SENIOR THESIS PRESENTATIONS
Wednesday, June 8, 2011, WENIGER 304
Refreshments will be served!

STUDENTS are especially welcome!

(please check the PH dept main web page for any changes to the ordering of these talks)

9:00 – 9:25 Howard Dearmon & Allison Gicking (Honors College)
Neutron Capture Cross Sections and resonance Integrals of Selenium and Cadmium Isotopes Advised by Ken Krane

9:25 – 9:40   Rachel Waite
The Seebeck Coefficient of BiCuOSe:Ca Advised by Janet Tate

9:40 – 9:55 Jessica Gifford (Honors College)
Gravitational Waves and the LISA Interferometer Space Antenna Advised by Oksana Ostroverkhova

9:55 – 10:10 Lee Collins (Honors College)
Monte Carlo Simulations of Structure and Melting Transition of Small Ag Clusters Advised by Guenter Schneider

10:10 – 10:25 Kris Paul
Exploring the use of photometric data for estimating redshift of galaxies observed in the Sloan Digital Sky Survey Advised by NASA Ames/JT

10:25 – 10:35 BREAK

10:35 – 10:50 Sean Caudle
Simulated Radial Compression of Single & Double-walled Carbon Nanotubes Advised by Guenter Schneider

10:50 – 11:05 Shaun Kibby
Three Meter Dish Radio Telescope Service Life Extension Program (SLEP) Advised by Bill Hetherington

11:05 – 11:20 Jeff Holmes
Digital Signal Processing Enhancement to the Oregon State University Single-Dish Radio Telescope Network Advised by Bill Hetherington

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Earlier thesis presentations by the class of 2011
Cory Pollard OSU MASLWR Secondary Systems Control Algorithm Advised by Nuclear Radiation Center/HJ
Dave Mack Optical and Electrical Properties of Thin Film $BaSnO_3$. Advised by Janet Tate

version 6 June 2011, 10am.

Howard Dearmon & Allison Gicking

Neutron Capture Cross Sections and resonance Integrals of Selenium and Cadmium Isotopes

The neutron capture cross-section of an isotope is an important value to know for many applications of nuclear physics, including neutron activation analysis and creating control rods for nuclear reactors. There are many elements for which the cross-section has never been measured or the current values are in major disagreement with one another. Selenium and cadmium are two elements whose isotopes have poorly measured neutron capture cross-sections.

The measurements were taken by irradiating the different isotopes in the Oregon State University TRIGA reactor and then analyzing their respective gamma ray spectra. There are two ways to find a neutron capture cross-section, by measuring the thermal cross-section or by measuring the resonance integral, of an isotope. The details and results of this method are explained in the presentation.

Bio. Howard Dearmon is a physics major in his senior year at OSU. He plans on either going to graduate school for medical physics or nuclear physics in the near future. In his free time he likes to spend time with his family and go camping.

Bio. Allison is a fourth year physics major at OSU. She is taking an extra year as an undergrad to explore the world of biophysics and figure out what she wants to do in grad school. However, she is definitely ready to get out of the Willamette Valley and go somewhere sunny…...

Rachel Waite

The Seebeck Coefficient of BiCuOSe:Ca

The Seebeck coefficient of a material is the voltage produced by that material when a temperature gradient has been introduced between its two ends. The Seebeck coefficient is important because it tells us the sign of the carriers present and can be used to help in energy conservation as heat is transformed into a potential. In this report the Seebeck coefficient of p-type BiCuOeSe:Ca semiconductors on MgO substrates were determined experimentally between temperatures of 60-300 K using the a method in which a small temperature gradient (about 4 K) is applied to two ends of the sample and is measured by a differential thermocouple. Doping levels varied from 1.79% to 2.38%. Subsequent measurements are taken as both the temperature gradient and the potential of the sample return to 0. At low temperatures BiCuOSe:Ca behaved metallically, that is the Seebeck coefficient decreased linearly with temperature. The Seebeck coefficient did not decrease with increased doping as expected and in fact the amount of doping had no relation to the Seebeck coefficients of the samples, but the amount of doping was similar among the samples and thus no real conclusion could be drawn between the amount of doping of the BiCuOSe:Ca samples and their Seebeck coefficient.

Bio: Rachel was born in Portland, OR and attended Wellsboro Area High School in PA and Newport High School in OR, graduating from Newport HS in 2004 and specializing in liberal studies. After studying Communications at Linn Benton Community College for four years she changed her major to Physics and transferred to Oregon State University. She graduated in the spring of 2011. She plans on attending graduate school at the University of Maine in the fall of 2011 for a PhD. As of yet she has no idea in which area she wishes to specialize

Jessica Gifford

Gravitational Waves and the LISA Interferometer Space Antenna

Improvements on the charge control measurements of the torsion pendulum, electron gun, and autocollimator system were conducted at the University of Washington in preparation for the fabrication of the final prototype of the Laser Interferometer Space Antenna (LISA) gravitational wave detector for NASA. One main cause of transient forces on LISA is solar charges in space that can cause unwanted torque on the test masses. Using a torsion pendulum as a geometric equivalent of the test masses, charge control measurements were conducted by producing a sinusoidal curve of the charge. The pendulum could be negatively or positively charged by an electron gun or a UV LED by increments as small as a pico-coulomb.Photocurrent of the UV LED and electron gun were measured by fabricating two new electron guns, one including an Einzel lens.The results from varying the voltage using the DAQ, showed that the photocurrent linearly increases and asymptotically approaches a maximum current. However, by moving the battery system, the current jumps drastically, which means that the production of photocurrent is yet to be conclusive.

Bio: I am graduating with a Honor's Bachelor in Science with a Mathematics Minor. My thesis is also on "Lab on a Chip" done in Oksana Ostroverkhova's optics lab. The LISA project was done as a summer REU at the University of Washington. My plans for after graduation are to go to Arizona State University in the PhD physics program. I hope to pursue astrophysics in a field similar to gravitational waves or neutrinos. This summer I am working at ASU in their nano-sensors laboratory and therefore am leaving two days after graduation. Some other interesting facts about me are one that I graduated from Roseburg High School as a valedictorian. I also have a twin sister in civil engineering who is also graduating from OSU with me this term. I am also a tuba player for the OSU marching band.

Lee Collins
Monte Carlo Simulations of Structure and Melting Transition of Small Ag Clusters
The behavior of a small atomic cluster is largely dependent on its geometry, due to the high proportion of surface atoms to interior atoms. Clusters with particularly stable geometry, "magic number clusters", require a large latent heat to melt, and have a relatively low binding energy per atom. Metropolis Monte Carlo simulations we used to simulate the melting of silver clusters with 3-56 atoms. The specific heat was calculated at 25 temperature values as the cluster was cooled from 1200-200 K. The binding energy was also calculated in a separate simulation. 13 and 55 atom icosahedral magic number clusters, and a 19 atom semi-magic number cluster, were identified using the specific heat peaks. A 25 atom semi-magic number cluster was also identified using the binding energy per atom.

Bio: Lee Collins was born and raised in Portland, Oregon. He graduated from Woodrow Wilson High School. Outside of school, he enjoys participating in intramural sports, volunteering at the local Humane Society, and playing the electric guitar. After graduation, he is moving to the OSU College of Oceanic and Atmospheric Sciences for graduate school in Physical Oceanography. He will be working with Eric Skyllingstad and Karen Shell modeling Arctic melt ponds.

Kris Paul
Exploring the use of photometric data for estimating redshift of galaxies observed in the Sloan Digital Sky Survey
The Sloan Digital Sky Survey (SDSS) offers vast amounts of data for celestial objects. Spectral data is collected for a limited number of objects while a photometric telescope obtains images of all detectable objects in the viewing area. Photometric data is collected from 5 bands, u,g,r,i and z, in and around the visible spectrum. Several computational methods have been developed to determine the object's redshift using this photometric data, but with far less accuracy than is possible with the spectroscopic data. The research conducted for this paper involved using computational techniques on the photometric data for both analysis and predicting redshift of galaxies. Linear discriminate analysis and decision trees were used to make redshift predictions for discrete redshift values. It was expected that predictions would not be much

better than what might occur by chance, however receiver operating characteristic (ROC) analysis showed a large area under the curve, which signifies results much better than by chance. The results of this study suggest that there may be room for improvement in prediction techniques. Future direction for research in this area may include analysis of other commonly used prediction methods and further investigation of variations in the, u,g,r,i and z bands. A better understanding of these methods could lead to improvements in redshift predictions, allowing astronomers to create a more complete and accurate map of the known universe.

Bio: Kris Paul spent last summer as an intern at NASA Ames, where she started her research project. Here at OSU she has been involved with the Society of Physics Students (SPS) and served as treasurer. She has supported herself throughout her college career doing freelance web design and programming. Currently she is an intern at Hewlett Packard, here in Corvallis. Needing a break from school for a while, she is currently planning on finding a job and may be back in a year to continue her education.

Sean Caudle
Simulated Radial Compression of Single & Double-walled Carbon Nanotubes
The number of concentric layers of graphene making up a carbon nanotube is modeled by computer-simulated compression of a nanotube, in analogy to compression through atomic force microscopy.
Bio: Sean Caudle is a senior in the Computational Physics (CPUG) program at Oregon State University. With a main interest in Solid State research, he will begin graduate study at Arizona State University in the Fall.

Shaun Kibby
Three Meter Dish Radio Telescope Service Life Extension Program (SLEP)
Oregon State University's three-meter single-dish radio telescope has undergone structural and computational redesign to improve its angular precision and establish tracking capabilities. The radio telescope infrastructure, motor and circuit mechanisms, and computational controls are the only aids to position the dish toward a celestial target, and their quality has a large impact on the telescope's final performance. The first stage of development for the new implementation of the radio telescope structurally allowed the dish to be re-positioned by a computer controlling vertical and horizontal drive motors. The research team fabricated an infrastructure design that increased the efficiency of dismantling and re-assembling all telescope components. Stage two of the radio telescope redesign completed fabrication of the circuitry and computational command structure allowing computer-to-motor communication. The research team focused on reducing the error in the analytical and computational network as a result of temperature fluctuations, moisture, and humidity changes within a weather-proof housing that contains sensitive circuitry and equipment.

Bio: Shaun Kibby graduated from General H. H. Arnold High School Wiesbaden, Germany June 2006 and arrived at Oregon State University in Fall 2006. He is pursuing a Bachelor of Science Degree in Physics and has completed two years of thesis research on the OSU's Radio Telescope. The faculty advisor is Professor William Hetherington and Research Team member is Jeff Holmes. Upon graduation, Shaun Kibby will commission in the United States Air Force as a Second Lieutenant and report to Laughlin AFB, TX for Pilot Training.

Jeffrey Holmes
Digital Signal Processing Enhancement to the Oregon State University Single-Dish Radio Telescope Network
As part of the Service Life Extension Program (SLEP) for the Oregon State University radio telescope we have created a digital "back-end" that makes use of an Analog-Digital Conversion (ADC) network to receive the analog signal collected by the radio telescope receiver and converting that signal into digitized data sets. This back end was created using development

boards manufactured by Linear Technology Corporation. The key component to the ADC network is the use of FPGA technology. The FPGA allows for implementation of Digital Signal Processing (DSP) algorithms in an infinitely re-configurable hardware platform. The use of hardware implementation of data analysis algorithms allows for a significant reduction in computational overhead that occurs during strictly software-based algorithm implementation. The initial stage of the project was to investigate the feasibility of implementation of the DSP "back-end" and a proof of trial period demonstrating the viability and feasibility of the system as well as documenting any significant gain in the signal to noise ratio between the existing analog based "back-end" and the new DSP based back end. The secondary focus of the project was to provide the researchers with an opportunity to investigate the operation and programming associated with the FPGA based DSP network. We created new baseline criteria that are being used to acquire materials for Generation 2 of the DSP "back-end". Finally we demonstrated the flexibility of using a DSP based "back-end" in terms of frequency agility and operational focus (i.e. the ability to rapidly reconfigure the system on-the-fly in order to change observational targets).

Bio: Jeffery Holmes is a Post-Baccalaureate student who has Associate of Science degrees in Physics and Math from Linn-Benton Community College, and a Bachelor of Science Degree in Human Resources Management from the Milano Graduate School of Management and Urban Policy at The New School (New York University). He is pursuing a Bachelor of Science Degree in Computational Physics and has completed two years of undergraduate research (including an OSU URISC grant and a NASA Space Grant) on Digital Signals Processing at the Oregon State University Radio Astronomy Laboratory. After graduation, Jeffery Holmes will be attending graduate school at OSU in either an Astrophysics or Professional Science Masters Program capacity.