

"All the v's
That's fit to Print"

ΦYAST ΦLYER

The Department of Physics & Astronomy
The University of Oklahoma
Volume 4, Number 3 Spring 1996
Dick Henry, Editor
Danette Miller, Production

Undergraduates Flock to OU for Summer Research

This summer will see plenty of activity as undergraduates from around the country come to the Physics and Astronomy Department to participate in an NSF sponsored REU (Research Experiences for Undergraduates) site. This is the first year of a three year REU site grant obtained by Maureen O'Halloran, Bob Petry (Co-PIs), Kieran Mullen and Sheena Murphy. We are one of 51 Physics REU sites and 15 Astronomy REU sites which are sponsored nationwide by the National Science Foundation. This site grant and matching funding provided by OU will give undergraduates a chance to participate in a ten week program of research and colloquia. The NSF program is aimed particularly at students from universities and colleges where opportunities to participate in externally funded research projects are limited.

The Physics and Astronomy REU site at OU will involve nine external students funded by NSF, three local students funded by OU and five or more local students funded by various individual grants. The plans are for students to work directly with individual faculty on a project related to that faculty members own research. In addition, the students will participate in twice weekly lunchtime seminars to learn about different areas of research and how to present their own research. To make sure the summer is not all work and no play, we will be arranging a number of social activities as well!

The REU students who will participate in the program are Rollin Thomas (Purdue U., IN) and Dean Richardson (OU) who will be working in Astrophysics; Billy Gaston (Langston University, OK) and Janet Martinez (OU) working in experimental Atomic, Molecular and Chemical Physics; Jennifer Frese (Bowdoin College, ME), Preston Larson (OU), and Alexander Ogston (Kenyon College, OH) working in experimental Condensed Matter; Jim Hicks (Oklahoma City U.) working in experimental Particle Physics; Kristen Luken (Rockhurst College, MO) and Sharon Kennedy (U. of Central Oklahoma), working in theoretical Condensed Matter; and Kirk Van Opdorp (Augustana College, IL) and Kyrill Shokirov (U. Of Arizona) working in theoretical Atomic, Molecular and Chemical Physics. Additional local students involved in summer research include Derrick Kiker (experimental Condensed Matter), Jennifer Jeffries and Emily Gresham (experimental AMC), Tina Patrick (exp. HEP and AMC) and Darrin Casebeer (Astrophysics) .

The program will run from June 3 through August 9. With so many students it is easy to see that our Department will be a lively and interesting place this summer! Assuming we survive the experience, the program will be repeated next summer. Details will be available on our Web site at

<http://www.nhn.ou.edu/reuhome/>

Maureen O'Halloran

Research Updates:

Experimental Atomic, Molecular, and Chemical Physics.

FIRST SIGNALS! It looks like a duck, it walks like a duck, it quacks like a duck, it must be HF!

Monday, April 29 was an exciting day for the Keil group. After one year of developing their atomic fluorine source (with Tommy Ericson and Joel Young), and another year and a half improving their crossed-beam scattering apparatus, the group (Gamini Dharmasena, Rosemary Lasell and Kyle Copeland) finally saw their first scattering signals for the elementary chemical reaction $F+H_2 \rightarrow HF+H$. This reaction has been studied at the molecular level for over 25 years, but the Keil group's novel detection technique using an HF chemical laser and a cryogenic bolometer provides for the first time simultaneous resolution of both orbital and rotational angular momenta. Recent improvements to the experimental apparatus were expected to provide as much as a factor of thirty improvement in signal to noise, and the hopes of the Keil group were more than born out. About a half-dozen independent tests were conducted to confirm that the unexpectedly strong signals originate from HF reaction products born immediately after the chemical reaction, with no complicating secondary collisions. All of these tests were positive, leaving a remarkably "clean" experiment! The group is now taking scattering data which will be supplemented with state-of-the-art theoretical results from the Parker group. Later in the summer, more ambitious experiments in state-to-state reaction dynamics will be undertaken with isotopic substitution and improved quantum state specificity.

If one laser is good, two must be better!

Unable to wait until his own lab is ready, new faculty member Neil Shafer-Ray has temporarily set up a second Nd:YAG pump laser in Maureen O'Halloran's lab. Together with grad student Kushlani Dharmasena and undergrads Emily Greshem and Janet Martinez they have successfully generated 190 nm Vacuum Ultraviolet light by first doubling a dye laser and then mixing the UV doubled light with the infrared 1064 nm Nd:YAG laser. The plan is to use this VUV light to excite absorption bands in molecular oxygen and then to use a second, visible, dye wavelength to excite predissociated Rydberg states of O_2 . Theory predicts that exciting these Rydberg states at low energy will produce primarily two ground state $O(^3P)$ atoms, while higher energy excitation will produce one electronically excited $O(^1D)$ fragment. Not only is the physics of the predissociation process itself interesting, but a new means of selectively producing oxygen atoms in different electronic states will lead to a variety of new experiments probing important atmospheric reactions.

Maureen O'Halloran

PAISOT Off to a Good Start!

The Physics and Astronomy Informal Seminar on Teaching (PAISOT) got off to a good start this semester with three monthly meetings. The

seminar was the initiative of the Committee on Teaching Effectiveness (Mike Morrison (chair), Dick Henry, Sheena Murphy and Kieran Mullen), in order to disseminate information about various issues connected with teaching, and to encourage discussion among the faculty about issues, problems, methods, and anything else related to teaching physics. Each meeting consisted of some sort of short, informal presentation followed by an open forum for discussion. The meetings this semester will focus on those topics of greatest interest to the largest number of faculty, based on the responses to an earlier survey.

Our three seminars to date have been:

*Computers and Physics Teaching at OU: Courseware, Packages, and Programming (Michael Morrison, Bruce Mason and Kieran Mullen)

*Feedback and the Learning Cycle: Finding What Works in the Classroom (Guest Speaker David Hestenes)

*Team Learning Techniques (Dick Henry, Michael Morrison)

The seminars have been very well attended, with more than half of the faculty present, and have been characterized by informal, animated discussion. The first meeting showcased some success stories of integrating computers into classes. Our second meeting featured David Hestenes, a visiting expert on Physics education. Hestenes gave the departmental colloquium, the informal seminar, and met individually with many members of the department. Rarely has a speaker sparked so many lively conversations. The third seminar was on cooperative or team learning techniques, and featured the innovative approaches Dick Henry and Michael Morrison use in their undergraduate classes.

We plan to continue the series in the Fall. Other topics of interest include: lecture demonstrations, strategies for teaching large classes, and strategies for teaching non-scientists. The level of participation in these seminars indicates that not only does OU do great research, but there is strong interest in great teaching, too!

Kieran Mullen

LIBRARY NEWS

Physics/Astronomy Library now has access to the Institute of Physics Journals Online. To access these from your on campus PC you need to get a password from the library. They are available on world wide web from the PC in the library also. There should be several other online journals available soon. There are also many online databases that can be accessed from the library. If you are having any difficulty finding research materials be sure to ask at the library desk. We have more and more ways to help you every day. Many of the online products are limited to campus internet protocol addresses however. If you see notices in journals about online access ask us about it and we will explain how to access them or begin work on getting access.

For those of you who have not been in for a while we have a beautiful Gateway PC connected to the Internet thanks to the Physics Honors Committee and thanks especially to Kieran Mullen and Phil Gutierrez. And it works very nicely thanks also to the help and advice of Bruce Mason, Andy Feldt and Maureen O'Halloran. We also must thank Maureen O'Halloran for her kind donation of a printer, ribbons, paper and the loan of a

cable so that we can print off the PC.

We have also shipped out journals older than 1978 to Bizzell Library's 4th floor this year and weeded the Dewey Decimal Collection books to make room for our crowded monograph collection. Things keep changing and getting better. Please feel free to make suggestions for improving service at anytime to any of the library staff or to: zsampson@nhn.ou.edu.

AWARDS AND HONORS

Carmen Pantoja won the Nielsen Prize with her thesis on "Lifting the Veil of the Anticenter Zone of Avoidance." Carmen will return at some future time to present a colloquium on her work. Currently, she is a postdoc at the Center For Astrophysics in Cambridge, MA.

Dick Henry received a Presidential Professorship and the General Education Award.

Junior Faculty Summer Fellowships were presented to Matt Johnson, Sheena Murphy, Neil Shafer-Ray, and Mike Strauss. This represents roughly one-fifth of these awards given across campus and suggests that we have a power-house of young new physicists coming up.

THE PAPER CHASE:

Recent Publications

K. A. Milton and R. Das, "Finite-Element Lattice Hamiltonian Matrix Elements: Anharmonic Oscillators" *Lett. Math. Phys.* 36, 177 (1996). (Note that R. Das was an OSSM student at the time this paper was written. He went on to win the gold at the Physics Olympiad, and is now a physics student at Harvard, taking courses from Shelly Glashow, Sidney Coleman, et al.)

S. V. Kravchenko, Whitney E. Mason, G. E. Bowker, J.E. Furneaux, V. M. Pudalov, and M. D'Iorio, "Scaling of an Anomalous Metal/Insulator Transition in a 2D system in Silicon at $B=0$ ", *Phys. Rev. B*, 51, 7038 (1995).

P. J. McCann, L. Li, and J. E. Furneaux, "FTIR Characterization of IV-VI Semiconductors Grown by LPE on (100) Ba F₂", *Proceedings of the 7th International Conference on Narrow Gap Semiconductors*, Santa Fe, NM, 1995, ed. by J. Reno, (Institute of Physics Conference Series 144, 1995), p. 150.

Y. Zhang, and J. E. Furneaux, "Infrared Photodetectors Using Capacitance Variation in InAs_{1-x}Sb_x MIS Devices", *Proceedings of the 7th International Conference on Narrow Gap Semiconductors*, Santa Fe, NM, 1995, ed. by J. Reno, (Institute of Physics Conference Series 144, 1995), p. 321.

Y. Zhang, J. Su, J. Winesett, J. E. Furneaux, W. K. Liu, M. B. Santos, and R. E. Doezema, "Cyclotron Resonance and Hall Effect Studies of Ultra-High Mobility InSb Films", *Proceedings of the 7th International Conference on Narrow Gap Semiconductors*, Santa Fe, NM, 1995, ed. by J. Reno, (Institute of Physics Conference Series 144, 1995), p. 374.

- J. E. Furneaux, S. V. Kravchenko, Whitney E. Mason, G. E. Bowker and, V. M. Pudalov, "Destruction of the Quantum Hall Effect with Increasing Disorder", Phys. Rev. B, 51, 17227 (1995).
- M.B. Santos, and W.K. Liu 1995, "RHEED Studies of the Surface Reconstructions of InSb(001) During Molecular Beam Epitaxy", in Narrow Gap Semiconductors (IOP Publ.) p199.
- S. V. Kravchenko, Whitney E. Mason, J. E., Furneaux and, V. M. Pudalov, "Global Phase Diagram for the Quantum Hall Effect: An Experimental Picture", Phys. Rev. Lett., 75, 910 (1995).
- Whitney E. Mason, S. V. Kravchenko, G. E. Bowker, J. E. Furneaux and, V. M. Pudalov, "Experimental Evidence for the Coulomb Gap in Two Dimensions", Phys. Rev. B, 52, 7857 (1995).
- A. A. Shashkin, G. V. Kravchenko, V. T. Dolgoplov, S. V. Kravchenko and, J. E. Furneaux, "Comment on 'Fate of the Delocalized States in a Vanishing Magnetic Field'", Phys. Rev. Lett, 75, 2248 (1995).
- E. Baron, P. H. Hauschildt, and A. Mezzacappa "Radiative Transfer in the Co-Moving Frame," MNRAS, (1996), 278, 763--772.
- E. Baron, P. H. Hauschildt, D. Branch, R. P. Kirshner, and A. V. Filippenko, "Preliminary Spectral Analysis of SN 1994I" MNRAS, (1996), 279, 779--803.
- P. H. Hauschildt, E. Baron, S. Starrfield, and F. Allard, "The Effects of Fe II NLTE in Nova Atmospheres and Spectra", Ap. J., (1996), 462, 386-403.
- Liu W.K., Yuen W.T. and Stradling R.A. "Preparation of InSb Substrates for Molecular Beam Epitaxy", J. Vac. Sci. Technol. B 13(4) 1539 (1995)
- Liu, W.K., and Santos, M.B. 1996, "Characterization of Oxide Desorption from InSb(001) Substrates", J. Vac. Sci. Technol., B14(2), 647.
- W.K. Liu, and M.B. Santos 1995, "RHEED and XPS Study of Oxide Desorption from InSb(100) Substrates", Narrow Gap Semiconductors (IOP Publishing), p.194.
- Liu W.K., Fang X.M. and McCann P.J. "A Reflection High-Energy Electron Diffraction Study of the Molecular Beam Epitaxial Growth of CaF₂ on Si(110)", Appl. Phys. Letts., 67(12), 1695 (1995)
- Fang X.M., Chatterjee T., McCann P.J., Liu W.K., Santos M.B., Shan W. and Song J.J. "Molecular Beam Epitaxy of Eu-doped CaF₂ on Si(100) Substrates", Appl. Phys. Letts., 67(13), 1891 (1995)
- "The First Detection of Platinum, Osmium and Lead in a Metal-Poor Halo Star: HD 126238," J.J. Cowan, C. Sneden, J. W. Truran and D. L.

Burris, ApJ Letters 460, L115 (1996).

J.J. Cowan, C. Sneden, J. W. Truran and D. L. Burris, "The First Detection of Platinum, Osmium and Lead in a Metal-Poor Halo Star: HD 126238," ApJ Letters 460, L115 (1996).

R.B.C. Henry, K.B. Kwitter, & J.W. Howard, "A New Look At Carbon Abundances In Planetary Nebulae. I.", 1996, ApJ, 458, 215.

CASH FLOW:

New Grants

DOE, Milton, "Nonperturbative Quantum Field Theory"--Theory Task, \$90,000.

National Science Foundation, Research Experiences for Undergraduates, 1996-1999, \$156,000. Co-PI Maureen O'Halloran and Bob Petry "Undergraduate Summer Research in Physics and Astronomy: An REU Site at the University of Oklahoma". (See above article by MAOH regarding this program.)

NASA Long Term Space Astrophysics July, 1996 -- May, 2001 "Quantitative Analysis of Supernova Ultraviolet Spectra" E. Baron, D. Branch and P. Hauschildt (ASU) \$250,000.

Our proposal to Fermilab to search for monopoles in beam pipes and structures discarded from CDF and D0 has been essentially approved subject to execution of a mutually satisfactory memorandum of understanding. We are moving the detector from Michigan now, and it now appears we should be receiving samples from Fermilab by the end of the year. My new postdoc, Leonard Gamberg from Tubingen University (Ph.D. Tufts), will be working with me on the theory of monopole production and binding to matter.

MEETINGS ATTENDED:

Contributed Papers

Scott McCartney, Mid-America Regional Astrophysics Conference, April 12/13, Kansas City. "An Analysis of the O'Connell Effect in W UMa Stars".

Chris Stockdale, Mid-America Regional Astrophysics Conference, "Searching for a Massive Black Hole in the Center of NGC 7331" April 12-13.

Kazuhiro Hatano has attended two meetings lately: 187th AAS meeting, January 1996, in San Antonio, TX; and 26th MARAC meeting, April 1996, in Kansas city, MO.

Several members of the Solid State Group attended the APS March Meeting in St. Louis, 18-22 March, and presented the following papers:

"Experimental Evidence of the Coulomb Gap with an Electric Field", Whitney E. Mason, S. V. Kravchenko, and J. E. Furneaux, Bull. Am. Phys. Soc., 41, 648 (1996).

"Experimental Observation of a Metal-Insulator Transition in 2D at Zero Magnetic Field", V. Kravchenko, Bull. Am. Phys. Soc. : Invited Talk, 41, 731 (1996).

Fang X.M., Liu W.K., Chatterjee T., McCann P.J., Santos M.B., Shan W. and Song J.J. "Molecular Beam Epitaxy of Eu-doped CaF₂ and BaF₂ on Si"

Zhang Xuemei, Ma W.L., Goldammer K.J., Liu W.K., Zhang Y., Santos M.B. and Doezema R.E. "Fabrication and Characterization of InSb Quantum Wells with Al_xIn_{1-x}Sb Barriers"

Liu W.K., Fang X.M., Winesett J., Ma W.L., Zhang Xuemei, Santos M.B., McCann P.J. "Molecular Beam Epitaxy of InSb on Si Substrates Using Fluoride Buffer Layers"

AAS Meeting in San Antonio in Jan., "Evidence for a Spectroscopic Sequence Among SNe Ia", Peter Nugent

SEMINARS AND INVITED TALKS

Kim Milton, OU seminar, "Sonoluminescence and the Casimir Effect," 2/15/96.

John Furneaux, Colloquium at University of Iowa "2D Or Not 2D That Is The Question", Apr 15, 1996

John Cowan, "Stellar Heavy Element Abundances and the Age of the Galaxy", Michigan State University.

RESEARCH TRAVEL

Ed Baron went to ASU to visit Peter Hauschildt where they made major progress parallelizing their synthetic spectra code. It now runs faster on our 8 proc SP2 than on a \$40M Cray C90. Considering it costs about \$4M/year to run a C90 and our SP2 cost 800K that is pretty good price/performance. Since Peter has accepted a tenure track job at the Univ. of Georgia, this will be Eddie's last visit to ASU in the foreseeable future and future trips to work with Peter will be to Athens, GA.

Pete Nugent visited LBL, Berkeley CA., week of April 15, to assist the Cosmology group directed by Saul Perlmutter in the examination of the high z , SNe spectra that they have obtained recently.

Pete Nugent also took a trip to the 4m telescope in Chile (CTIO) in March to obtain photometric data for approx. 9 SNe from $0.4 < z < 0.8$ with the LBL group. "They're trying to make an observer out of me", Pete laments. "The first night was awesome. Seeing was 0.7 arcsec. The second night was hell. We had trouble even trying to find an 8th mag star to guide on. Cloud-city. Oh well, what we got the first night was worth the trip."

Kinda gives you an appreciation for experimental/observational data, huh Pete. And you thought it was tough being a theorist!

DEPARTMENT VISITORS

Visiting Kim Milton were: Tonnis ter Veldhuis, Vanderbilt, 3/20-22, postdoc candidate, and Leonard Gamberg, Tubingen, 4/4-8, postdoc candidate, accepted, coming in September.

Ed Aifer, a graduate Student from Bennett Goldberg's group at Boston University, and who is collaborating on Infrared spectroscopy, visited John Furneaux.

GRAD STUDENTS TO READ MILTON

Kim Milton has completed teaching the second semester of graduate electrodynamics, and with it, nearly finished version 2.0 of the manuscript of his book. "Addison-Wesley is, I'm told, going to send me a contract for publication [very soon]! The final version will be completed next year, as I teach the course again. The resulting book will be both better and cheaper than Jackson!," says Kim.

TEACHING NEWS

Kim Milton gave a talk to honors students at Northeast High School in OKC on "Big Science vs. Small Science".

FALL OPENHOUSES SCHEDULED

Three public lectures, each followed by a trip to the OU Observatory, are scheduled this fall for the fourth annual fall astronomy public lecture series "Friday Night At The Observatory". Lectures will take place on September 20, October 18, and November 15. Mike Zeilik from the Department of Astronomy at the University of New Mexico will speak on a topic related to archeoastronomy on 9/20, and Debra Burris, a graduate student in our Department, will speak on 11/15. The 10/18 speaker is to be announced at a later date. Each lecture begins at 7:30pm in 128 Dale Hall and is followed by an openhouse at the OU Observatory, beginning about 8:45, weather permitting. All events are free and open to the public.

ALUMNI NEWS

There is none. At least no one has sent any. Let's hear from you. Even if you've written before, write again. You must be doing something!

SCRATCHPAD

According to a large number of Harvard undergrads surveyed in their caps and gowns on Commencement Day a few years ago, seasons occur because the earth's distance from the sun varies over a year, i.e. in summer we are closer to the sun than in winter. Evidently, they forgot to discuss their theory with their friends from Down Under. Go get um, National Merit Scholars!

Babies.

Babies.

Babies!

It's been a Physics & Astronomy Baby Boom!!

Recent Births

*Chris & Michelle Eck

Marie Elizabeth 10/28/95

*Neil & Kerry Shafer-Ray

Reed Thomas 11/30/95

*Chris & Tina Hladik

Ashton Stephen 2/21/96

*Bijan & Beth Nemati

Michael George 3/3/96

*Tad & Karen Thurston

Gehrig Elliott 3/8/96

Expectant Parents

*Peter & Deepa Nugent

Due July 15, 1996

*Georg & Trish Steinbrueck

Due August 23, 1996

*Wayne Trail & Terry Goforth

Due October 29, 1996

*Bruce & Debbie Mason

Due November 25, 1996

Congratulations to everyone!!

(Just what is in the water in Nielsen Hall anyway?)

Danette Miller

Have a wonderful summer!!