"All The v's That's Fit To Print"

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REFLECTIONS ON 2005

The past year's events and accomplishments were extraordinary even by our standards! Some of the highlights have been related in recent issues of the *Phyast Flyer*. Let me briefly repeat them.

First and foremost is the renaming of the department as the Homer L. Dodge Department of Physics and Astronomy and the gift of $6M from the Avenir Foundation. The three endowed faculty chairs, the graduate fellowships, and the kick-off funding for the renovation of old Nielsen Hall will all have a lasting effect on our future and help to make us worthy to bear Homer Dodge's name.

The year 2005 also saw the faculty move into new offices in the Phase II addition, each with individually chosen new furniture. The atrium separating the new building from the old has been a great place to have our daily tea. It is a striking space containing the ever-swinging Foucault pendulum and made very elegant by furnishings provided by President Boren as well as Native American artwork donated by David and Molly Boren.

Thanks both to President Boren and Provost Nancy Mergler, departmental faculty salaries were increased in 2005 by the largest percentage increase among physics departments nationwide according to a recent survey. This special increase, aimed at bringing us closer to regional and national averages, reflects the confidence of the University's administration in us and recognition of our accomplishments. Our external funding, among the highest for departments at OU, is perhaps the most visible symbol of our vitality to those outside the Department. It hit a new record of $4.2M in 2005.

These events occurred of course against the quite normal background of daily life within the Department. Our faculty taught their courses, did their research, and performed service. Our fantastic staff made it possible for the Department to carry out its functions. And our students made it all worthwhile with their vibrancy and hard work.

We received wonderful support from our alumni and friends in 2005 and many of you donated to departmental endowments. Your continued trust in us, in the job we are

doing, and in our future is really important. Thank you so much! We pledge to keep up the good work!

---Ryan Doezema

AWARDS AWARDS AWARDS

Numerous undergraduates were recognized in April for their good scholarship. In addition, two faculty members received prestigious awards as well. First, the students.

Physics & Astronomy:
Students in Physics & Astronomy who were recognized for their *good scholarship* are Adam Anderson, Brett Barasch, Sara Barber, Christopher Bares, Joshua Barron, Henry Bradsher, Dustin Combs, Erin Cooper, Emily Day, James Dizikes, Jason Evans, Caitlin Finley, Jason Garman, Tyler Hardman, Joshua Harrison, Spencer James, Jeremy Jernigen, Christopher Krycho, Devin McCombs, Amar Molinas, Tuan Nguyen, Brittany Pendleton, Kevin Perot, Holly Presnell, Brian Reed, Jonathan Sharp, Alea Smith, Samual Spence, Brett Thomas, David Thompson, and Randi Worhatch.

Karcher Scholarships were awarded to Ethan Brown, Susan Gosse, Devin Harper, Wes Ketchum, Joe Mitchell, Julie Skinner, Joshua Smith, Derrick Toth, and Daniel White.

The Cuba and Ted Webb Scholarship was presented to Nicholas Hall, while the *Henry L. Dodge Scholarship* was given to Jerod Parrent.

The William Schriever Award for Outstanding Scholarship in Physics & Astronomy went to Joshua Smith and Daniel White.

The Duane E. Roller Award for Outstanding Scholarship in Physics & Astronomy was presented to Devin Harper and Wes Ketchum.

The J. Clarence Karcher Award for Outstanding Scholarship was given to James Dizikes and Tuan Nguyen.

Engineering Physics:
Students in Engineering Physics receiving recognition for *good scholarship* are Gareth Basset, Brett Billbe, Daniel Freno, Stephen Glenn, Hawken Grubbs, Stanton Harwood, Eric Johnson, Thomas Kennington, Aaron Marshall, Robert McClure, Jr., Christopher McGuffey, Kelly O'Roke, Emily Scales, Joshua Smart, and Matthew Ulmer.

The *Karcher Award* was presented to Daniel Wasielewski, Ernest Sanchez, Christopher Allen, Christian Crowe, Alexander Down, David Kelle, Sarah Lumpkins, Michael Meier, Brian Morris, Robert Nicholas, Joel Ramey, Alexis Reusser, Jared Seay, Ryan Smith, Alan Taylor, and Jeffrey Woidke.

The William Schriever Award for Outstanding Scholarship in Engineering Physics was presented to Christian Crowe and Daniel Freno.

The Duane E. Roller Award for Outstanding Scholarship in Engineering Physics was given to Eric Johnson and Stanton Harwood.

Department Awards:
The Dodge Prize for the Outstanding Sophomore and Junior went to Susan Gosse and Sarah Lumpkins, respectively, while Emily Day received the *Fowler Prize for the Outstanding Senior*.

The Stanley Babb Award for Outstanding Leadership and Service was presented to Randi Worhatch.

Finally, it should be noted that Emily Day also was presented with the *Carl Albert Award* by the College of Arts and Sciences.

Now for the faculty awards. Two faculty members were recognized with prestigious university honors. Mike Strauss (HEP) received a Presidential Professor award for excellence in teaching and research, while Yun Wang (AP) was given a Regents Award for Excellence in Research.

Congratulations to all of the award winners, both students and faculty members for their dedication and hard work.

WELCOME REU STUDENTS, SUMMER 2006

Again this summer the Department is playing host to many undergraduate students in Physics & Astronomy both from OU and elsewhere who wish to take part in our Research Experience for Undergraduates program, funded in part by the NSF. These students are selected each spring from a large pool of applicants and are invited to Norman during June and July to work with individual faculty members, assisting them in their research.

This summer's group of students (and their mentors) are: Seth Toepler (Strauss), John Stupak (Parker), Ethan Brown (Mullen), Jonathan Peters (Brian Grady, Engineering), Miriam Musco (Branch/Baron), Robert McClure (Santos), David Kelle (Bumm), Alexander Down (Johnson), Dustin Combs (Shafer-Ray), Chris Crowe (Shafer-Ray), Derrick Toth (Watson), Tony Bridgewater (Strauss), Henry Bradsher (Henry), Donald Booth (Parker), Josh Smith (Shaffer), Matt Donahue (Abraham), Chris Allen (Johnson), and Savith Chauhan (Shaffer).

REPORTS ON RESEARCH & TEACHING

Exciting work in both teaching and research continues unabated in our Department. Here are some brief summaries submitted by several faculty members about what they're up to these days.

Kim Milton (HEP)

I have been on sabbatical this year, as E.T. Jaynes Professor at Washington University, St. Louis. I have been continuing video meetings with my three students (Shajesh, Prachi, and Wagner) as well as Ines, on a twice-weekly basis. In St. Louis I have been collaborating with Carl Bender on non-Hermitian but PT-symmetric quantum theories. As a result
of my work this year 8 reviewed papers are published so far in 2006, one on the thermal Casimir effect (with my Norwegian collaborators), four on local and global Casimir energies in spherical and cylindrical geometries (with my students), two on PT symmetry (with Bender and his students), and a long review on magnetic monopoles by myself. Four more papers are in press or under review. In addition, I completed Milton and Schwinger: "Electromagnetic Radiation: Variational Methods, Waveguides, and Accelerators," which has just been published by Springer, on the basis of which I taught
a very successful course at WU. My DOE grant (with Kao) was substantially increased this year, to include funding for a postdoc, and I received a new NSF collaborative grant (with Steve Fulling of Texas A&M) to continue my researches into quantum vacuum energy (Casimir effect). So I guess you can say I had a productive year, as well as a fun one in St. Louis.

Greg Parker (AMP)

I currently have three graduate students working with me. Xuan li is developing theoretical methods to solve problems associated with "coherent control of

bimolecular reactions". We hope to be the first to do accurate quantum mechanical calculations for this process and to provide experimentalists guidance. Daniel Brue is working on "three-body recombination at ultracold temperatures". We will provide accurate quantum mechanical rate constants using a realistic potential energy surface. Jeff Crawford just started working with my group this past semester. He is developing a time-dependent scattering code to study reactive collisions in the presence of an electromagnetic field.

The High Energy Experimental Group

The high energy experimental group has been putting much of its time and effort into running large scale computing farms over the past year. During this time, the computing resources available to us have vastly increased. Recently we
purchased a computer cluster consisting of 40 3GHZ dual processing nodes and we are currently processing simulated data as part of an ATLAS Tier II center. We have just started running on the newest cluster at the OU supercomputing center. This cluster called TopDawg has over 1000 processors which allows us to run many more simulation jobs for the ATLAS detector. Because TopDawg is now available for general use, the high energy group will be taking over the old supercomputing cluster
which consists of nearly 250 CPUs. We have already started processing data directly from the D0 experiment on this cluster. This is the first time that any remote site has run primary processing from the D0 experiment. When we are finished, we will have processed over 42 million events and transferred over 7.8 PetaBytes of data. Brad Abbott will be on sabbatical this upcoming year and will be a guest scientist at Fermilab, where he will serve as the computing coordinator for the D0 experiment. We have also recently sent a number of students to the experiments to begin their research. Sohrab Hossain (Phil Gutierrez's student) and Mandy Rominsky (Mike Strauss's student) are now resident at Fermilab. Razzak Meera Lebbai (Pat Skubic's student) has just left the country to begin working at the ATLAS experiment in Switzerland. Rusty Boyd has been resident at CERN for over a year and two new postdocs have recently joined the group to begin working on ATLAS and computing.

Bruce Mason (SS)

In the past year, work on the physics and astronomy education digital library, ComPADRE (http://www.compadre.org) has expanded greatly. We were chosen as one of a few central participants in the NSF's National Science Digital Library (NSDL, http://nsdl.org), providing disciplinary resources to the library. The work involves improving the technical infrastructure of the library, expanding current content collections, and starting new collections to broaden the coverage of the library. This growth is also increasing the collaborations with other libraries and the authors of physics resources.
The biggest change made in my teaching efforts was the use of the in-class voting system to give multi-question, multiple choice quizzes. I felt it was helpful, although some of the students might disagree. These quizzes gave the students more frequent and immediate feedback on how they are doing. Because each quiz was done twice, once individually and once in groups, they also increased the amount of time the students were teaching, and learning from, each other.

Ryan Doezema (SS)

Mike Santos and I, along with several students, have been working on magneto-excitons in InSb quantum wells. This will form the center of Taroshani Kasturiarachichi's thesis. We have just observed the excitonic transitions in a newly constructed cryostat with a new FTIR spectrometer and expect the data for the project to be complete by summer's end. Will Gempel is busy designing an orthogonal-set of Helmholtz pairs in order to study the angular dependence of electron spin resonance in InSb quantum wells.

Eddie Baron (AP)

I've been working on several topics this year: 1. Improving the 3D capabilities of our PHOENIX code; 2. Modeling Type II supernova, both to determine abundances to study the results of stellar evolution modeling and for cosmological probes; and 3. Modeling Type Ia supernovae studying exactly where the features form, which hydrodynamical model is closest to the

observations and trying to determine and understand just what is needed to reproduce the observed homogeneity as well as the diversity. With undergraduates I have been working on modeling Type Ib supernovae (Wesley
Ketchum) and the Type Ic hypernova SN 1997ef (Michael Troxel). I, along with Karen Leighly, have been working with Darrin Casebeer on modeling FeLoBAL quasars. Remarkably using the same techniques for obtaining
distances to supernovae, we have obtained reasonably accurate distances to these AGN at redshifts of z=0.698 and z=1.776.

David Branch (AP)

Since May, 2005, my main professional obsession has been a comparative study of spectra of Type Ia supernovae (SNe Ia) obtained near and before the time of peak brightness. Also involved in this project are 7 undergraduates (Leeann Chau Dang, who visited from Whitman College as an REU summer student in 2005; Nicholas Hall; Joshua Harrison;
Wesley Ketchum; Mercy Melakayil; Jerod Parrent; and Michael Troxel), graduate student Darrin Casebeer, Visiting Research Scientist David Jeffery, and Eddie Baron. A paper that has recently appeared in print is concerned with the near-maximum-light spectra of 24 SNe Ia. Comparisons with synthetic spectra generated with the SYNOW resonance-scattering code provide a basis for discussion of line
identifications and an internally consistent quantification of the spectroscopic diversity among SNe Ia. Among our conclusions is that SNe Ia appear to have a continuous distribution of properties, rather than consisting of several discrete subtypes. At present we are working in the same way on spectra obtained before the time of maximum
brightness. Our goals are to firm up line identifications in SNe Ia and advance our understanding of the physical differences that are responsible for the observational manifestations of diversity. This in turn will help us to understand the nature of the progenitor binary systems and the explosion mechanism, and lead to improved confidence
in using SNe Ia to probe the nature of the dark energy.

John Cowan (AP)

We are continuing our observational and theoretical
abundance studies trying to understand the nature of heavy element formation in stars. These studies are being undertaken with graduate students Jason Collier and Stacey Long. In addition our group is making multi-wavelength (radio, X-ray, optical, etc.) observational studies of
nearby face-on galaxies. These projects involve graduate student Larry Maddox and former student (now professor at Marquette) Christopher Stockdale. The observations are designed to identify the nature of the many point sources in, and the nuclear regions of, such galaxies as M83, M51 and M101.

Dick Henry (AP)

My work continues in two directions: 1. attempting to understand the origin and evolution of nitrogen in the Universe; and 2. using planetary nebulae to probe abundances patterns in the Milky Way and other galaxies.
Along with graduate student Aida Nava, I am continuing to study elemental abundances in low metallicity objects such as blue compact galaxies and damped Lyman alpha systems in an attempt to understand their chemical evolution. In particular, we are interested in the natural history of nitrogen as well as how quickly stellar material ejected during final evolutionary stages mix with the surrounding interstellar medium. My research in planetary nebula abundances involves undergrads Julie Skinner and Henry Bradsher. Currently, we are interested in understanding why sulfur in planetary nebulae is often found to be depleted significantly below expected levels.

RECENT GRADUATES

Over the past year numerous students have finished up their graduate programs and have earned their MS or PhD degrees. Those students completing their masters

degrees are: April Hendley (spring, 2005; Branch), Beselin Kostov (summer, 2005; Wang), Pedro Llanos (summer, 2005; Bumm), and Shawn Frierson (summer, 2006; Shaffer). Doctoral students who have graduated are: Robert Meyer (spring, 2005; Santos), J.C. Chokomakoua (spring, 2005; Murphy), Preston Larson (summer, 2005; Johnson), Bryan Bichsel (summer, 2005; Abraham), Sebastien Bongard (summer, 2005; Baron), Ines Cavero-Pelaez (summer, 2005; Milton), and Thushari Jayasekera (fall, 2005; Mullen). Congratulations to all of these students!

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