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Physics

January 2012

Letter From the Chair

Dear Friends of the Department:

Grades are handed in and reports are filed, which now leaves us time to reflect on the year 2011. We are very fortunate to welcome a number of people to the Department. Michael Zwolak is a new assistant professor, who moved here from Los Alamos. His field of study is biological and nano-scale physics, using computational methods. We also welcome several new postdoctoral fellows: Justina Pytel, Mary Bridget Kustusch, Wendi Wampler, and Landon Prisbrey. Visiting from Korea are Prof. Joo-Hiuk Son and his two graduate students Hyeongmun Kim and Hee Jun Shin. We also welcome nine new graduate students to our program.

We are continuing our search for faculty members to expand out biophysics program, and this year we focus on hiring experimental physicists. Biophysics has become a very exciting field in which many advanced optical techniques are applied. Hence a position in this area connects internally well with our researchers in optics, and at the same time connects us with the biological sciences. In addition, we are looking for a new faculty member in physics education research. This search is part of an effort in the university to fill a group of new faculty positions related to science and engineering education. Also in this case, the search fits very well with our current efforts in the field as well as with the increased emphasis on education research within the university, through the emerging Science, Technology, Engineering, and Mathematics (STEM) education center. In about a month we will enter the next phase of these searches, where we interview candidates on campus. That is always a very enjoyable time, with many stimulating presentations on forefront research.

We were honored to host Prof. Philip Kim for this year's Annual Physics Yunker Lecture. His public lecture, "Relativity, Quantum Physics and Graphene", received many compliments. If you missed the lecture, the video link can be found on the department website. Our department also hosted the thirteenth annual meeting of the Northwest Section of the American Physical Society, October 20-22, 2011 (see the article in this newsletter).

Our faculty members and students have received a number of honors and awards. Professor David McIntyre was promoted to Full Professor and was also awarded the Frederick H. Horne Award for Sustained Excellence in Teaching Science by the College of Science. Professor Bill Hetherington was awarded an Oregon Space Grant Consortium Faculty Research Grant to support his work on the OSU Radio Telescope and PicoSatellite projects. Professors Rubin Landau and NamHwa Kang (SMED) were awarded a grant from the NSF for "Collaborative Research: INSTANCES: Incorporating Computational Scientific Thinking Advances into Education & Science Courses." Professors Janet Tate and Guenter Schneider have a new $700,000 NSF grant in collaborations with Professor Malgo Peszynska of Mathematics as well as colleagues from UO Physics, UO Chemistry and UIUC Materials Science, to study impact ionization processes. Students who were honored are listed later in the newsletter.

I hope that the year 2012 will be a great year for you all!

Henri Jansen
Chair

INSIDE:

Physics

Degrees Awarded

Matthew Leyden, PhD (Physics), accepted a position as scientist at NT Bio, a Santa-Barbara-based start-up company building nanoelectronic biosensors.
Landon Prisbrey, PhD (Physics), now a post-doctoral researcher in Ethan Minot's group at OSU.
Joe Tomaino, PhD (Physics), now a process-engineer at Intel, Hillsboro, OR.

Steven Bussell, BS (Physics)
Christopher Carlsen, BS (Physics), to grad school in Atmospheric Science at Oregon State University.
Sean Caudle, BS (Computational Physics), to pursue a Ph.D. in Physics at Arizona State University.
Lee Collins, BS (Computational Physics - Summa Cum Laude) to grad school in Atmospheric Science at Oregon State University
Jessica Gifford, BS (Physics – Magna Cum Laude), to pursue a Ph.D. in Physics at Arizona State University.
Shaun Kibby, BS (Physics)
Michael Lindsey, BS (Physics & Computational Physics – Cum Laude)
David Mack, BS (Physics – Cum Laude), now teaching at LBCC.
Elizabeth Nystrom, BS (Physics)
Kristine Paul, BS (Computational Physics)
Cory Pollard, BS (Physics – Cum Laude)
Kyle Quillan, BS (Engineering Physics)
Keith Schaefer, BS (Physics)
Jeffrey Shores, BS (Engineering Physics)
Rachel Waite, BS (Physics) to grad school at University of Maine
Kyle Williams, BS (Physics)

Student Awards

Graduate Students

Joe Tomaino received the Department of Physics Graduate Research Award for his work on THz spectroscopy measurements of graphene and GaAs quantum wells.

Lin Li received the Peter Fontana Outstanding Graduate Teaching Assistant Award.

Whitney Shepherd was awarded a Whiteley Fellowship in Material Sciences for the Summer of 2011.

Undergraduate Students

Afina Neunzert was awarded the Janet Richens Wiesner University Honors College Scholarship for Undergraduate Women in Science.

River Wiedle received a 2011 URISC award to work with Janet Tate on a "New Implementation of Thermal Conductivity Measurements on Semiconducting Thermoelectric Materials".

Chris Jones (physics major) received a 2011 URISC award to work with Yevgeniy Kovchegov (Dept. of Mathematics) on a project entitled "Quantum Walks and Quantum Algorithms".

Sam Settelmeyer was awarded a DeLoach Work Scholarship by the Honors College to work with Dedra Demaree.

Physics

Research: Computational Condensed Matter Research

Guenter Schneider
Dr. Schneider joined the Oregon State University Physics faculty in 2006

The central research themes of my group are the computation of materials properties from first principles and collaboration with local experimental research groups on the materials studied in their laboratories. Within the physics department we collaborate intensively with Prof. Janet Tate and her team on the optical and electronic properties of wide bandgap semiconductors, and with Prof. Oksana Ostroverkhova and her research group on charge transfer in organic conductors.

Before I give you a flavor of our current projects, let me outline our theoretical approach. Computing materials properties from first principles uses only the elements that make up a molecule or a solid and their atomic positions as input. This sounds like a sport where we make a really hard problem even harder by using as little input as possible, but in fact this minimal input set is all we need to describe the motion of the electrons moving in the background generated by the ionic cores of the atoms. We solve for the motion of the electrons using quantum mechanics but we do it with a twist. In quantum mechanics the motion of the electrons is described by a wave function, which in a solid is an incredibly complicated object because there are so many electrons: approximately 1023 in a cubic centimeter. Instead of using Schrödinger's equation to solve for the wave function with its ~3x1023 variables, we solve for the electron density, which is a comparatively simple function of only 3 spatial coordinates, using density functional theory. This theory due to Walter Kohn, who received in 1998 the Nobel Prize in Chemistry for this work started in 1964, tells us two things: 1. we can compute many materials properties quantum mechanically from the electron density alone (skipping the wave function altogether) and 2. the equations that would allow us to actually do the computations exist; but it doesn't tell us the equations itself. This doesn't sound useful at all but we do have a number of approximations for these equations, which allows us to compute properties of materials such as lattice parameters and compressibilities or the absorption of light in semiconductors reliably and accurate to within a few percent. The predictive power of density functional theory is now good enough for it to play a crucial rule in the design and discovery of new drugs, better battery materials or, in our case, the search for new semiconductors for transparent electronics and better solar cells.

You might have guessed by now that we are not the theorists of old, working with nothing but paper and pencil, but members of a rather recent species, the computational theorist. Together with Prof. David Roundy we operate our own computing cluster in Weniger Hall. Typical calculations take from a few hours to several days on our cluster, but sometimes they run for several weeks or even months. Even though the raw computing power of our cluster exceeds 1 Tflops (1012 floating point operations per second) we always have use for more computers.

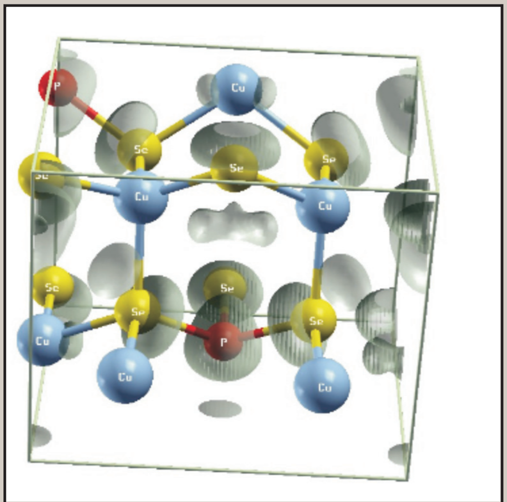

Fig. 1: The structure of Cu_3PSe_4 with the anti-bonding P-s/Se-(s)p orbital highlighted. This orbital forms the bottom of the conduction band and even a small change in the P Se bond length strongly affects this orbital and the bandgap.*

When we study semiconductors, which are made in thin film form by Prof. Janet Tate's group or in the OSU chemistry department by Prof. Doug Keszler's group, we always start by calculating the onset of optical absorption (usually the bandgap but not always). The bandgap is the fundamental property of a semiconductor and it determines any potential application. For example, if the onset of light absorption is in the

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Research: Computational Condensed Matter Research

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near infrared just outside of the red part of the visible spectrum (approximately 1.4 eV in our energy units) and the light absorption process is direct, then this semiconductor has the potential to be an efficient material for the light absorber layer in a solar cell. We recently studied just such a material, copper phosphor selenide (CuP_3Se_4), and with a direct bandgap of 1.4 eV, its optical properties make it almost ideal for a solar cell material, but without any toxic elements like cadmium in cadmium indium gallium diselenide (CIGS) and cadmium telluride or arsenic in gallium arsenide **(Fig. 1)**.

While we are excited that our theoretical and computational exploits might point the way to a more environmentally friendly solar cell, they also posed an interesting theoretical puzzle. Using the standard approximations in density functional theory we obtained a perfectly reasonable 3% error in the bond length between phosphor and selenium. However this 3% error resulted in a large (35%) error in the calculated bandgap. Had we simply relied on the standard approach we would have dismissed this material as unsuitable for use in a solar cell. Instead we were able to unravel this tight coupling between bond length and bandgap in this case, and by identifying its signature, we learned an important lesson for future projects. Only for the calculation of optical properties can we extrapolate from the results for the ideal (defect free) material to the real semiconductor material which, especially if it consists of multiple elements, can contain a large number of defects. The electronic properties of a real semiconductor material are determined to a large extent by its defects and we must include them in our analysis. Typically we consider point defects such as a missing atom (a vacancy) or an atom of one type occupying the site of another atom type (an anti-site). If the number of possible defects is large, hundreds of calculations and simulations are required before we are able to predict based on basic growth parameters such as temperature and chemical potential (which quantifies if there is more or less of a given element available for material growth in the growth chamber) the concentration of each defect type, which and how many charge carriers a defect generates, and ultimately the number of electrons and holes in the material. The information that we can extract from these extensive calculations provides direct guidance to the experimental researcher on how to modify the growth process for a specific effect.

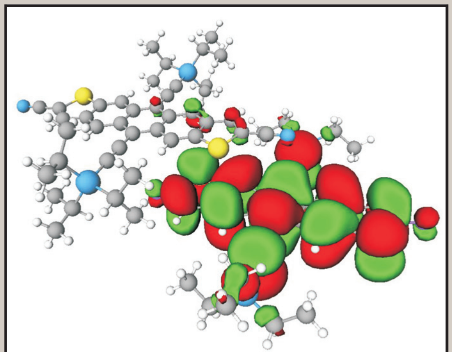

Fig. 2: The highest occupied molecular orbital (HOMO) of a two molecule complex consisting of ADT-TES-F (donor) and ADT-TIPS-CN (acceptor) The HOMO orbital is strongly localized on the ADT-TES-F molecule.

In an abstract sense, the interface of one material with another is just a large defect. Not surprisingly the semiconductor interfaces in thin film solar cells, which consist of a minimum of 3 layers of materials and often many more, are crucial for the function of the entire device. But these interfaces present not only challenges but potentially harbor opportunities where an electron from a wide bandgap material entering a smaller bandgap material can generate additional charge carriers using a process called impact ionization. Together with Prof. Janet Tate in Physics and Prof. Malgosia Peszynska (Dept. of Mathematics) and several colleagues at the University of Oregon and the University of Illinois at Urbana-Champain we were awarded a National Science Foundation SOLAR grant to study the physics of impact ionization at semiconductor interfaces. In this project our contribution ranges from the calculation of interface properties which directly ties into our work on semiconductor materials to solar cell device modeling and developing a theory of impact ionization in an inhomogeneous medium.

Our work on organic conductors in collaboration with Prof. Oksana Ostroverkhova presents several additional challenges over our work on inorganic semiconductors.

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Research: Computational Condensed Matter Research

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Most importantly the theoretical description of the optical and electronic processes in organic molecules is considerably more difficult because of the formation of excitons (electron hole pairs) with large binding energies. In addition, the molecules we are interested in, chiefly ADT derivatives **(Fig. 2)**, are large molecules with 70+ atoms each, making a direct computational approach impossible with current computing resources. Our approach is to break the systems apart and start from the basic single electron properties of the molecules and crystals. We continue with looking at molecule pairs (for the experts: we consider a donor and an acceptor molecule which form a bulk heterojunction in the organic conductor) and try to extrapolate to the properties of the bulk materials.

I am very interested in including undergraduate researchers in my work but important courses with background material for my research, like the statistical mechanics capstone course and the introduction to solid state physics course are offered only in the Spring term of the senior year, and students usually take these classes only after they have completed their senior thesis research. After some experimentation with different topics I have settled on problems in condensed matter physics (solids and liquids) which can be treated solely with Newtonian mechanics and atoms interacting with each other using model forces. Undergraduate researchers in my group are tackling the problem of melting in clusters using molecular dynamics and Monte Carlo simulations. There are many interesting and even fundamental questions: when is a piece of material to small so that the melting process can no longer be described as bulk like with a melting temperature depression due to the surface. Experimental evidence suggests that the melting temperature of a piece of material with as few as one or two thousand atoms can still be described as bulk melting plus corrections. A few thousand atoms is well within our computational resources for this type of simulation and I am looking forward to the time when one of my undergraduate students will find a thermodynamic definition of what constitutes a “bulk” material.

Teaching: Physics Education

by Dedra Demaree
Dr. Demaree joined the OSU Physics faculty in 2007.

Friends, footholds, and fear: measured impacts on physics learning

Understanding how to maximize student learning is a tricky undertaking – there are a seemingly endless number of variables; consider the press on the relationship between proper nutrition and the learning of school children – a factor that would escape most of us when listing what is needed for our students to succeed. Learning college or graduate level physics is an even trickier proposition – since student content knowledge must be solid for success. Physics Education Research (PER) is a multi-faceted enterprise that incorporates deep physics knowledge, cognitive science, educational psychology, and statistics of complex systems. The goal of any researcher is to be able to make a claim supported by data concerning a research

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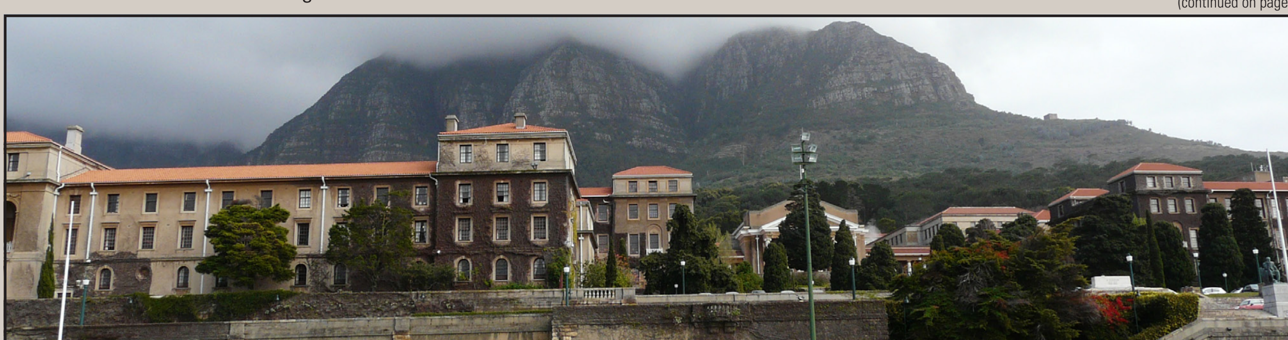

University of Cape Town Campus, Cape Town, South Africa.

Teaching: Physics Education

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question. "Friends, footholds, and fear" isn't just a catchy title, it refers to three aspects for which we have data to support their influence on student's critical thinking in the physics classroom.

For the past four years I have taken annual trips to the University of Cape Town (UCT) in South Africa. My research there has lead to joint supervision of South African graduate students, two month-long stays by UCT students to OSU, and joint publications between OSU and UCT students. I collaborate with Dr. Saalih Allie who is a member of both the PER group and the Academic Development Program, designed to foster the access, retention and success of students from disadvantaged educational backgrounds. Dr. Allie first developed the extended first-year experience for students seeking science degrees during the apartheid era when non-white students experienced inferior pre-college education. More recently he established an extended first-year graduate option for the National Astrophysics and Space Science Program which, despite being a flagship science initiative for South Africa, had failed to recruit and retain black South African students. I have been the external evaluator for this program since its inception. The program currently has three black South Africans moving into PhD level work, three starting masters research, six finished with their graduate coursework, and seven finished with the extended preparatory year.

Dr. Allie and I have supervised a number of projects centered around increasing success for the undergraduate and graduate extended-year students that contribute to our fundamental understanding of what impacts students in the physics classroom. Here is a summary of a few of our projects:

Friends and the impact of perceived audience:

- Task: Students were given a worksheet to fill out asking them to report the results of lab measurements as they would tell three different audiences: their instructor, as they would write it in the lab report, and as they would explain it to a friend. Each student answered all three questions with the same laboratory data.

- Findings: 74% of students (sample size of 120) answered the same question differently to at least one of the audiences, with 24% answering differently for all three audiences. In the example below the student provided a rather naïve answer to the instructor and a much more sophisticated response to the friend.

- Student quote: "…because when I speak to the lecturer I don't say everything. I stand to be corrected. … but if like a friend comes to me I be like ok I also know something about standard uncertainty ….so if I'm speaking to a lecturer and my friend it will be two totally different answers.."

- Implication: We may not get a good understanding of how much our students know depending on how we ask them about their knowledge. We may be able to improve learning by having them articulate deeper understanding through well-posed questions.

Footholds for understanding and conceptual metaphor:

- Task: Explain density/denseness in words, draw an explanatory diagram, predict the equation for charge density (these students have not previously seen the topic of charge density but have seen mass density).

- Findings: Four "foothold metaphors" were found for density: packing, heaviness, sinking, and abstract property. 80% of students with a packing metaphor were able to correctly predict the equation for charge density as opposed to less than 25% for any of the other metaphors (sample size of 126)

- Student quote: "Density firstly is measured in g/cm^3. It is calculated by the formula mass/volume. It is the amount of space or how heavy the amount of mass the substance takes up of a container."

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Teaching: Physics Education

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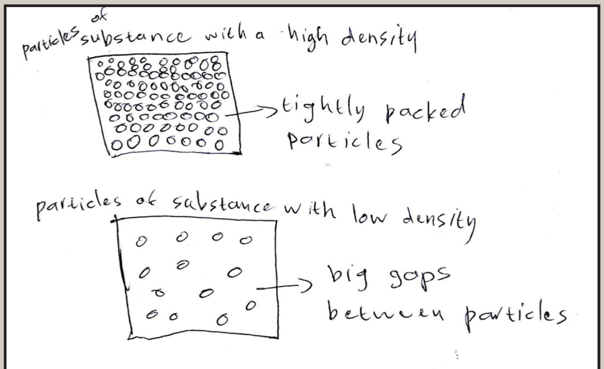
- Implication: If students' ideas are based on appropriate foothold metaphors they will be more successful when extending their knowledge to new contexts.



Example of a student response to the density task.

Fear and conflicts:

- Task: Students were given the word "astrophysics" at the center of an otherwise blank piece of paper and asked to write any words, phrases, images, or diagrams that come to mind when they see the word astrophysics. Students were then asked about what they wrote.

- Findings: Entering graduate extended-program students struggle with their perceptions of differences in values and practices associated with achievement in their past educational experiences and those seen to lead to success in the new situation. Students completing research are conflicted by personal fulfillment and passion for their studies and whether their work will be perceived to be beneficial to and by their home communities.

- Student quote: "How do the 'guys upstairs' (administrators and instructors) what do they really expect from us… Electricity and Magnetism is so important so if it takes time to grasp now, then what is really expected? I want to do it but am barely making it. Eventually you reach a point where you have to teach others – how is that going to be possible?"

- Implication: Students struggle through a process of adjusting to internal conflicts that goes far beyond learning physics content knowledge in order to succeed, even in graduate school.

This work, combined with other research has led us toward developing a generalizable cognitive framework that can be used to develop curricular materials that can aid students. The key premise is centered around the notion of an "idea space" and that the success accomplishing a task is related to the size of the space. Thus, if students have a large 'idea space' when approaching a learning task more meaningful engagement will take place. To understand the 'idea space' consider what you would think if someone asked you "Is it true that the net force on an object is proportional to its acceleration?" vs. the question "What are all the possible interactions between an object and its environment that could impact the motion of the object?" The former question puts a student in the frame of recalling authoritative information and being either correct or incorrect with only two possible choices: yes or no. The latter allows the student freedom to express understanding about multiple aspects of Newton's second law without being limited to an expected response.

Another way of thinking about the idea space is as follows: A large 'idea space' optimizes working memory for engaging with the task at hand combined with a strong network of cognitive resources for meaning making and critical thinking. On the other hand, any monitoring function uses up working memory and reduces the capacity to engage with the task at hand i.e. a smaller idea space is created. A classic example of monitoring is that of stereotype threat. Research indicates that stereotype threat uses up working memory that crowds out space for problem solving, leading to lower scores for those who fear they will be judged as a stereotype. Thus, fear in general leads to a reduction

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of the idea space.

Classroom materials developed from PER results are consistently shown to increase student learning. The strength of having a generalizable cognitive model with which to develop materials is it can be more easily applied than adopting new curricular material. Our findings show that existing classroom materials can be easily altered simply by reconsidering how the questions are posed to the students. There is no need to change the content of an existing course or laboratory materials. This is a revolutionary way of considering curricular reform since it does not require adopting any set textbook or materials, and changes can be made gradually to fit a particular instructional style or level of students.

OSU's PER group has a $250,000 grant from the National Science Foundation for helping faculty implement curricular reform. We are using the 'idea space' model to inform how we talk with faculty about classroom activities. Participants from OSU and local community colleges bring physics activities to workshops and we discuss optimization of how to present the activities to students in order to achieve specific learning goals. This novel approach to professional development has allowed us to create a community that shares best practices and where each participant learns from each other. This project is in its early stages but has already improved activities written for the reformed introductory courses at OSU and has facilitated the transition for faculty members interested in using reformed materials in their own courses. Learning gains have been measured for each introductory course over the past four years, and consistent, statistically significant increases have been found for students in the reformed courses.

For more updates, follow us on facebook.

We post significant news to the page "Department of Physics - Oregon State University" (you can find a link to this facebook page at www.physics.oregonstate.edu).

On the facebook page find links to the video of this year's Yunker Lecture, and recent news articles about research in our department (including reports of work by Yun-Shik Lee, Corinne Manogue and Dedra Demaree).

Become a fan of the page to have updates automatically forwarded to your facebook account.

Summer Internship at NASA Goddard Space Flight Center

by Mason Keck
Mason is a senior majoring in Physics. He is writing up his internship work for his physics senior thesis, and plans to attend graduate school next year.

This summer, I interned at NASA Goddard Space Flight Center in Greenbelt, Maryland, 5 miles NE of Washington, D.C. Within Goddard, I worked in the X-Ray Astrophysics Division with mentor Dr. Andy Ptak. Dr. Ptak is a research astrophysicist who previously held positions as a research scientist at Johns Hopkins and Carnegie Mellon. My internship involved helping to determine the science goals of future X-ray astrophysics missions, which will feature very high spectral resolution calorimeter spectrometers. I worked specifically with the development of the Advanced X-Ray Spectroscopic Imaging Observatory (AXSIO) mission concept. My work was to develop a computational routine to automate simulations and model-fitting of X-ray astrophysics data using X-ray data analysis software, XSPEC.

In terms of the science I studied, the internship served as a survey of X-ray astrophysics. I learned about basic physics of Active Galactic Nuclei (AGN), starburst galaxies (which are galaxies with a high-rate of star formation), and the X-ray background. High-energy processes in AGN and starburst galaxies produce X-rays, so the science studied for this internship included particle physics, including photoelectric absorption, bremsstrahlung, Compton scattering, and cross-section theory; detector physics, including spectral resolution and photon detection; and thermodynamics, including blackbody radiation.

Although the mission involved the development of an X-ray telescope for astrophysics, my work mostly involved statistics and computational science. Concepts in statistics I studied included least-square fitting and error analysis. Computational considerations involved developing code to iterate through every combination of input parameter values. I worked with the command-line and the python and tcl languages. This was an important technical skill that I gained during the internship, and I now feel competent enough with command-line computing to actually feel productive using it.

I gained a great appreciation for the development of a large-scale NASA mission concept. My internship came at a very interesting time for the X-Ray astrophysics division at NASA Goddard. I was initially accepted for an internship with the International X-Ray Observatory (IXO). IXO was essentially ended about as soon as I accepted the internship in April due to budgetary concerns. The IXO team at NASA redirected their efforts to a NASA-only led project, which became AXSIO, so my internship transferred to AXSIO. I got to see the basic considerations in mission concept development, including launch vehicle considerations (mass and size of telescope), budget considerations, and science goals for the mission concept. I saw in detail how these different factors influenced each other in the development of the final mission concept.

The mission concept is finalized during a mission design laboratory (MDL), which is a very intensive one-week event in which the mission team fleshes out every aspect of the mission, from the launch of the mission to the mission's end of life. Unfortunately, I had to leave before the MDL, but I participated in all of the AXSIO meetings, and I was present for an in-person meeting covering all-aspects of the mission concept in preparation for thee mission design laboratory run. This meeting of professional scientists and engineers could be the most amazing event I have ever witnessed, as they demonstrated an understanding of astrophysics, mechanical and electrical aspects of telescope design, and instrument electronics to a very high degree.

Overall, being involved in the development of a large-scale mission at NASA Goddard was awesome. Beyond Goddard, I also had time to explore the Washington D.C. Metro system and the capitol area. I also experienced an earthquake and a hurricane in the course of a week.

Oregon State University hosts the North-West Section of the American Physical Society

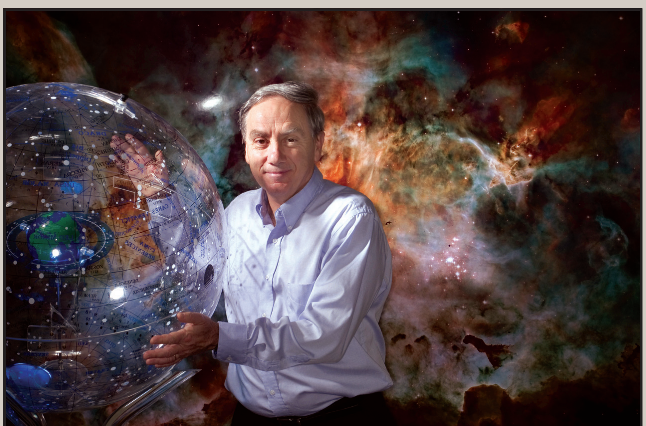
By David McIntyre

The Department of Physics hosted the Thirteenth Annual Meeting of the Northwest Section of the American Physical Society (APS) in Corvallis during October 20-22. The Northwest section of the APS is the largest geographically and includes Oregon, Washington, Idaho, Montana, Wyoming, British Columbia, Alberta, and Alaska. This annual meeting has a balanced blend of plenary talks, invited talks, and contributed talks and posters. Students are especially encouraged to present their work in a small and friendly setting. The meeting was held in the conference facilities of the LaSells Stewart Center on campus and had over 200 attendees.

The conference got underway Thursday afternoon with a reception for attendees in our new studio teaching room in Weniger Hall. That was followed in the evening with a public lecture by the renowned astrophysicist, Mario Livio, on the Greatest Scientific Achievements of the Hubble Space Telescope. An overflow audience saw spectacular images from the orbiting telescope and heard about research that led to this year's Nobel Prize on the expansion of the universe.

On Friday and Saturday, the program comprised of plenary talks in the mornings and parallel, disciplinary sessions in the afternoons with invited and contributed talks. The plenary talks featured outstanding speakers from around the Pacific Northwest and the world. Yun-Shik Lee from our own Physics Department told us about his recent work in generating and using THz radiation, with recent impressive results on using THz to image single layer graphene. Ken Krane, also from our department, recounted the history of the famous Halliday and Resnick introductory text, on which he is now a co-author. Ken pointed out Halliday's penchant for introducing obscure references to James Joyce in the text (see volume 2 of the extended version of the 3rd edition). Other plenary talks included reports on neutrino oscillation experiments, the LHC, and graphene.

Friday afternoon featured a poster session with 32 posters from around the Pacific Northwest, with a reception to lubricate the lively discussions. The evening banquet featured an engaging after-dinner talk by Prof. Ed Brook of the OSU Geosciences Department. Prof. Brook is a paleoclimatologist who ventures to the poles when the sun is out and extracts ice cores that date back 100,000 years. His OSU laboratory measures the gas content of these cores to learn about the history of greenhouse gases.



Renowned astrophysicist Mario Livio, a leader of the Hubble Space Telescope Science Institute.

Saturday's sessions were separated by an undergraduate luncheon hosted by the Society of Physics Students (SPS). This was hosted by Tom Olsen, formerly of Lewis and Clark College, who is now the Assistant Director of the Society of Physics Students in Washington, DC. Tom provided information to the students about opportunities for graduate school and employment. OSU students were very visible at the conference, both as participants and as student helpers. OSU Physics students, both graduate and undergraduate, presented 11 talks and 2 posters.

We received many compliments from attendees on the conference's science and its organization, and we look forward to next year's meeting in Vancouver, BC.

Physics

Alumni Update

Thanks for contacting us! We're always pleased to hear news of your careers and activities. Drop an email to individual faculty members or update us via our alumni page at the departmental website. Please keep your address current with the OSU alumni office, so we can mail you a copy of the newsletter.

Undergraduates:
Elliot Koch (B.S. 1999) is a Research Associate in the Department of Astrophysics at the University of New South Wales in Sydney, Australia.

Levi Kilcher (B.S. 2003) received a Ph.D. in Physical Oceanography from OSU in December 2010.

Scott Clark (B.S. 2008) was spotted at SC2011 in Seattle. He is finishing a Ph.D. in Applied Math and is taking a position with Yelp.

Alden Jurling (B.S. 2008) passed his prelims at the University of Rochester and presented a paper at the Frontiers in Optics section of the Optical Society of America meeting.

Jessica Gifford (B.S. 2011) is a Ph.D. student at Arizona State University.

Garrett Banton (B.S. Nuc. Engr. 2011, Ostroverkhova) is at Sulzer Pumps, Inc. in Portland, OR.

Josh Kevek (2011) is a Research Support Specialist in the Kavli Institute for Nanoscience at Cornell University.

Graduate Students:
Fuxiang Han (Ph.D. 1993) is now Full Professor at Dalian University of Technology in China. He has recently published a book "Problems in Solid State Physics with Solutions".

Goran Karapetrov (Ph.D. 1996) is Associate Professor of Physics at Drexel University.

Jung-Hwan Song (Ph.D. 2005) we are very sad to report that Jung-Hwan Song passed away this year. Our sympathies to his family and friends.

Nathan Nebergall (M.S. 2006) is the Lab manager at Pacific University in Forest Grove.

Lisa (Eccles) Taylor (PSM 2006) is Adjunct Professor at the Oregon Institute of Technology where she teaches the calculus-based General Physics course.

Skye Dorsett (Ph.D. 2008) is teaching at Pacific University.

Michael Low (M.S. 2008) is a professor of physics at Oklahoma City Community College.

Paul Newhouse (Ph.D. CH 2008, Tate) is a post-doc in Bruce Parkinson's group at the University of Wyoming.

Daniel Harada (M.S. 2010) is employed by WaferTech, Camas, WA.

Jennifer Roth (M.S. 2010) taught physics at LBCC winter term 2011 and became the proud mother of a baby girl a few weeks after the term.

Matt Leyden (Ph.D. 2010) has accepted a position at NT Bio, a California start up company that is commercializing carbon nanotube biosensors.

Josh Russell (M.S. 2011) has a permanent position with SolarWorld in Beaverton, after starting out as an intern.

Joe Tomaino (Ph.D. 2011) is working for Intel, Hillsboro as a process engineer.

Sissi Li (Ph.D. Sci. Math. Ed. 2011, Demaree) is now a postdoc at California State University, Fullerton.

Faculty and Staff:
Jim Ketter was shown on TV, as part of OSU's Precollege Programs for Talented and Gifted Youth. See http://kezi.com/news/local/218408.

Prof. Tevian Dray was elected Fellow of the American Physical Society, for his contributions to the theory of general relativity, which include investigations of light-like surface layers and the physics of signature change.

Rubin Landau's Computational Physics eTextBook is now available (free!) at compadre.org and merlot.org (these website are national repositories for educational resources).

Verna (Paullin-Babcock) Loveall celebrated her marriage in November.

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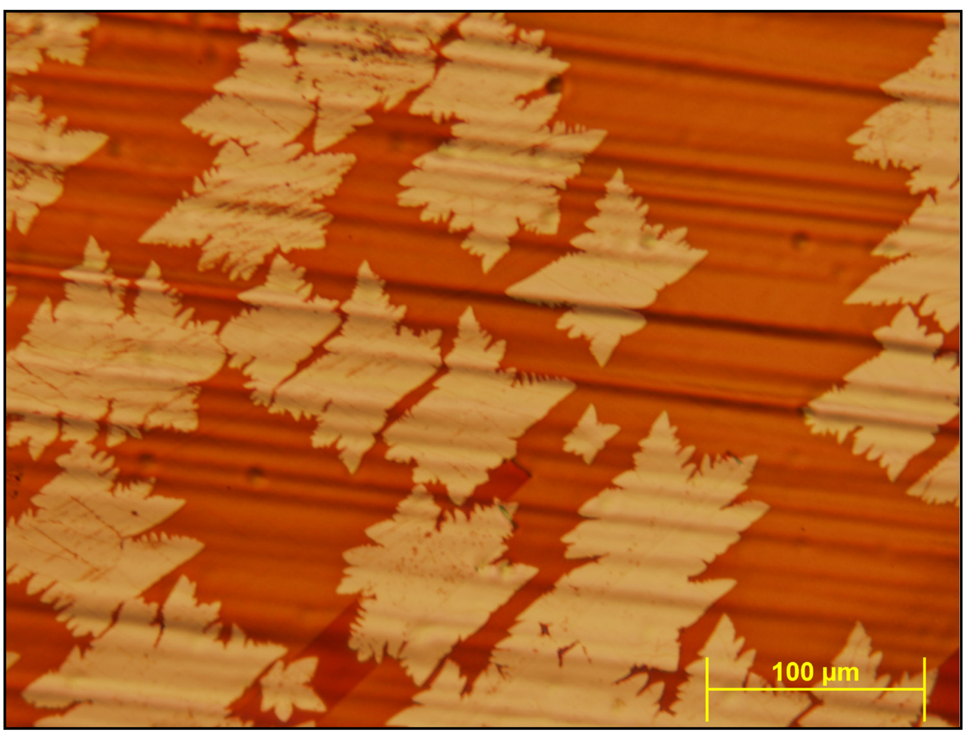

Graphene grown on copper foil by researchers in Ethan Minot's lab. This optical microscope image shows pieces of graphene (about 10-micron in size) with flower-like geometries. The graphene flowers are only one atom thick, but are able to prevent oxidization on the underlying copper. Red areas are oxidized copper, yellow areas are not oxidized.