

PHYAST FLYER

The Department of Physics & Astronomy

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FROM THE EDITOR

We are quickly closing out another academic year in the Department. As I write this, final exams are in progress. Most of us will now go into our summer research mode, from which we emerge in August. This is our opportunity to work full time on papers, attend meetings, catch up on journal reading, have uninterrupted conversations with Department colleagues, and enjoy the relative quiet of Nielsen Hall.

Also with this newsletter we come to the end of the second year of publication. I am pleased that we are able to publish an unusual amount of alumni news (see below), thanks in large part to a few people who sent me a bundle of information about themselves and others via e-mail. If I haven't heard from you as yet, please take the opportunity to write and update us on what you are doing. My e-mail address is: henry@phyast.nhn.uoknor.edu. Have a good summer!

Dick Henry

NEWS FROM THE MAIN OFFICE

The Department's newest Secretary is **Danette Miller**. She comes to us from the Center for Public Management and Educational Development. Danette mainly handles the grant accounts, travel vouchers, colloquium announcements and textbook ordering. She replaces **Connie Walters** who left the Department to move to Utah where she is working at the University of Utah. Connie keeps in contact with the department by e-mail and says "hello!" to everyone! We welcome Danette to our office staff and look forward to many years of Physics Phun!

Grettie Bondy, our Graduate/Undergraduate Studies Secretary, has "distinguished" our Department by being awarded a Distinguished Service Award from the Hourly Employees Council recently. Grettie has been with our Department since April of 1987. We look forward to more of the same "distinguished service" from Grettie!

Our final member of the office staff, **Linda Christie**, will be celebrating her 10-year anniversary with our Department in July of this year. Linda began in 1984 working as

the Department Receptionist when Debbie Grubis was Staff Assistant. After Debbie left, Linda was hired as the Staff Assistant and has been working in that position since September of 1985. Linda has seen office personnel come and go, but she believes that this complement of staff should be one of the best yet! She looks forward to another 10 years with the Department, and feels confident enough in the staff that she might even take a vacation this year, since she hasn't taken a "real" vacation in the 10 years she's been here!

If you get a chance to stop by the office, say "Hello" to our staff and let them know you're an alumnus. They'll update you on the latest Departmental information and make sure they have your current address for future mailings of the Phlyast Phlyer! To reach the office staff by e-mail, the Internet address is: christie@phyast.nhn.uoknor.edu.

TEACHING NEWS

John Furneaux attended two seminars/ workshops on teaching given by people from Carnegie-Mellon U. in March. The first one was on teaching a calculus-based undergraduate E&M course. They have developed a new approach

which is much more student friendly and hands on. The seminar included a complete workbook which is also a text. John was quite impressed and would be willing to share the materials with anyone who is interested. The second workshop was given by Fred Reif, for whom John was a TA at Berkeley in his graduate student days. He also had some very interesting insights which John found useful.

Mike Morrison, who is now an Adjunct Professor in English, has taught a course on science in fiction with R.C. Davis of the English Department this spring. Enrollment in their course exceeded 100, which is quite a change for Mike, who is used to teaching the small upper-level undergraduate physics courses. Mike looks forward to doing just that next fall.

Kim Milton has taught Advanced Particle Physics over Compressed Video (two-way video and audio) with students at OU and OSU. Kim claims that it's been an interesting experience, and the content has been a lot of fun, too. He hopes someday to turn it into a book. (He's currently writing a monograph on the Casimir Effect.)

Dick Henry again this year has taught an interdisciplinary course in physical evolution for the Honors Program with Doug Elmore from Geology. This is a repeat of the course they taught during spring, 1993. The

course enrolled 23 students. In this course students look at contemporary topics in astronomy and geology, while learning about the physical basis for each. In addition, papers exploring science and society issues are written.

RYAN WINS GENERAL EDUCATION TEACHING AWARD

Stewart Indestructo Ryan has been honored once again for his exemplary teaching, this time by being presented with the newly created General Education Teaching Award. This award is given to the OU faculty member whose teaching is considered to have contributed most to the university-wide general education program. In the past, Stu has received the Regents' Award for Superior Teaching (1992), the AMOCO Foundation Good Teaching Award (1990), the Oklahoma Foundation for Excellence's Oklahoma Medal for Excellence in Teaching (1989), the Burlington Northern Faculty Achievement Award (1987), and the Baldwin Study/Travel Award (1986). Presumably the \$1500 from his latest honor will be used to purchase new wigs, CO₂ bike fuel, liquid nitrogen, and a new wall for his home on which to mount all of his plaques.

ALUMNI NEWS

Benjamin White (BS90,PHY) is about to finish his MD degree at The Johns Hopkins School of Medicine and will then begin a six-year postdoc in neurosurgery at Wake Forest University's Bowman Gray School of Medicine in July. He is married to **Robbie Thomason** (BS90,PHY) who has taught for three years in the inner city schools in Baltimore. Their first child was born last November 1. Ben's younger brother Jeremy is currently a freshman in physics at OU. Ben says that he misses physics!

Kevin Cobble (BS79,AST; MS85,EP) is currently working for E-Systems, a defense contractor, in Greenville, TX. He is in charge of the development of neural network algorithms and nonlinear dynamics algorithms for use in signal recognition and demodulation. He is involved in the marketing of these as well, visiting ARPA and various government labs. He is also currently investigating nondestructive methods for performing aircraft inspection. This includes X-ray, Eddy current, and ultrasonic inspection techniques and the analysis of the resulting images and the detection of features in these images that may be an indication of corrosion or cracks. E-systems has various subcontracts with universities and is also extending work to highways and infrastructure. Kevin is married to Melissa

Finch (whom he met at E-systems) and they have two children, Paul 8, and Pam 5. Kevin has built a 20" telescope in his free time and is currently trying to move it from a Dobson mounting to an equatorial mount and adding a CCD with the aim of getting some automatic observations.

Kevin reports that several other OU grads work for E-systems as well.

Bill Kloeping is a systems engineer working on the maintenance section of the aircraft. He is married to **Debbie Grubis** a former secretary of the Physics and Astronomy Dept.

Linda Barker has a BS in Astrophysics and an MS in Physics and works in Kevin's department on advanced algorithms for digital signal processing for satellite communication and FAA aircraft.

Kevin Burnett has a BS in Astrophysics and joined E-Systems after a stint in the Air Force. He is married to another Astrophysics graduate from OU, **Karen Henry Burnett**, who received a degree in astrophysics in 1984. He flew the aircraft that Kevin Cobble's group works on for the Air Force and is a Program Manager for that contract.

Bruce Hudson has a BS and MS in Physics and is working on algorithms for the control of

hardware used to collect and analyze signals.

Bill Jennings received his MS in Engineering Physics and designs digital hardware for signal collection and processing.

Kevin closes, "I think that we have the largest collection of OU Astrophysics majors anywhere in the world and possibly the largest of physics majors in general. We also have a large collection of high powered parallel processing computers that are idle in the evenings and on weekends, so if there are any projects that could use some of this untapped talent let us know. E-Systems is in the process of installing an internet connection but for now you can reach me at cobblekl@delphi.com"

Eldon Ferguson (PhD53) was awarded the Will Allis Prize from the APS in April. This prize is intended to recognize and encourage outstanding research into the microscopic or macroscopic behavior of ionized gases. The citation reads: "For his pioneering development and application of the flowing afterglow technique to provide detailed microscopic understanding of low-energy ion-molecule reactions of importance in weakly ionized gases and ionospheric physics". Eldon is currently the director of the Climate Monitoring and Diagnostics Laboratory.

TOWARD THE STARS: ASTRONOMY GRADUATE STUDENTS

The pace of publications from the astronomy graduate students seems to be increasing, as witnessed by the many articles written by **David Branch's** supernova group. **Peter Nugent** and **Adam Fisher** have been co-authors on two papers, "On the Relative Frequencies of Spectroscopically Normal and Peculiar Type Ia Supernovae" and "The Distance to the Type Ia Supernova 1972E and Its Parent Galaxy NGC5853: A Prediction." **Tom Vaughan** is sending off a paper "Blue and Visual Absolute Magnitude Distances of Type Ia Supernovae" and is currently writing "Photometric Redshifts for Spectroscopically Normal Type Ia Supernovae" for later publication. They all also attended the AAS Meeting in Washington last January to present their work. In addition, **Doug Miller** will likely defend his Ph.D. research on "NLTE Synthetic Spectra of Type Ia Supernovae" in late July, and will be bending his efforts towards finding employment. We all wish him luck out in the "real world," hoping he doesn't finally settle down at the Taco Bell. **Tim Young** is also a likely graduate this summer, defending his work on "Type II Supernovae Light Curves".

John Cowan's new research group is forming, with **Chris Eck** taking his specialist exam

in May and working with Dr. Cowan on observations of radio supernovae remnants. **Debra Burris** is also in the group, and she begins her research this summer into galactic chemical evolution models by theoretical modeling of heavy element abundance data taken of very metal-poor halo stars.

Dick Henry's group has been active, with **Joe Howard** now analyzing halo planetary nebulae for future comparison to disk objects. Joe recently co-authored a paper with Dick on abundance gradients in spiral galaxies. **Jim Buell** continues his work on multivariate data analysis of planetary nebulae as well as studying the nucleosynthesis of intermediate mass stars using his detailed stellar evolution code. **Tad Thurston** is constructing an algorithm for easier determination of nitrogen abundances, with future plans of applying the work to finding the origin of galactic chemical gradients. **Scott McCartney** is working with **Tibor Herczeg** analyzing the properties of contact binaries.

We also welcomed first year graduate astronomy students **Heidi Morris**, **Jackie Milingo**, **Neil Miller**, and **Melani Menendez**, and wish them luck this summer in their teaching assignments and preparation for the qualifying exams.

Tad Thurston

WHAT'S UP IN ATOMIC PHYSICS?

The past year has been as active as usual for the Atomic, Molecular and Chemical Physics group. We have had a number of interesting visitors: Antonio Lagana (Perugia, Italy), Chris Greene (U. Colorado), John Loeser (Oregon State), Barbara Whitten (Colorado College), and Millard Alexander (U. Maryland). Our AMC lunchtime semester extended to two semesters this year. Graduate students who participated and gave talks included **Tommy Ericson**, **Kyle Copeland**, **John Walkup**, **Kushlani Dharmasena**, **Bill Isaacs**, and **Yuxin Qin**. Research activities continue apace in both experiment and theory.

Mark Keil's molecular beam lab is gearing up to undertake a detailed experimental study of the reactive scattering of $F + H_2$. This summer they will be constructing and testing a cooled molecular hydrogen source (originally designed by undergraduate **Marc Schiermeier**). Graduate students **Tommy Ericson** and **Kyle Copeland** have already helped set a new world record for the production of a beam of atomic fluorine. They have achieved stable operation at $1000^\circ C$ by using magnesium fluoride as the nozzle material for the beam source. This beats previous sources by about $300^\circ C$, an important result which

improves the atomic beam flux by about a factor of ten. In an unending quest for better performance, **Joel Young** in the machine shop has been experimenting with nozzles made of tubes of single-crystal magnesium fluoride in contact with resistively-heated tubes of tantalum. This would vastly simplify the current, rather complex design, constructed by **Bob Littell** with help from **Barry Bergeron**. Since fluorine is the most corrosive gas known, the atomic source may even find use in surface etching applications (atomic chlorine is now generally used for experiments). The group at OU has already demonstrated the ability of atomic fluorine to etch most every surface it comes into contact with! Unfazed, they are now recklessly contemplating the use of pure fluorine in the beam source to gain another factor of five. Based on preliminary tests, the experimental group has supplied **Greg Parker** with a range of collision energies so that he can begin to calculate differential cross-sections for eventual comparison with the results of the scattering experiments, so the race between experiment and theory is on.

Maureen O'Halloran and graduate student **Kushlani Dharmasena** are busy in their laser lab collecting data on the multiphoton excitation of Rydberg states of carbon dioxide. They have completed a series of studies using three-

photon excitation to bound Rydberg states followed by single-photon ionization. Following the coherent absorption of three ultraviolet photons, the CO_2 molecules have enough energy to dissociate, but because this energy is localized in the Rydberg electron, the dissociation rate is small enough for ionization to compete effectively. By detecting the rate of ionization for different Rydberg levels, they are able to learn about the degree of interaction between the Rydberg electron and the ion core. Next on the agenda are studies of two-photon excitation (which will access Rydberg states of differing symmetry) and a study of the dissociation of nitric oxide (NO). They will be joined this summer by undergraduate **Jennifer Jeffries**.

Deborah Watson and post-doc **Martin Dunn** continue their collaborations with **Dudley Herschbach** of Harvard University and **David Goodson** of Southern Methodist. OU graduate student **John Walkup** has recently joined this group. They are working on the extension of a method called Dimensional Perturbation Theory to the study of simple atomic systems such as Helium. With this method, they generalize the Schrodinger Equation to an arbitrary number of dimensions. The philosophy behind the method is the notion that, just as a two-dimension world can be understood more

easily from the perspective of a three-dimensional universe, so might insight into three-dimensional physics be gained by using the perspective of higher dimensions.

Greg Parker continues his work on reactive scattering calculations. This year he has been working on detangling the spaghetti of molecular potential energy curves involved in reactive scattering of systems such as $\text{Li} + \text{HF}$ in order to locate and identify scattering resonances. He is also interested in obtaining time-dependent results to visualize, for the first time, a chemical reaction as it evolves using accurate quantum mechanics. This year he has incorporated the use of video technology, including a "video toaster" which is also used in making special effects for commercials and movies, to make three-dimensional images of molecular potential energy surfaces and wavefunctions. In the coming year he will be on sabbatical at the University of Houston to work with **Don Kouri** on time dependent reactive scattering calculations.

Michael Morrison is busy on several fronts. Together with post-doc **Weigo Sun**, they have completed a multi-year effort to calculate ab initio cross sections for elastic scattering, momentum transfer, and vibrational excitation of N_2 molecules by low-energy electrons. This project has moved into an exciting new

phase: an international effort involving joint experimental and theoretical work conducted in "real time" through the magic of FAX and EMAIL. **Stephen Buckman** of Australian National University is currently conducting crossed-beam measurements of differential scattering cross sections. Results are exchanged and compared to theory, suggesting future experimental measurements, interpretations and calculations. This summer, OU will host a visit by **Steve** and **Paul Burrow** of the University of Nebraska for a mini-Nitrogen-fest, during which time they will write up current results and plan future calculations.

On another project, **Mike** and graduate student **Bill Isaacs** are completing thesis work on quantal calculations of the scattering of Rydberg, alkaline-earth atoms and rare-gas atoms. This is the first such research to consider aligned initial states, which opens new doors to exciting insights in collision physics, as illustrated in a colloquium given this semester by **Barbara Whitten** of Colorado College. They have received funding from NSF for a probable sabbatical visit by **Barbara** to OU next year. A parallel collaboration with **Eric Layton** of the Joint Institute for Laboratory Astrophysics has yielded results which were presented at the DAMOP meeting this April, where **Bill** also gave a talk about his work. **Eric** and **Mike** plan to write up

their findings this summer, when Mike will spend a month at JILA.

Mike also plans to work on the second volume of Understanding Quantum Physics this summer, with the hope of having a draft ready for use in Physics 4803 this fall. (Volume I is already being translated into Russian!) As if that's not enough, work will continue on a project involving scattering of low-energy electrons and sodium atoms. This multi-year, large scale project has involved the collaboration of many workers, including OU alumni **Wayne Trail** and **Terry Goforth** as well as Mike Morrison, Hsiao-Ling Zhou, Barbara Whitten, Klaus Bartschat, Keith MacAdam, and David Norcross. The first paper to emerge will be published in Physics Review A this May.

Maureen O'Halloran

UPDATE ON SOLID STATE

Eight people from our group attended the March meeting of the APS in Pittsburgh. **Jianhua Su**, **Yousong Zhang**, **Whitney Mason**, **Amy Liu**, **Guatum Dev**, **Mike Santos**, **Serguei Kravchenko**, and myself. It was a quite eventful meeting especially for me because of the ongoing solid state search. I was able to see most of our final (job) candidates give their talks, which were very well received;

I have been continually impressed with the quality of the people we have been able to attract as candidates this year. The work Sergi and I have been pursuing on ultra-high mobility Si Metal Oxide Field Effect Transistors (MOSFETs) was very well received and from our perspective seemed to be the most important development in 2D Physics presented at the meeting. We have just submitted two more papers on this subject; the references will be included in the newsletter when they are published.

The solid state search has proceeded very well. **Kieran Mullen**, who is currently a post-doc with Steve Girvin at the University of Indiana, and has also worked with Toney Legget at the University of Illinois, and got his PhD with Eshel Ben-Jacob at the University of Michigan, became our first choice after much deliberation. He has accepted the position and will be joining us in the Fall. The Experimental portion of the search is not yet completed. We have made an offer to an outstanding Surface Physics candidate who will compliment our molecular beam epitaxi (MBE) effort, but negotiations are still under way. Everyone was very impressed with the interviews of all six candidates and the colloquia were some of the most interesting and well presented we have had here in the last few years. We will be very happy with our new colleagues.

All of us in the Solid State area feel that we have made a significant step forward with this search which will continue to pay off for many years to come.

John Furneaux

THE PAPER CHASE: RECENT PUBLICATIONS

"Continued Fraction as a Discrete Nonlinear Transform," **K. Milton**, **C. M. Bender** *J. Math. Phys.* 35, 364 (1994).

"A Hubble Space Telescope Ultraviolet Spectrum of Supernova 1993J", **D. Jeffery**, **D. Branch**, et al. 1994, *Astrophysical Journal*, 421, L27.

"The Distance to the Type Ia Supernova 1972E and Its Parent Galaxy NGC 5253: A Prediction", **D. Branch**, **A. Fisher**, **T.J. Herczeg**, **D.L. Miller**, and **P. Nugent** 1994, *Astrophysical Journal*, 421, L87.

COLLOQUIA, PRESENTATIONS, INVITED TALKS

"2D Electron Systems in Semiconductors", **Ryan Doezema**, March 31, OU Department of Chemistry and Biochemistry Colloquium.

"The Physics of SN 1993J: One Year Later", **Ed Baron**, April, at the Physics of Supernovae

conference at the Franklin Institute, Philadelphia.

"The Form of Abundance Gradients in Spiral Disks", **Dick Henry**, March, LLNL.

"Chemical Evolution of Cluster Spirals", **Dick Henry**, March, LLNL.

"The Casimir Effect from Quarks to the Cosmos", **Kim Milton**, March, at Harmonic Oscillator II conference in Cocoyoc, Mexico.

"Type Ia Supernovae as Distance Indicators", **David Branch**, April, at the Physics of Supernovae conference at the Franklin Institute, Philadelphia.

"Hubble Hubble Toil and Trouble", **David Branch**, February, at the reunion of the 1993 Arts and Sciences Summer Scholars (high school students).

RESEARCH TRAVEL MEETINGS ATTENDED

Kim Milton, collaboration with Carl Bender at Washington University, St. Louis, Feb. 28-March 5.

Bill Isaacs and **Weiguo Sun** participated in the annual meeting of the Division of Atomic, Molecular, and Optical Physics, which was held last week in Washington DC.

A group of eight from Solid State, APS meeting, March,

Pittsburgh (see Furneaux' article above).

Dick Henry participated in the workshop on Galactic Chemical Dynamics, March 17-19, LLNL.

Ed Baron participated in the Physics of Supernovae conference at the Franklin Institute, Philadelphia, April.

David Branch participated in the Physics of Supernovae conference at the Franklin Institute, Philadelphia, April.

GRANTS. AWARDS

Kim Milton, DOE Theory Grant, renewed for \$111K.

John Cowan, NSF, \$94,525.

John Cowan, NASA (HST), \$53,931.

David Branch, NASA (HST), \$26,000.

DEPARTMENTAL VISITORS

Peter Hauschildt (ASU) visited **Ed Baron**, Apr 18-22.

Friedel Thielemann (Harvard) and Jim Truran (U. Chicago) visited **John Cowan** for four days in March.

Chris Hill from Fermilab visited **Kim Milton** on April 14.

Tina Bird and Keith Ashman, both from the University of Kansas, visited **Dick Henry** in April.

DEPARTMENT AWARDS PRESENTED TO STUDENTS

The Department held its annual awards ceremony on Thursday, April 28. **John Cowan**, chairman of the Undergraduate Studies Committee presented awards to the undergraduate winners in Physics and Astronomy. the Karcher Award for outstanding scholarship in Physics and Astronomy went to **Kazunori Ishibashi**, while the award for Outstanding Junior went to **Marc Welliver**.

John Furneaux, co-chair of the OU Engineering Physics Program, presented awards in this subdivision. **Michael Fast** received the award for Outstanding Scholarship in Engineering Physics, while the award for Outstanding Junior went to **Daniel Sinars**. **Preston Larson** was recognized as the Outstanding Sophomore.

Department Chair **Ryan Doezema** presented the Fowler Prize for the outstanding senior and the Nielsen Award to an outstanding thesis by a recent PhD graduate. The Fowler Prize went to **Nicole Belcher**, who is part of the Engineering Physics program. **Mark Lambrecht** was presented with the Nielsen Award.