^{41}\text{K}\) to be \((P) = 0.88(6)\%\). Furthermore, I will present a comparison of optical pumping models as it pertains to our application, demonstrating that a quantum mechanical approach based on the density matrix formalism is necessary to accurately account for the various depolarizing mechanisms.

2:24PM C5.00003 Improvement of Environmental Monitoring for the SeaQuest Detector\(^1\), ELIZABETH CARLISLE, Abilene Christian University, SEAQUEST COLLABORATION — SeaQuest(Fermilab E906), uses the 120 GeV accelerator at Fermilab to collide protons with a fixed target. The primary targets are liquid hydrogen and liquid deuterium. SeaQuest will study the anti-down to anti-up quark asymmetry known to exist in the sea of gluons, quarks, and antiquarks in the proton and neutron. Recording environmental conditions is important, since detector performance and response can vary with conditions such as humidity, temperature and pressure, which vary over time. Due to the size of the detector hall, there are vertical temperature gradients, so temperature must be measured at varying heights. Another important need is to monitor temperature in electronics racks to know when they are overheating. The requirements of the equipment to be used were that it had to be ethernet based and rely only on non-proprietary software. Also, in order to be used during a data run, it has to be fast enough to be recorded in the 55 second gaps between proton spills. This presentation will focus on our solution for measuring environmental conditions, as well as how the time it took to read out data was dropped from 17.5 seconds to 6.9 seconds.

\(^1\)This research supported in part by the U.S. DOE under grant #DE-FG02-03ER41243

2:36PM C5.00004 Studies of neutron scattering off \(^{54}\text{Fe}\) with monoenergetic neutrons at 3 and 4 MeV\(^2\), SAMUEL HENDERSON, LESLIE SIDWELL, SALLY HICKS, University of Dallas Department of Physics, JEFFREY VANHOY, EVARISTO GARZA, JOSHUA STEVES, United States Naval Academy Department of Physics, STEVEN YATES, MARCUS MCELLESTREEM, University of Kentucky Department of Physics and Astronomy, ERIN PETERS, University of Kentucky Department of Chemistry, BENJAMIN CRIDER, TIM ROSS, FRANCISCO PRADOS-ESTÉVEZ, University of Kentucky Department of Physics and Astronomy — Accurate and precise neutron scattering data from \(^{54}\text{Fe}\) and other structural materials in the fast neutron energy region are essential for the optimization of current and future fission reactors. Neutron scattering and absorption by \( \text{Fe} \) affects the ideal operating parameters for the nuclear fission process and also affects the overall efficiency of the nuclear reactor. While neutron elastic crosssections for \(^{54}\text{Fe}\) at incident neutron energies between 3 and 4 MeV have been previously measured, the previous experiments tended towards larger error in the elastic, and there is a significant dearth of experimental data for the inelastic states. Neutron elastic and inelastic differential scattering crosssections of \(^{54}\text{Fe}\) have been measured at the University of Kentucky Accelerator Laboratory at the fast neutron energies of \( E_n =3 \text{ MeV} \) and 4 MeV. Results from our measurements and comparisons to evaluated cross sections from the National Nuclear Data Center will be presented.

\(^2\)This material is based on work supported by the Department of Energy under grant NEUP: NU-12-KY-UK-0201-05 and the Cowan Physics Fund at the University of Dallas.

4:00PM - 4:00PM — Session D1 Poster Session (4:00 - 6:00) — Gran Salon - Michael Sadler, Abilene Christian University

D1.00001 Structural Integrity of ssDNA on the Surface of Solid-state Nanopores, MOHAMMED ARIF MAHMOOD, WAQAS ALI, ASHFAQ ADNAN, SAMIR IQBAL\(^1\), University of Texas at Arlington — Self-assembly and 3D conformity of nucleic acid aptamers enable selective binding with biomarkers and cells. One mode of utilizing selective property of the aptamers is by grafting these in solid-state nanopores. Coating the inside walls of the nanopores with protein specific nucleic acid aptamers changes the energy landscape and affects the biomarker translocation. When the target protein passes through the nanopore, it interacts with surface-bound DNA and the process alters overall energy profile, which is essentially specific to the protein detected. The simulations showed that fundamental challenges in this process were to ensure these detection motifs held their structure and functionality under applied electric field and experimental conditions. The all-atom molecular dynamics simulation of the effects of external electric field on the 3D configuration of such ligand-DNA demonstrated how the grafted moieties affected the translocation time, velocity and the detection frequency of the target molecule. A novel case of protein translocation was also investigated for comparison where DNA was pre-bound to the protein.

\(^1\)Corresponding author

D1.00002 How to get more students in physics, SAMINA MASOOD, University of Houston Clear Lake — Physics programs are slimming down. Not many students are attracted to physics program any more. We identify some of the key factors that play key role in the loss of students. We also propose a few steps to motivate students to increase the physics enrollment.
D1.00003 Analysis of Atomic Spectra with applications to solar measurements\textsuperscript{1}, KEELEY TOWNLEY-SMITH, SARA-JEANNE VOGLER, CRISTIAN BAHRIM, Department of Physics, Lamar University — Atomic and molecular spectroscopy allows us to reveal the constituents of matter. Using PASCO® equipment we analyze the emission lines of several components of air such as oxygen, hydrogen, nitrogen, carbon dioxide, water, and helium. The pressure broadening on the emission lines allows us to enlarge them to a few nm in width and thus, to well resolve the lines. The characterization of the emission lines is applied to unknown compound spectra to identify the atomic constituents present. Also, the information can be further used to identify absorption lines embedded in the emission spectra of a known blackbody source of radiation: indeed the profile of the emission lines and their location should coincide with the absorption lines. The dominant absorption lines are from the ground atomic state. We attempt to apply this knowledge to de-convolute the absorption lines from the blackbody spectrum of the Sun modified by the absorption lines of Hydrogen and Helium atoms located in the Sun’s corona, and of Nitrogen, Oxygen, Carbon and other atoms from the Earth’s atmosphere.

\textsuperscript{1}We acknowledge the Sigma Pi Sigma organization of AIP for sponsoring our Lamar University SPS Chapter’s project on astronomical and solar measurements.

D1.00004 Modeling of Light Propagation and Optical Aberrations with Ray Tracing and Gaussian Beams\textsuperscript{2}, SATZHAN SITMUKHAMBETOV, MALIK RAKHMANOV, University of Texas at Brownsville — We built a model to understand light propagation through optical systems using ray tracing and Gaussian beam techniques. We use it for analysis of various optical systems including lenses, mirrors, interferometers, and laser resonators. We do not make paraxial approximation in our ray tracing algorithm. Therefore, the model can be used to study common optical aberrations, such as spherical aberration, coma, or astigmatism. Also, we can use the model to analyze natural optical phenomena, such as rainbow. The model is a useful tool for research and educational purposes.

\textsuperscript{2}Center for Gravitational Wave Astronomy, University of Texas at Brownsville.

D1.00005 Stochastic Optimization Techniques on Parameter Estimation of Binary Inspirals: Particle Swarm Optimization and Genetic Algorithm\textsuperscript{1}, SHIHAN WEERATHUNGA, Center for Gravitational Wave Astronomy, University of Texas at Brownsville; Department of Physics, University of Texas at San Antonio, SOUMYA MOHANTY\textsuperscript{2}, Center for Gravitational Wave Astronomy, University of Texas at Brownsville — The search for gravitational wave (GW) signals from inspiralling compact object binaries is performed using matched filtering on GW detector data. Numerical maximization is applied over a set of matched filter outputs to estimate signal parameters. The noisy nature of the data and the large number of signal parameters lead to a highly multi-modal and high dimensional objective function. This precludes the use of deterministic locally convergent optimization algorithms and a plain grid search is computationally prohibitive for even a modest number of signal parameters. Stochastic optimization methods can be used to efficiently find optimal solutions in such situations. We are engaged in a comprehensive study of the performance of two popular stochastic optimization algorithms, Particle Swarm Optimization and Genetic Algorithm, on the GW matched filtering problem. Results are presented here for a two dimensional testbed binary inspiral problem. Studies of higher dimensional problems are in progress.

\textsuperscript{1}Center for Gravitational Wave Astronomy, University of Texas at Brownsville.

\textsuperscript{2}Dr. Soumya Mohanty is the adviser of Shihan Weerathunga.

D1.00006 Pulsar Timing Simulator for the testing of Gravitational Wave Analysis Pipelines, JING LUO, FREDRICK JENET, University of Texas at Brownsville — We are developing a pulsar pulse time-of-arrival simulator based on SPICE, the solar system ephemeris software package developed at NASA’s Jet Propulsion Laboratory. Currently, the analysis and simulation of pulsar timing data has been predominantly carried out using either the TEMPO or TEMPO2 software packages. This completely TEMPO-independent simulation will enable full end-to-end testing of these packages as well as the data analysis pipe-lines based on these packages. This includes pipe-lines that will be used to detect and study gravitational waves. This poster describes the current design of the new package, its capabilities and limitations, and well as the results of preliminary tests of the TEMPO2 package.

D1.00007 Searching for accreting white dwarfs, black holes, and neutron stars within \textit{Swift} ultraviolet counterparts to \textit{Chandra} X-ray sources in the Galactic Bulge Survey region, CATHERINE FIELDER, THOMAS MACCARONE, Texas Tech University, ROBERT HYNES, Louisiana State University, THE GALACTIC BULGE SURVEY COLLABORATION — The \textit{Swift} portion of the Galactic Bulge Survey (Jonker et al. 2011) surveyed random sections from the northern strip of the Galactic plane ($1^\circ < b < 2^\circ$) in the direction of the Galactic center. By avoiding the center of the Galaxy extinction is much more limited while still maintaining a relatively high source density. The source list was originally compiled by \textit{Chandra} in the X-ray. We are searching for CVs, and possibly LMXBs, but coronally active stars and other hot stars may be detected. All of the detections in the UV are expected to be foreground objects. Some of the overall goals of the Galactic Bulge Survey are to 1) Constrain the Neutron star equation of state, 2) constrain the black hole mass distribution, and 3) constrain X-ray binary formation scenarios, all of which can be accomplished through source-type population numbers and making detailed follow-up observations of the X-ray binaries in order to better understand their distribution. The goal for this segment of the project is to match the UV observations with X-ray sources from \textit{Chandra} and to then classify these sources. A total of 50 out of about 1200 sources were matched in the UV, which is not unusual considering the \textit{Swift} coverage was less than half of that of \textit{Chandra}. 8 of these sources have noticeable UV excess and 3 of these sources seem to vary.

D1.00008 Looking for Periodicity in X-Ray Emission Data, ANDRES CUellar, STEPHANIE COHEN, MATTHEW BENACQUISTA, University of Texas at Brownsville — X-Ray Binaries are systems in which matter falling from one component of the system to the other releases energy in the form of X-Rays. We created an algorithm which uses Pearson’s Chi-Squared test to look for periodicity in X-Ray emission data from NASA’s \textit{Swift} Burst Alert Telescope (BAT) 58-Month Hard X-Ray Survey. We use the known High Mass X-Ray Binary J1647.9-4511B to verify the accuracy of our program testing over a range of periods, bins and energy bands to verify the true period. Results are discussed.
D1.00009 Examining XMM Observations in the Galactic Bulge Survey Region\textsuperscript{1}, VICENTE ESTRADA-CARPENTER, Southwestern University — The VXMM catalog was created in an effort to find help find low mass X-ray binaries (LMXBs) as part of the Galactic Bulge Survey (GBS). VXMM consists of XMM-Newton observations made in the GBS region, two 6x1 degree regions 1 degree above and below the galactic plane. The goal of the project was to find GBS X-ray sources that exist in XMM observations in order to classify them. The XMM data was downloaded from NASA’s database. Source detection was conducted on the filtered data using the 2-XMM Serendipitous Survey as a guideline for the procedure. The sources detected make up the VXMM catalog, which was used to cross reference with the GBS catalog to find GBS sources in the XMM data. In total the VXMM catalog found 107 GBS sources in the data. The spectra of several of these sources were examined to see which could be classified in the time available. CX13 was picked as it was the brightest GBS source not classified that was present in the data. CX13 was determined to not be an active star as its temperature would be too high. Using a power-law model fit LMXB was ruled out, as was background AGN after the power spectrum was analyzed. Leaving it to most likely be a cataclysmic variable.

\textsuperscript{1}Supported by NSF and Louisiana State University

D1.00010 Determining the Relativistic Spin of the Black Hole Cygnus X-1, SEBASTIAN GOMEZ, The University of Texas at El Paso, MICHAEL NOWAK, Massachusetts Institute of Technology — Cygnus X-1 is a very well studied black hole in a high mass X-ray binary system. In order to have a complete description of a black hole one needs to know its mass and spin. The mass and spin of Cygnus X-1 have been measured to be \( \sim 14.8 \, M_\odot \) and \( a^* > 0.95 \), respectively. The problem is that there is a dust cloud in the line of sight to Cygnus X-1. This dust cloud scatters the X-rays from the source creating a dust halo around the source. This could affect the previous measurements of black hole spin. We improved upon previous studies of the spin by modeling the dust halo that lies in front of the system with the use of the ISIS and MARX software analysis packages. We analyzed 2011 data from the Chandra and RXTE telescopes from when the system was in the high/soft, accretion disk dominated, state. The data fits well with a multi-temperature blackbody, a broken power law and a beta source function that was used to describe the dust halo. All of our fits yielded similar results, with spin values of \( a^* > 0.9 \). Accurately knowing the spin of Cygnus X-1 could give us insight into jet formation around black holes and when and how this black hole was formed.

D1.00011 Variable Star Search Using ROTSE-I Data, ISAAC GUERRA, ROBERT KEHOE, Southern Methodist University — We present results of a variable star search using data from the Robotic Optical Transient Search Experiment-I (ROTSE-I) telescope. Variable stars fluctuate in brightness as seen from Earth due to either intrinsic changes in the star’s brightness or to extrinsic changes in the amount of the star’s light that reaches Earth. Our research is focused on analysis of the time variation of optical light output as recorded in ROTSE-I images. Specifically, we are attempting to identify short-period variable star candidates which have amplitude variations on the order of one magnitude and periods on the order of several hours. For each candidate analyzed, we plotted a light curve and examined the shape to determine the type of variable. We also use a grouping, filtering, and averaging (GFA) algorithm that will help us reduce the error in the data taken by the telescope. Then to determine the period and amplitude of variation, we phased observations of the candidate from multiple nights into one plot using a cubic spline fit. We report on the confirmed discovery of a previously unidentified contact binary: ROTSEI J112431.65+460702.7. This star is now listed in the International Variable Star index (VSX) maintained by the American Association of Variable Star Observers (AAVSO).

D1.00012 Kozai mechanism and the dynamics of highly inclined planetary orbit in HD 196885 binary system, SUMAN SATYAL, Univ of Texas, Arlington, BILLY QUARLES, NASA Ames Research Center, Moffett Field, CA, TOBIAS HINSE, Korea Astronomy and Space Science Institute, Daejeon, Republic of Korea, JOAQUIN NOYOLA, Univ of Texas, Arlington — About 1/3 of the stars in the Milky Way are believed to be in binary; however, among the confirmed 900\textsuperscript{1} exoplanets only 7% are found to orbit binary stars. Depending on the orbits around the host star(s) a planet could be S-type, orbiting either one of the binary, or P-type, orbiting both of the binary. We have studied the dynamics of an S-type planet in HD 196885 AB considering the perturbation due to the secondary companion and with an emphasis on higher orbital inclination \( (i_{pl}) \) within the binary plane. Mean exponential growth factor of nearby orbits (MEGNO) maps are used as a chaos indicator to determine regions of likely orbital stability for the various choices of \( i_{pl} \), semi-major axis and longitude of ascending node (\( \Omega \)). Based on our analysis we have quantitatively mapped chaotic and quasi-periodic regions of the system’s phase space. By inspection of the resonant angle we study the qualitative behavior of the argument of periapsis and find it to librate or circulate as a consequence of Kozai oscillations. Also, based on our stability analysis, an attempt has been made to constrain the possible higher mass limit of the planet and improve upon the current ephemeris with a more consistent dynamical model.

\textsuperscript{1}http://exoplanetarchive.ipac.caltech.edu/index.html

D1.00013 Matching Black Hole Merger Waveforms\textsuperscript{1}, JOSE MCKINNON, University of Texas at Brownsville, JOHN BAKER, PHILIP GRAFF, NASA Goddard Space Flight Center, NASA GODDARD SPACE FLIGHT CENTER TEAM — Matched filtering techniques require accurate waveform models to perform precise parameter estimation. We present a hybrid gravitational waveform model for the inspiral and coalescence of non-spinning black-hole binaries. Since numerical-relativity (NR) waveform calculations remain computationally expensive and so cannot be used to investigate the complete space of possible parameters, we have combined effective-one-body (EOB) and post-Newtonian (PN) waveforms to produce a “complete” inspiral-merger-ringdown quadrupole waveform for use in the identification of systematic biases in parameter estimation of binary black-hole mergers. The approach is based on both frequency-domain (FD) and time-domain (TD) matching, and the minimization of systematic errors that arise from the matching process. In this work we have used various PN template families, such as the TaylorT1, TaylorT2, TaylorT3, TaylorT4 and the TaylorF2, together with the EOBNR (2,2) mode. Here we give results of the waveform matching technique and its efficiency for the different waveform models.

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D1.00014 Optical Photometry of BY Cam Modeled Using a Multipolar Magnetic Field Structure, JOHN MORALES, PAUL MASON, Univ of Texas, El Paso, ANDREY ZHILKIN, DMITRY BISIKALO, Institute for Astronomy, Russian Academy of Sciences, EDWARD ROBINSON, University of Texas at Austin — We present new high-speed broad-band optical photometry of the asynchronous polar (magnetic cataclysmic variable) BY Cam. Observations were obtained at the 2.1-m Otto Struve Telescope of McDonald Observatory with 3s integration times. In an attempt to understand the observed complex changes in accretion flow geometry, we performed full 3D MHD simulations assuming a variety of white dwarf magnetic field structures including both aligned and non-aligned dipole plus quadrupole field components. We compare model predictions with photometry and various phases of the beat cycle and find that synthetic light curves derived from a multipolar field structure are consistent with the optical photometry.
D1.00015 High Speed Optical Photometry of the LMXB UW CrB: An improved Limit on the Orbital Period Derivative. JACOB SEGURA, PAUL MASON, Univ of Texas, El Paso, EDWARD ROBINSON, University of Texas, Austin — We present new broad band optical photometry of the low mass X-ray binary (LMXB) UW CrB on four consecutive nights in June 2013. These data were obtained at the 2.1-m telescope of McDonald Observatory and have a time resolution of 10s and cover a bit more than one orbital cycle each night. The light curves display partial eclipses of the accretion disk by the donor star that vary both in depth and orbital phase in the same manner as has been previously reported. Analysis of the new eclipse times in conjunction with published timings are well fitted with the best quadratic ephemeris, and discuss its implications on the average mass transfer rate. By including the newly observed type I bursts with published bursts in our analysis, we find that bursts are not observed between 0.93 and 0.07 phases, i.e. they are not observable during partial eclipses of the disk.

D1.00016 Thermodynamics and kinetics of single stranded DNA (ssDNA) binding proteins. NABIN KANDEL, UTB Graduate Student, AMHED TOUHAMI, UTB Faculty, AMHED TOUHAMI TEAM, NABIN KANDEL TEAM — The aim of the present research project is to probe the thermodynamics and binding kinetics of bacteriophage T7 gene protein, gp2.5, and its deletion mutant lacking 26 C-terminal residues, gp2.5-26C. Single-stranded DNA binding proteins which stabilize ssDNA relative to dsDNA are essential for DNA replication in all living systems. Bacteriophage T7 gene 2.5 protein (gp2.5), encoded by gene 2.5 of the bacteriophage T7, is a single-stranded DNA binding protein that binds to and stabilizes transiently formed regions of ssDNA. The factor gp2.5 physically interacts with both T7 DNA polymerase and with T7 helicase/primase and plays multiple roles in T7 DNA replication and recombination in phage-infected cells. It forms a stable homodimer in solution and has a core that is well adapted for interactions with ssDNA and a highly acidic C-terminal tail. This tail is required for dimer formation and for interactions with other replication proteins of the bacteriophage T7 replication system. Its deletion mutant, lacking the C-terminal 26 residues, gp2.5-26C, binds ssDNA more tightly than the full length protein. To this end, force-extension relations at the overstretching transition of dsDNA in the presence of gp2.5 and gp2.5-26C are conducted using optical tweezers microscopy.

D1.00017 Proposed Mechanisms of cellular uptake of LDL-DNA complexes 1. JUAN GUEVARA, TROY McWHORTER, NATALIA GUEVARA, University of Texas at Brownsville — Low-density lipoproteins, LDL, have been shown to be natural vehicles for transport and delivery of exogenous genetic materials to the cell nucleus. The process involves binding of LDL and nucleic acids, binding of the complex to a receptor, endocytosis, release of complex, and translocation to nucleus. Understanding of LDL-mediated gene delivery processes depend on the morphology of the donor and acceptor (DA) interfaces. In experiments, these DA complexes are usually deposited from this study of this simple model system will be applicable to more complex bacterial pathogens and will enhance our ability to inhibit their adhesion to surfaces.

D1.00018 Bacterial Pili mechanics and dynamics at the Nanoscale. GLENN GRISSOM, AHMED TOUHAMI, University of Texas at Brownsville — The adhesion of bacteria to surfaces plays an important role in disease, providing the critical first step in the biofouling of a surface and in biofilm formation. Initial stage of adhesion involves thin appendages called pili present on the surfaces of many gram-negative bacteria. The aim of the present study is to determine the molecular forces required to evaluate adhesiveness of type I and type IV Pili to substrata. The adhesiveness of single bacteria cell to substrata as a function of pili expression are investigated using an AFM cantilever as a force transducer. This work is particularly innovative in that, for the first time, the extension and retraction dynamics of a range of pili as monitored by fluorescence and simultaneously the adhesion force are assessed by AFM force spectroscopy. Insight gained from this study of this simple model system will be applicable to more complex bacterial pathogens and will enhance our ability to inhibit their adhesion to surfaces.

D1.00019 Exploring the Membrane Association Behavior of Beta-Amyloid Protein Using Multiscale MD Simulations 1. YI YI CAO, Trinity University, SARA CHENG, University of Texas at Austin, CAMPBELL COMPTON, HOA NGUYEN, K. CHENG, Trinity University — Interactions of beta-amyloid (A-beta) protein with lipid membranes have been linked to Alzheimer’s disease (AD). At present, the mechanisms of A-beta/lipid interactions remain unclear. Using a multiscale molecular dynamics (MD) simulation technique, we have investigated the membrane-association behavior of A-beta in a lipid bilayer. The protein was initially in a gamma or alpha state and associated with the membrane surface. The protein in the gamma state detached from while the alpha state still remained attached to the membrane. We propose that the association of the lipid insertion domain with the hydrocarbon domain embedded in the lipid hydrocarbon region. Using a coarse-grained (CG) MD simulation, the gamma state detached from while the alpha state remained attached to the membrane. Applying a reverse mapping (CG to atomicistic) procedure and a subsequent atomistic simulation, the alpha state still remained attached to the membrane. We propose that the association of the lipid insertion domain with the hydrocarbon region of the membrane is important to stabilize the membrane association behavior of A-beta. This membrane associate behavior might play a key role in the self-aggregation of A-beta on the 2D membrane surface that eventually lead to AD.

1Supported by NIH grant 5SC1GM099637-03.

D1.00020 Molecular Dynamics Study of Phthalocyanine and Sulfonated-Phthalocyanine and C60 Interface. CARLOS DIAZ, MARCO OLGUIN, TUNNA BARUAH, RAJENDRA ZOPE, UTB — Organic photovoltaics (OPV) hold promise as cheap large-area technology for power generation. The fundamental mechanism of power conversion in OPV is dominated by interfacial processes such as charge transfer and charge separation. The energetics and dynamics of these processes depend on the morphology of the donor and acceptor (DA) interfaces. We examine the effect of sulfonation on the morphology of thin films. By introducing the acceptor molecules such as C60 in various concentrations we examine the variation in the morphology of OPV films with the different forms of phthalocyanine surfaces. We then select a few configurations of the DA complexes from the molecular dynamics trajectories and determine the charge transfer energies and the transport gap at the quantum mechanical level. Finally, by averaging over the configuration we obtain insights into the charge transfer energetics and the energy level alignments at the organic DA interface.

1Supported by the Trinity University HHMI Program.
D1.00021 A comparison of methods to characterize non-stationarity in time series data\textsuperscript{1}. ROBERT STONE, SOMA MUKHERJEE, University of Texas at Brownsville — In this work we examine methods to characterize a time-dependent noise background of time series data generated by the Laser Interferometer Gravitational wave Observatories (LIGO). This non-stationarity originates from both instrumental and environmental noise, and can be exhibited by sharp transient features in the data as well as by slowly-varying statistical properties. The efficient identification of the presence of non-stationarity can have the net effect of increasing the sensitivity of the detectors. We present the results of various methods we applied to characterize the non-stationarity of the data, including machine-learning approaches. These methods have exhibited significant overlap with results generated by standard LIGO data monitoring tools.

\textsuperscript{1}The authors would like to acknowledge the support of the National Science Foundation for its funding of the LIGO observatories and the CGWA CREST grant, and the Center for Gravitational Wave Astronomy

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D1.00022 Dilution factor measurement for a vibrating steel string\textsuperscript{1}. MOISES CASTILLO, Department of Physics and Astronomy and Center for Gravitational Wave Astronomy, University of Texas at Brownsville, GIANNIETRO CAGNOLI, Laboratoire des Matériaux Avancés, Université Claude Bernard Lyon 1, MARIO DIAZ, Department of Physics and Astronomy and Center for Gravitational Wave Astronomy, University of Texas at Brownsville — Measurements of mechanical losses have been done in the past in configurations parallel and perpendicular to the gravitational potential of earth with different sample shapes. Gravity will modify the quality factor of resonances when the restoring force depends on it, like in a pendulum, because of the conservative nature of the gravitational field. The configuration used in this experiment involves a steel string under tension. The restoring force will be due to the rigidity of the string and tension rather than gravity. The goal is to quantify the relation between the tension of a steel string and its quality factor for varied resonant modes and to demonstrate that the tension of the string works like a conservative field for the string dynamics.

\textsuperscript{1}Support for this work came from Center for Gravitational Wave Astronomy (CGWA) and grants NASA# NNX09AV06A and NSF# HRD0734800. Thanks to Trevor J. Guston, Juan G. Vazquez, Joe G. Avilla, Cade Daniel for their contributions in design.

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D1.00023 Properties of Gold Thin Films Sputtered on Glass\textsuperscript{1}. LINDSAY BECHTEL, CHRIS TANNER, ANDRA TRONCALLI, Physics Department, Austin College, MIKHAIL KOZLOV, Nanotech Institute, University of Texas at Dallas — When gold thin films have a thickness below 100 nm they begin to have different optical and electrical properties than bulk gold. In our project we deposited thin films of gold by sputtering onto glass. We made a set of 12 thin films ranging from 2 to 50 nm. These films were characterized through AFM measurements and transmittance spectroscopy. We will discuss the optical properties at various wavelengths for each film.

\textsuperscript{1}Work sponsored by the II-VI foundation.

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D1.00024 Monoclinic RbD\textsubscript{2}PO\textsubscript{4}: room temperature synthesis, chemical and structural stability upon heating\textsuperscript{1}. CRISTIAN BOTEZ, MASOUD MOLLAE, ANDRES ENCERRADO MANRIQUEZ, MICHAEL EASTMAN, University of Texas at El Paso — Monoclinic RbD\textsubscript{2}PO\textsubscript{4} polycrystals (DRDP) were synthesized via the room temperature crystallization of RbH\textsubscript{2}PO\textsubscript{4} (RDP) dissolved in D\textsubscript{2}O. Powder x-ray diffraction (XRD) data collected at T=25°C indicate that this deuterated crystal phase crystallizes in space group P2\textsubscript{1}/m with unit cell parameters a=7.688\textsubscript{A}, b=6.922\textsubscript{A}, c=4.781\textsubscript{A} and β=109.02° and is isomorphous with the intermediate-temperature phase of its hydrogenated counterpart RDP. We found no evidence of previously reported [Phase Transitions 80, 17 (2007)] polymorphic phase transition in DRDP upon heating from room temperature to 210°C. All lattice parameters vary smoothly within this temperature range, demonstrating that the P2\textsubscript{1}/m phase persists upon heating. In addition, the unit cell volume of monoclinic DRDP is ~ 1% greater than that of its RDP polymorph at all temperatures between 150°C and 210°C, which indicates the absence of significant deuterium-hydrogen isotope exchange. Further heating to 240°C leads to the thermal decomposition of the title compound via dehydration.

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D1.00025 Two Dimensional Transition Metal Dichalcogenides Synthesis and Exfoliation\textsuperscript{1}. MARINA PAGGEN, Univ of Texas, El Paso, KANOKPORN CHATTAKUN, BRIAN LEROY, Univ of Arizona — Transition metal dichalcogenides (TMDCs) are layered crystals that can be exfoliated to a monolayer while maintaining their electronic properties. Since the demand for high performing smaller electronic components is on the rise, the ability for the compounds to maintain electronic properties at the atomic level makes them appealing for various state-of-the-art applications. However, most TMDC compounds are not naturally abundant and must be synthesized in order to evaluate their electronic properties. An efficient and reliable method is required to synthesize the TMDC material. To determine the best techniques, methods of crystal synthesis and exfoliation were coupled to see which materials were best suited for this process. The chemical vapor transport method and sublimation methods were successful synthesis procedures and consistently created layered structured crystals. Micromechanical cleavage is the cleanest and simplest method for exfoliating monolayers. The compounds evaluated through this process were two semiconductors: tungsten disulfide and tungsten diselenide, as well as a superconductor: tantalum disulfide. For the semiconductors, photoluminescence was used to determine the number of layers and confirm the direct bandgap in exfoliated monolayer samples. For all compounds, atomic force microscopy was used to confirm the number of layers once exfoliated. All materials exhibit a potential for clean synthesis through mechanical exfoliation, simplifying the process to synthesize samples for TMDC research.

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D1.00026 X-ray Diffraction Study of Acetaminophen\textsuperscript{1}. VICTOR GONZALEZ, LEONEL GRIEGO, ANDRES ENCERRADO, CRISTIAN BOTEZ, The University of Texas at El Paso — Acetaminophen is one of the most common active ingredients in pharmaceutical products. Its crystal structure might change if it is not stored correctly. We analyzed the crystal structure of acetaminophen to observe if it changes upon heating. Pharmaceutical products usually need to be stored carefully, which includes keeping them in a dry and cool place. If acetaminophen were to be exposed to high temperatures when stored improperly, its crystalline structure may be affected; therefore, changing its biological properties. We prepared our powder samples by crushing two 500mg tablets of Equate\textsuperscript{®}. We collected diffraction data on a Siemens\textsuperscript{®} D5000 X-ray diffractometer at temperatures between 25°C and 150°C. We analyzed each data set by carrying out full-profile (Le Bail) refinements starting with the known room-temperature lattice parameters a=11.72 b=9.379 c=7.106 and β=97.472, and space group p2\textsubscript{1}/n of acetaminophen. Our data and analysis reveal that the lattice parameters vary smoothly within the 25 – 150°C temperature interval, which indicates that no polymorphic phase transitions occur. Further heating above 150°C leads to the thermal decomposition of the active ingredient.
D1.00027 Density Increasing in Special Theory of Relativity , FLORENTIN SMARANDACHE, University of New Mexico — According to the Special Theory of Relativity the mass of a moving object increases with the speed of the object with the factor \( F(v) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \), but what really increases: the object density, the object volume, or both? Because \( \text{Mass} = \text{Volume} \times \text{Density} \) for homogeneous bodies, and since the object length decreases (in the direction of movement), then should we understand that the object volume also decreases? The volume decreases with the contraction factor \( C(v) = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \), hence the density increases with \( F^2(v) \). Then the Mass-Increasing Factor is equal to \( F(v) \). Yet, Einstein himself disliked the concept of relativistic mass given by the formula:\[ M(v) = \frac{m}{\sqrt{1 - \frac{v^2}{c^2}}} \]

where \( m \) = rest mass, and \( M \) = relativistic mass of the object moving at speed \( v \).

D1.00028 On the Fluid Dynamics Nature of General Relativity and Estakh’s Fluid Field Geodesic Equation , AHMAD REZA ESTAKHR, Researcher — EFFG (Estakh’s Fluid Field Geodesic) Equation is developed analogy of Einstein’s Field Equation and EMG (Estakh Material-Geodesic) Equation (Which is developed analogy of Navier-Stokes Equations and Einstein Geodesic Equation ref.1) by EMG equation \( \frac{D\mu}{D\tau} = J_\alpha \Omega^{\alpha\beta} + \partial_t T^{\mu\nu} + \Gamma^\alpha_{\beta\gamma} J^{\gamma \mu} T^\beta_\nu \) we can find EFFG equation \( \frac{D\mu}{D\tau} = J_\alpha \Omega^{\alpha\beta} + \frac{c^4}{8 \pi G} \partial_t (g^{\mu\nu} R + g^{\mu\nu} \Lambda) + \Gamma^\alpha_{\beta\gamma} J^{\gamma \mu} T^\beta_\nu = 0 \) Where \( R^{\mu\nu} \) is Ricci Curvature tensor, \( R \) the scalar curvature, \( g^{\mu\nu} \) the metric tensor, \( \Lambda \) is cosmological constant, \( G \) is gravitational constant, \( c \) is the speed of light in vacuum, \( T^{\mu\nu} \) the Stress-Energy tensor, \( J^{\mu} \) is four-current mass density, \( J_\alpha \Omega^{\alpha\beta} \) is Material derivative, \( T^{\mu\nu} \) four-velocity field and \( \Gamma^\alpha_{\beta\gamma} \) is Christoffel symbol. ref 1: http://meeting.aps.org/Meeting/DFD13/Session/R8.4

D1.00029 Ground and excited state properties of dye attached fullerenes , AMANDA GARNICA, MARINA PAGGEN, RAJENDRA ZOPE, TUNNA BARUAH, University of Texas at El Paso — \( C_{60} \) fullerene and its derivatives are the most popular acceptors which are used in molecular/polymeric complexes used in organic photovoltaics. We have studies \( C_60 \) molecule functionalized with two dye molecules: DPP and TBTDT. Using density functional theory and large polarized all electron Gaussian basis, we optimized the structures of the \( C_{60}-DPP \) and \( C_{60}-TBTDT \) molecules. The electronic structure of \( C_{60} \) changes upon functionalization with the dye molecules. The electron affinity of the functionalized fullerenes increases. The optical spectra of the functionalized molecules will be presented. Inspection of molecular orbitals of these systems indicates that the HOMO level is localized on the dye whereas the LUMO is on the \( C_{60} \) molecule. We have also calculated several lowest CT excited states where the charge transfer takes place from the HOMO on the dye to the LUMO on the \( C_{60} \) molecule.

D1.00030 Magnetic properties of positive and negative charged superparamagnetic nanoparticles , GAMAGE DANNANGODA, KAREN MARTIROSYAN, BORIS ERMOLINSKY, University of Texas at Brownsville — Magnetic oxide nanoparticles particularly well known drug-delivery vehicles since their surfaces can be easily modified with antibodies to target specific receptors on tumor cells. The advantages of specific properties of superparamagnetic magnetic nanoparticles can be used as magnetic responsiveness and magnetic imaging. In this report we studied magnetic properties of positive and negative charged magnetite \( Fe_3O_4 \) nanoparticles. The electrical potential of the particles were varied from -33 mV up to 45 mV. Saturation magnetization and coercivity were obtained from the hysteresis loops at room temperature and 5K under a maximum applied field of 9T. The higher saturation magnetization for positive particles was \( M_s = 53 \text{ emu/g} \) at 300K compared to negative particles (\( M_s = 25 \text{ emu/g} \) at 300K) could be the effect of higher mean particle size or higher grain size of magnetization of positive charged particles. Zero-field-cooled (ZFC) and field-cooled (FC) magnetization curves were measured in the temperature range of 1.9-300K using magnetic field of 1000Oe. Zero coercivity and remanent magnetization and merging point indicate that the particles are superparamagnetic at the room temperature.

D1.00031 Thermogravimetric and magnetic characterization of solution combustion synthesized \( YFe_2O_4 \), SHANGIR SIDDIQUE, MKHITAR HOBOYSAN, CHAMATH DANNANGODA, KAREN MARTIROSYAN, University of Texas at Brownsville — \( YFe_2O_4 \) has interesting magnetic properties which are sensitive to the crystalline size of particles. The rare-earth ferrites similar to \( YFe_2O_4 \) are widely used in fuel cells, catalysts, gas sensors, magnetic materials, and environmental monitoring application. Yttrium ferrite exhibits soft magnetic properties which can be used in devices with high frequency applications. Recent studies also show that it has electrical and magnetic coupling, and shows ferroelectricity near the ferrimagnetic transition temperature around 250 K. It is also a multiferroics, and displays more than one primary ferroic order parameter simultaneously. We prepared \( YFe_2O_4 \) by solution combustion synthesis, using \( Y(NO_3)_3 \times 6H_2O, \ Fe(NO_3)_3 \times 9H_2O \) and glycine \( NH_2CH_2COOH \), that were dissolved in distilled water. The mixture was gradually vaporized during heating at 250 °C. The produced soft foam then was ignited and a light brown fluffy product was received. We analyzed the solution combustion of ferrite by thermo-gravimetric analysis to understand the mechanism of interaction, as well as characterized the combustion products by XRD and measured magnetic properties over the temperature range from 1.8K to 300K with PPMS. According to TGA results, the decomposition of the nitrates starts at around 150 °C. The exothermic interaction begins at 200 °C. The product has good magnetic properties. The saturation magnetization began at a magnetic force of 3100 Oe, with magnetic moment of 34 emu/g, and at 1000 Oe the magnetic moment is 24 emu/g.

D1.00032 An Empirical Model for Subwavelength Diffraction in Silicon Nano-Patterned Membrane , ANTON GRIBOVSKY, MALIK RAKHMANOV, Department of Physics & Astronomy, University of Texas at Brownsville — Nano-patterned membranes or two-dimensional photonic crystal slabs promise many applications in silicon nanophotonics. They can be used as highly efficient broadband reflectors or narrowband filters in silicon integrated circuits. These applications are based on interaction between the radiation field and the guided modes in the slab. The associated subwavelength diffraction in the reflected light was experimentally observed for 1064 and 1550 nm wavelengths. In this work we introduce an empirical model to explain this subwavelength diffraction and its polarization properties. The model is built in terms of periodic waves excited in the slab by the incident light. The study of the empirical model is backed by the FDTD simulations of light scattered by the reduced size nano-patterned membrane. By varying the periodicity of the in-plane waves, their amplitudes and phases we achieve agreement with experiment.
The body. The nanoparticles themselves are designed with a polymeric shell loaded that is injected with an anti-cancer drug called quercetin that makes them more attractive for biosensing applications. The synthesized nanocubes also have a significantly higher coercivity as compared to cubic MNPs. The PPMS was used to compare the magnetic properties of the synthesized spherical and cubic Fe₃O₄ MNPs on a volume and targeted cubic MNP volume and for a second set of spherical MNPs the diameter was equivalent to the body diagonal of a targeted batch of nanocubes and polycrystalline nanospheres with tunable body diagonals and diameters via solvothermal and thermal decomposition reactions.

Electrochemical performance characterization of nanostructured LiCoO₂

It is well known that travelling surface plasmon polaritons (SPPs) can be generated by using Kretschmann geometry, in which a sample (in this case a nematic liquid crystal E48) is sandwiched between thin noble-metal film coating (~25 nm thick) on the base of high-index prism and Indium-Tin-Oxide coated glass slide [1,2] The onset of SPPs is evidenced by loss in the intensity of totally reflected p-polarized light at a certain angle greater than the critical angle for total internal reflection. Recently, we have observed interesting interference effects and changes in the plasmon resonance, which appear to be related to the spatial periodicity of the metal film and field-induced changes in the refractive index of the liquid crystals.

D1.00035 Role of apparent spatial periodicity of metal film and ac electric field on the surface plasmon resonance and interference effects in nematic liquid-crystals

If we suppose that fly in the opposite direction from the fixed point (therefore he is at rest with particle A) his speed with respect to observer in O measures the speed of particle B as being v ≥ c. But, an observer that travels with particle A (therefore he is at rest with particle A) measures the speed of particle B as being v = v₁ + v₂ ≥ c.

Similarly for an observer that travels with particle B: he measures the speed of particle A as also being superluminal: v = v₁ + v₂ ≥ c. If we suppose v₁ = c and v₂ >0, then for the observer that travels with particle A his speed with respect to observer in O is c. But, in the same time, for the observer that travels with particle A his speed with respect to particle B should be greater that c, otherwise it would result that particle B was stationary with respect to observer in O. It results that c + v₂ > c for non-null v₂, contrarily to the Special Theory of Relativity.

D1.00036 Comparison of Monocrystalline Nanocubes and Polycrystalline Nanospheres of Fe₃O₄

In general, reducing the particle size of electrode materials in lithium-ion batteries to nano domain level overcome this problem. Nanoscale dimensions will provide a short path for the ion motion in the ionic solid electrodes. Therefore, reactions become faster and batteries can be charged and discharged rapidly. In this report we describe the behaviour features of the electrochemical performance of lithium ion battery electrode material (LiCoO₂) produced by Carbon Combustion Synthesis of Oxide (CCSO). The custom-made pouch-type battery was prepared. The battery was assembled in glove box using separator membrane with special type of polyethylene. The charge-discharge cycles were carried out in the potential range of 2.7-4.2 V using 8-channel battery analyser. The specific capacity had initial value of 200 mAh/g and after 30 cycles the capacity dropped to almost 180 mAh/g retaining over 90 % of initial capacity. This result is confirming that CCSO synthesized ultrafine LiCoO₂ has stable structure and gives opportunity to extract more than 66 % of theoretical capacitance.

D1.00037 Magnetic Ferrite Encapsulated Nanoparticles for Targeted Drug Delivery

Magnetic encapsulated nanoparticles have been in the interest of many researchers due to their impressive applications. One of the major applications of these nanoparticles is their biomedical relevancy. Nanoparticles have been in the center of 21st century Physics research and since then there have been major improvements that have made nanoparticles with more efficient designs and synthesis techniques in order to ensure the drug-delivering component of the Magnetic nanoparticles. The essential component of the nanoparticles is their ability to preform targeted drug delivery and targeted drug therapy that is able to transport the drug directly to the center of the desired cells and consequently, any excess uptake to the healthy cells in the body. The nanoparticles themselves are designed with a polymeric shell loaded that is injected with an anti-cancer drug called quercetin that targets lung cancer cells. Their structure is composed of mixed oxide particles such as magnetite Fe₃O₄ and ferrites CoFe₂O₄ and NiFe₂O₄.

D1.00038 Another Superluminal Thought Experiment

If we suppose we have two particles A and B that fly in the opposite direction from the fixed point O, with the speeds v₁ and respectively v₂ with respect to an observer that stays in the point O. Let’s consider that v₁ + v₂ ≥ c.

- If we suppose v₁ = c and v₂ >0, then for the observer that travels with particle A his speed with respect to observer in O is c. But, in the same time, for the observer that travels with particle A his speed with respect to particle B should be greater that c, otherwise it would result that particle B was stationary with respect to observer in O. It results that c + v₂ > c for non-null v₂, contrarily to the Special Theory of Relativity.
D1.00039 Improving Trigger Timing¹. LACEY MEDLOCK, Abilene Christian University, SEAQUEST COLLABORATION — SeaQuest (Fermilab 906) is a fixed-target experiment that uses the 120 GeV Fermilab Main Injector to collide protons with stationary targets. One of its primary goals is to study the ratio of anti-down to anti-up quarks that exist in the proton via the Drell-Yan process, in which an anti-quark and quark annihilate into a photon that then decays into a pair of muons. A previous Fermilab experiment, E866/NeuSea measured this asymmetry and indicated possible surprising behavior when the anti-quark in a proton carries a larger fraction of its momentum. SeaQuest will investigate this behavior. The SeaQuest detector relies on plastic scintillators to provide signals to know when a particle goes through the detector. The scintillators are up to 72” in length, which is a large issue because protons arrive every 18.9 ns. This gives a possibility of confusion of scintillator signals from two different proton collisions. In order to reduce the pulse length and in turn the number of missed events, we attached short wires that reflect an inverted pulse due to an impedance mismatch via an attached resistor. The wires make the signal length short enough to resolve this problem. These short wires with resistors are referred to as clip lines, which were constructed and installed on all scintillation detectors in the SeaQuest experiment.

¹This research supported in part by the U.S. Department of Energy

D1.00040 Development of Handheld Detector for Neutron Tagging. WILLIAM BAKER, CAITLIN CAMPBELL, Texas A&M University — The Cryogenic Dark Matter Search (CDMS) collaboration is in need of a cheap, efficient device for neutron veto/tagging for use in conjunction with its Si/Ge detectors. We have conceived of the idea of using plastic scintillators, with Gd (neutron capture cross section = 2.6E5 barns) loaded polyvinyltoluene and photodiodes to detect thermal neutrons. The device is light weight (<5 kg) and is shielded by polyethylene to thermalize higher energy neutrons for capture in the Gd loaded plastic. The capture by-products will be shifted to the UV-visible spectrum by the scintillating material, and then detected by high sensitivity photo-diodes. In addition, the device has the ability to discriminate against radioactive gammas, to avoid false positives. The device also provides a proof of principle for neutron veto (screening) around low background experiments, such as the CDMS experiment, where the basic principle can be applied in a multi-layer form to significantly enhance the neutron tagging so important for such low background experiments.

D1.00041 Three Dimensional Spatial Recognition Mapping of Magnetic Fields Utilizing Commercial Commodity Hardware¹. FRANCISCO LOZANO, University of Texas at Brownsville — A three dimensional portable tracking system can be developed using the relatively cheap commodity hardware known as the Wiimote. The Wiimote can be used to track position data, and can be coupled with data from other instruments. This research aims to integrate position and magnetic field strength data to build a virtual map of surrounding magnetic fields.

¹This material is based upon work supported by the National Science Foundation under Grant Number 1156600.

D1.00042 Report on Experimental Upgrades of Phonon Imaging Apparatus Used in Measurements of Ballistic Phonons through Superconducting Sn Crystals¹. FRANCISCO TERAN, TIM HEAD, Abilene Christian University — This presentation discusses work done to upgrade the performance of a phonon-imaging apparatus. Fabrication and testing of a sample holder used to perform the experiment, and the creation of C# programs to interface galvo-mirrors through a D/A convertor is discussed. We performed a preliminary phonon imaging experiment with a 1mm single crystal sample of Sn, but recorded no measurable ballistic phonon flux.

¹Thanks to the ACU PURSUIT grants for partial funding of this work.

D1.00043 Construction of Prototype B for the COMPASS Collaboration¹. JAMES MAL- LON, Abilene Christian Univ, COMPASS COLLABORATION — While there has been significant progress in the past years of understanding the quark and gluon structure of the nucleon, many important questions remain open; in particular, we have only elementary understanding of the origin of the proton spin. The COMPASS project is a fixed-target nuclear physics experiment at CERN which explores the internal structure of the proton. COMPASS II’s polarized Drell-Yan measurements will be exploring the quark angular momentum contribution to the spin of the proton by studying quark-antiquark annihilation. Several drift chambers must be constructed to replace older, faulty straw chambers. Smaller prototype drift chambers were constructed, one in Saclay, France, and the other Prototype B (PTB), at the University of Illinois at Urbana-Champaign. PTB is 16.5” wide, 72” long, and 3.03” tall, with 66 wires across two separate wire planes. This poster will detail the methods used to fully assemble PTB.

¹Supported in part by the NSF and the DOE

D1.00044 Cell Elasticity-based Microfluidic Isolation of Metastatic Tumor Cells. MUHYMIN ISLAM, SAMIR IQBAL, Department of Electrical Engineering, University of Texas at Arlington, Arlington, TX 76011, USA, YOUNG-TAE KIM, Department of Bioengineering, University of Texas at Arlington, Arlington TX 76010, USA — Circulating tumor cells (CTCs) have significant diagnostic value for cancer patients. We report a label-free, simple and rapid microchannel filter type device for isolation of metastatic cancer cells based on their mechano-physical properties like size and deformability. The microdevice fabricated in polydimethylsiloxane (PDMS) using soft-lithography contained one inlet and one outlet connected via 400 microchannels. It was observed that metastatic renal cancer cells, derived from real patient’s brain tumor were highly elastic and squeezed through microchannels much smaller than their sizes. Using a reverse-selectivity approach, the number of microchannels and their dimensions were varied to optimize and reduce the shear stress on tumor cells such that these did not pass through filtering channels. Consequently, the cancer cells were collected with an efficiency of more than 78% using channels with cross section area of 5 µm x 5 µm. Eventually tumor cells were mixed with blood and successfully isolated. The microfluidic channel device did not require pre-processing of blood (except dilution) or tagging/modification of cells.

D1.00045 Strain Degradation Study of In Situ MgB2 Wire. NATHANIEL GLASER, Texas A&M Univ — Accelerator-driven subcritical fission in a molten salt core (ADSMS) offers a double-edged solution to both the nation’s diminishing energy resources and accumulation of nuclear waste. The design for this next step in energy and environmental sustainability implements a strong focusing cyclotron (SFC) and, in the scope of this project, a quadrupole component. For the SFC quadrupole to appropriately focus the clusters of accelerated particles, a certain current density must travel through a cooled conductor of a specific geometry. However, the characteristics of the focusing depend largely on the conductor. To generate the appropriate magnetic field gradient and to comply with the geometric constraints of the SFC quadrupole, MgB2 wire was selected as the potential candidate that would best optimize the operational parameters (light cryogenic load, high current density, and degree of structural flexibility). This project developed the testing procedures for the viability of in situ (wind and react) MgB2 within the design constraints of the quadrupole. Methods by which to apply controlled degrees of strain across lengths of wire and methods by which the degradation mechanism of the wire segments could be analyzed through visual and performance metrics were developed.
In collaboration with Kendra Redmond and Roman Czujko, American Institute of Physics, College Park, MD. will be discussed, with special emphasis on a set of career tools for students and their mentors. The tools for each of these groups requires targeted information that addresses their particular roles in the collaborative process that will lead to not only an increase in the numbers of students who enter the STEM workforce, but in the quality preparation of those students. Moreover, the information clearly indicates that there are three distinct groups that must be engaged: the students themselves, the faculty and preparation of students for those opportunities. While each school was somewhat unique, we have identified a set of common features. In recent decades, biosensors have shown great promise in many applications ranging from environmental testing and biowarfare agent detection to clinical testing and cell analysis. The importance of biosensors is driven by several factors including chronic diseases and environmental health-related dilemmas, such as: diabetes and obesity, heart disease, stroke, cancer, chronic respiratory diseases, tuberculosis, etc. Significant problems with environmental monitoring, serious challenges in security and military applications and agriculture/food safety are also common driving motivations for biosensor development. In fact, biosensors are highly sensitive and selective to target analytes and provide near-real time response data while being cost effective and capable of resolving multiple analytical problems. The expanding role of biosensing in society and a real-world environment has led to an exponential growth of the R&D efforts around the world. The world market for biosensor devices is expected to reach $12 billion by 2015. Clearly, biosensors have become one of main analytical tools in 21st century and this presentation will discuss biosensing principles and applications in a variety of disciplines. In recent decades, biosensors have shown great promise in many applications ranging from environmental testing and biowarfare agent detection to clinical testing and cell analysis. The importance of biosensors is driven by several factors including chronic diseases and environmental health-related dilemmas, such as: diabetes and obesity, heart disease, stroke, cancer, chronic respiratory diseases, tuberculosis, etc. Significant problems with environmental monitoring, serious challenges in security and military applications and agriculture/food safety are also common driving motivations for biosensor development. In fact, biosensors are highly sensitive and selective to target analytes and provide near-real time response data while being cost effective and capable of resolving multiple analytical problems. 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