3:30PM D14.00001 Six degree-of-freedom thrust sensor for hybrid rocket — RYAN STRICKLAND, Hendrix College — Thrust is the reactive force experienced by a rocket due to the ejection of high velocity matter. A new six degree of freedom thrust sensor has been built for the UALR Hybrid Rocket Facility. The six degrees of freedom are the thrust force components in the three spatial directions (F_x, F_y, F_z) plus the three moments (roll, pitch, yaw). Even though the majority of the rocket’s thrust is in the axial direction, the components in the other directions are non-zero, and must be measured to account for the total work done by the rocket motor. The load cells on each of the six uni-axial legs of the sensor were calibrated, and preliminary firing data was collected during the summer of 2008. This research project has been funded by a NASA EPSCoR grant, and a Hendrix Odyssey project award.

3:42PM D14.00002 Using ring laser gyroscopes to measure seismic induced rotation — KIRK KIMERY, Hendrix College — Seismologists have known for years that the passage of seismic waves could introduce rotational motion in the surface of the Earth. For example, the rotation of tombstones has been observed in Japan following large earthquakes. However, until recently it has been difficult to measure these effects. The current generation of large ring laser gyroscopes has demonstrated the ability to measure rotation around a vertical axis with sensitivities in the nanoradian regime. Results from a horizontally mounted triangular ring laser 17.5 m on a side will be presented. In addition, the development of a ring laser designed to measure rotation about a north-south axis will be discussed. Finally, some preliminary results suggesting that ring lasers are sensitive to hurricane introduced vorticity will be presented.

1This work was supported in part by the NSF and the NASA Arkansas Space Grant Consortium.

3:54PM D14.00003 Nanoparticle Self-Assembly in the Cholesteric Liquid Crystal Blue Phase — DENNIS GARDNER, BETHANY WILCOX, IVAN SMALYUKH, University of Colorado at Boulder, LIQUID CRYSTALS MATERIALS RESEARCH CENTER TEAM — We study the spatial self-assembly and self-alignment of CdSe quantum dots and rods in liquid crystal (LC) suspensions. Employing the strong non-blooming fluorescent signals from these nanoparticles, we use fluorescent confocal microscopy to image the 3-D spatial location of the nanoparticles. We demonstrate that LC defects and structures allow for controlled localization, alignment, and assembly of these nanoparticles. Generalizing our studies for various nanoparticles of different compositions may provide new self-assembly-based methods of nanofabrication of metamaterials needed for applications such as cloaking at optical wavelengths, optical circuits, and super lenses.

2This research was supported by the NSF-funded Colorado Alliance for Graduate Education and the Professoriate.

4:06PM D14.00004 Optical Constants for Y_2O_3 in the Extreme Ultraviolet — JOSEPH MUHLESTEIN, Brigham Young University, BYU EUV/THIN FILMS GROUP TEAM — In applications such as measuring ionized He in the Earth’s magnetosphere, it is important to detect the relatively weak 30.4 nm line of He\textsuperscript{+} over the stronger 58.4 nm line of neutral He. Work done previously at BYU using theoretical optical constants has calculated that an aluminum/Y_2O_3 multilayer mirror should be effective at maximizing reflectance at 30.4 nm while minimizing the 58.4 nm line. We have measured the index of refraction of Y_2O_3 to improve the accuracy of these calculations and further our knowledge of Y_2O_3 between the wavelengths of 5 nm and 30 nm. We created a sample mirror using electron beam evaporation and took measurements using the Advanced Light Source at the Lawrence Berkeley National Laboratory. As this is the first direct measurement of the index of Y_2O_3 in this regime, it represents an improvement over previous data calculated using atomic scattering factors.

4:18PM D14.00005 Monopole Detection with the ANITA Experiment — MILES DETRIXHE, University of Kansas, ANITA COLLABORATION — The ANITA Experiment seeks detection of highly energetic particles traversing the Antarctic ice based on radio waves produced by Cherenkov radiation. The ANITA Experiment was afloat for 35 days in December 2006 and January 2007 while operating with an average duty cycle of approximately 50%, resulting in the most sensitive experiment to date to the diffuse flux of highly energetic ionizing particles. We discuss the experimental signature that would be produced by an ultra-relativistic magnetic monopole interacting with the Antarctic ice as measured by ANITA and the method for calculating the maximum flux of these particles.

4:30PM D14.00006 SISPI - The Data Acquisition System for the Dark Energy Survey — JACOB EITING, KLAUS HONSCHEID, DARK ENERGY SURVEY COLLABORATION — I will present the data acquisition and control system of the Dark Energy camera (DECam) which will be the primary instrument used in the Dark Energy Survey (DES). The data acquisition and control system, also known as Survey Image System Process Integration or SISPI, is responsible for coordinating the actions of the many components of the DECam instrument by providing reliable middleware. SISPI is implemented as a distributed multi-processor system with a software architecture built on the Client-Server and Publish-Subscribe design patterns. SISPI is written primarily in Python in order to decrease development time and to promote platform portability. A publish/subscribe data sharing middleware. SISPI is implemented as a distributed multi-processor system with a software architecture built on the Client-Server and Publish-Subscribe design patterns.

3This work is based upon work supported by the Center for Cosmology and Astroparticle Physics.

4:42PM D14.00007 ABSTRACT WITHDRAWN —

4:54PM D14.00008 ABSTRACT WITHDRAWN —

5:06PM D14.00009 Neutrino-Stimulated Pair-Creation in Supernovae — MALLORY YOUNG, Hendrix College — This research investigates the anisotropy of outgoing neutrino flux due to the production of electron-positron pairs as neutrinos interact with large magnetic fields typical of supernovae and other astrophysical phenomena. The deviation of the final neutrino from its original path is of interest since these stellar phenomena are especially sensitive to neutrino transport. Monte Carlo calculations of neutrino decay rates for varying energies and magnetic field strengths reveal a tendency for outgoing neutrinos to turn against the magnetic field upon decay. Data show that supernova-like conditions generate production rates on the order of 10^{−16} cm\textsuperscript{−2} with mean shifts in neutrino angle on the order of a few percent. Naturally, increased magnetic field strength amplifies these effects. These results demonstrate a mechanism by which a magnetic field can exert influence on a supernova’s important, neutral energy-carrier: the neutrino.

1Hendrix Odyssey Grant
5:18PM D14.00010 Measuring neutron flow with an upgrade of the CMS Zero Degree Calorimeter, JESSICA SNYDER, MICHAEL MURRAY, University of Kansas — One of the most exciting recent results in nuclear physics is the discovery that lead-lead collisions produced at the Relativistic Heavy Ion Collider, RHIC, produce an almost perfect fluid of quarks and gluons. This state was identified by the “flow” of particles. The Large Hadron Collider, LHC, will study gold-gold collisions at an energy 28 times higher. It is possible that this higher energy will produce a gas rather than a liquid in which gas we should be able to detect flow. We hope to detect flow by measuring the pattern of neutrons emitted along the beam axis using two detectors inserted between the electromagnetic and hadronic sections of the CMS ZDCs, https://zdc.web.cern.ch/ZDC/ . I will present results of GEANT simulations of such a detector and make estimates of it capabilities to measure neutron flow.

Sunday, May 3, 2009 1:30PM - 2:42PM –
Session J14 SPS: Undergraduate Research (including SPS) II Plaza Court 4

1:30PM J14.00001 Elastic Compton Scattering from Carbon, KASEY LEWIS, GERALD FELDMAN, George Washington University, COMPONOMAX-LAB COLLABORATION — The elastic Compton scattering cross section for carbon has been measured using tagged photons at the MAX-Lab facility in Lund, Sweden. To produce the photons, an electron beam impinged on an aluminum foil – the electrons radiated via bremsstrahlung and then entered a magnetic spectrometer which deflected them onto a plastic scintillator array in the spectrometer focal plane. The produced photons (Eγ = 95-115 MeV) scattered from a graphite block and were detected at 3 angles (θ = 60°, 120°, 150°) by high-resolution large-volume NaI detectors. Using timing information from the focal-plane scintillators, coincidences between converted electrons and scattered photons were identified, thereby “tagging” the energy of the incident photons. The elastic Compton peak was then observed in the energy spectrum of the NaI detectors. After subtracting random backgrounds due to cosmic rays and untagged photons, the resulting energy spectrum showed a clear peak sitting on a low-energy background. Accounting for this background with an exponential fit, the integral of the peak yielded the number of scattered photons in each NaI. The absolute cross section was determined from these yields using information about the photon beam flux, the target thickness and the detector solid angles. These data for the carbon cross section will be presented, and the energy and angle dependencies will be discussed.

1:42PM J14.00002 A Simulation-Based Study of T2K Alignment and Focusing Components, JORDAN WEBSTER, University of Rochester — The T2K neutrino oscillation experiment is scheduled to begin commissioning in 2009. The experiment uses a simulation of the neutrino beam to produce predictions of the relationship between observed events in the near (control) detector and the far detector, Super-Kamiokande. This correction is affected by the alignment of focusing components in the beamline. We report on the results of a simulation-based study of special studies with the near neutrino detectors which could be used to measure this alignment in situ.

1:54PM J14.00003 Search for a Fermiophobic Higgs Boson Decaying into Diphotons at CDF, BENJAMIN RAY, ROBERT GROUP, RAY CULBERTSON, CALLIE DEMAY, CDF/FNAL, CDF COLLABORATION — A search is performed for a Higgs boson decaying into diphotons using 3.1 fb of data collected by the CDF detector at center-of-mass energy of 1.96 TeV at the Fermilab Tevatron. The production cross section will be presented, and the energy and angle dependencies will be discussed.

2:06PM J14.00004 Zero Degree Calorimeters Radiation Containment Sarcophagus, KYLE AXTON, University of Kansas — The Zero Degree Calorimeters of the CMS experiment at the Large Hadron Collider will become significantly radioactive after the first few proton-proton runs. The detectors sit within large copper blocks, called TANS, that also include the two beam pipes. The calorimeters must be removed during bake out of the beam pipes. To minimize the radiation received by the personal a remotely controlled crane will place the calorimeters into a sarcophagus that will shield workers from the induced radioactivity. Both the mass and size of the sarcophagus are limited by constraints of the LHC tunnel. We will describe the design, construction and use of the sarcophagus.

3University of Kansas Honors Program and the National Science Foundation Award Number: 0449913.

2:18PM J14.00005 Search for heavy generation down-type quark in the same-charge dilepton signature at CDF, MATT HICKMAN, DANIEL WHITESON, UC Irvine, MICHAEL WILSON, SLAC, DAVID BERGE, CERN, CDF COLLABORATION — Using data collected at the CDF detector in Run II at the Tevatron we present a search for pair production of heavy quarks each of which decay to a top quark and a W boson-like quarks each of which decay to a top quark and a W boson, yielding a bbWW final state. The mode in which two same-charge leptons are produced is very sensitive because while the signal branching ratio is reasonable, same-charge dilepton events are rare in the Standard Model. We also impose a met and b-tag requirement. We present our preliminary results as well as future plans to improve our analysis.

3Undergraduate Student

2:30PM J14.00006 Searches for New Physics in Photonic Final States at the LHC with CMS, ANDY YEN, California Institute of Technology, CMS COLLABORATION — A brief summary of the CMS discovery potential for New Phenomena in selected photonic final states is presented. These include searches for diphoton resonances from Higgs and Randall Sundrum graviton decays, as well as a search for compositeness in excited lepton decays. Since the CMS discovery in these channels will rely heavily on performance of the CMS electromagnetic calorimeter, the relevant aspects of its design and operation in situ at the LHC are also discussed.

3Supported by the Caltech Summer Undergraduate Research Fellowships program.