

"All the v's

That's fit to Print"

ΦYAST ΦLYER

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SUMMER 1997 REU PROGRAM

For the second summer, undergraduates from across the country will participate in an NSF-sponsored Research Experiences for Undergraduates program. Students will work individually with various faculty in our department and also participate in seminars and social activities. Over 180 students applied and we selected ten external students and four OU students. Five additional OU students are receiving support from individual research grants, bringing the total number of student participants to nineteen. Students will begin arriving at OU the weekend of June 1 and stay for ten weeks to sample the delights of research in Physics and Astronomy and the local color and recreational activities. Judging by last year's experience they should have a busy and productive (as well as colorful) time. Students recruited from outside the university and their research mentors include Cristina Ancheta from San Diego State, CA, Kristopher Gutierrez from Texas Tech, and Tamara Rogers from the University of Arizona (Baron and Branch, Astrophysics), Soren Flexner from the University of Washington (Johnson, Condensed Matter Physics), Michael Kordosky from St. John's University, MN and Andy Warren from the University of Illinois (Skubic, Particle Physics), Kyle Peterson from North Park College, IL (Keil, Atomic, Molecular and Chemical Physics), Keith Slinker from Southern Nazarene University, OK (Parker, AMC Physics), Brian Tiburzi from Amherst, MA (Morrison, AMC Physics), and Ted Watters from Bridgewater State College, MA (Furneaux, Condensed Matter Physics). The four OU students competitively selected to participate in the REU program are Jennifer Jeffries, Max Knowlton, Tina Patrick, and Ian Spielman. Local students participating in the program are Myra Blaylock, Darrin Casebeer, and Jennifer Deaton (Baron and Branch, Astrophysics), Jennifer Jeffries (Shafer-Ray, AMC Physics), Max Knowlton and Dan Petersen (Johnson, Condensed Matter Physics) Tina Patrick (Gutierrez, Particle Physics), and Ian Spielman (Murphy, Condensed Matter Physics).

Maureen O'Halloran

WARD PAXTON VISIT

G. Ward Paxton, who received B.S., M.S., and Ph.D. degrees from our Department, was presented with the College of Arts and Sciences

"Distinguished Alumni Award" on April 11, 1997. Ward's thesis advisor was Dick Fowler. His positions in the electronics industry include Department Manager at TI (1959-1969), Chairman, President, and CEO of Spectronics Inc. (1969-1978), and Vice President of Honeywell Optoelectronics (1978-1983). Since co-founding Optical Data Systems in 1983, Ward has served as Chairman of the Board, President, and CEO. The activities on April 11 included a tour of Nielsen Hall and its facilities, lunch hosted by the College, a symposium talk by Ward Paxton entitled, "Entrepreneurism and High Technology in the 21st Century," and an evening banquet.

Ryan Doezema

NIELSEN AWARD

The Nielsen Award is presented annually to persons who have written theses of the highest quality. This year the Award was given to two of our recent PhD graduates, Whitney Mason (Solid State) and Pete Nugent (Astrophysics).

Whitney's thesis is entitled "Experimental Evidence of a Metal/Insulator Transition in Two-Dimensions in Zero Magnetic Field". Her thesis advisor was John Furneaux. During her graduate years, Whitney was author or co-author on 10 refereed publications and made presentations at eight high-level conferences. Her thesis work also earned her the university-wide Dissertation Prize for Physical Science and Engineering. Currently, she holds an ASEE Post-Doctoral Fellowship at the Naval Research Laboratory in Washington, DC.

Pete's thesis title is "Non-Local Thermodynamic Equilibrium Spectrum Synthesis of Type Ia Supernovae". His advisor was Ed Baron. During his stay at OU Pete coauthored roughly nine papers in refereed journals, made three presentations at conferences, and gave at least four posters at American Astronomical Society meetings. Pete currently holds an NERSC(National Energy Research Supercomputer Center) postdoc at Lawrence Berkeley National Lab.

Both Whitney and Pete will be invited back to give Department colloquia in the near future. Congratulations to both of them!

WORDS FROM ALUMS

Eric Butcher (BS EPHYS, 1993) stopped by the Department in May and let us know that he will soon be defending his PhD in Mechanical Engineering at Auburn University. He's hoping to take on a postdoctoral position soon.

Eldon Ferguson (PhD PHYS, 1953), a student of J.R. Nielsen, retired in 1995 from his position of Lab Director for NOAA, Commerce Department. He keeps up with research through former students and post-docs, and by periodically serving as Guest Professor in Innsbruck, Austria and Rennes, France. His honors include Guggenheim, Humboldt, and Erskine Fellowships, in addition to the 1994 Will Allis Prize. (Eldon notes, by the way, that Chun Lin received the 1996 Prize, giving OU a strong representation among the winners of that award!) His time is now divided between Boulder, CO, and France. He can be reached at 3715 Birchwood Dr., Apt. 15, Boulder, CO, 80304.

Edward Smith-Rowland (BS EP 1986) writes, "I recently completed my PhD in theoretical nuclear physics at the University of Maryland. My topic was Photoproduction of the Neutral Pion - Probing Finite-Density Effects in the Vector Meson Propagator. I am currently employed at IIT

Research Institute working on propagation of electromagnetic waves over complex surfaces."

Terry Stevenson now resides in Aurora, CO, and can be reached at spsxs19@idt.net. Also, check out his information on the alumni page of our web site.

Dan Sinars (BS PHYS, 1996) has been awarded both an NSF and an NDSE Fellowship and has the tough job of choosing between the two. Dan is currently working on his PhD at Cornell. You can congratulate him at ds67@cornell.edu.

Robert Coffie (BS, EP 1997) has also been awarded an NSF Fellowship. He plans on deferring it for a year while he works at Texas Instruments. After that, he will probably take up graduate studies in EE or Physics.

And Bill Dostalík (BS, EP 1988) writes, "Feeling prideful, I thought I'd contribute to your newsletter. I just finished my Ph.D. at the Univ. of Texas at Dallas and am working at TI's SC R&D lab known as SPDC (sc process and device center) doing plasma and etch modeling. I've been at TI since I left OU, but took a couple of years leave of absence to go to grad school. I live in Plano with my wife and daughter with another girl due in September. See you at Owen Field, I've got season tickets again."

TEACHING NEWS

Bill Romanishin and OU undergraduates Jennifer Deaton, Dean Richardson, Tina Patrick, Jason King, and Myra Blaylock spent five days of spring break observing (or rather, trying to observe) at the National Undergraduate Research Observatory near Flagstaff, Arizona. The March Arizona weather continued its pattern of the past few years, with only one clear night out of the five scheduled. The students spent the cloudy time exploring northern Arizona and even doing their physics assignments. Romanishin spent the cloudy days and nights collaborating with Steve Tegler, of Northern Arizona University on writing up results of their TNO (Trans-Neptunian Objects) research.

Kim Milton is nearly finished with his Electrodynamics book--on track for submission to the publisher in fall.

This past spring Dick Henry and Doug Elmore (Geophysics) taught their "Deep Time, Deep Space" Honors Colloquium to a group of 24 Honors students which included Departmental majors Derrick Kiker and Tina Patrick. The class explored geological and astrophysical topics both from the scientific and social impact points of view. The final class was marked by a rather emotional debate about scientific versus religious explanations for natural phenomena. A moderate amount of blood was spilled when the group defending science labelled religious explanations for things like cosmology as "stupid". The audience, which was basically a bunch of science-sympathizers, really went after the pro-science debaters for being narrow-minded.

GRANTS

Kim Milton, DOE High-Energy grant renewed. P.I. on Theory Task B, "Nonperturbative Quantum Field Theory" \$88,000.

W. Romanishin, NASA/ Hubble Space Telescope, "A New Technique for Photometry of Low Luminosity AGNs Using HST Reference Images"

\$17,751.

David Branch, Supernova Studies, \$50,000, NSF.

George Kalbfleisch, Monopole work, \$496,000, DOE.

David Branch, SINS: Supernova INTensive Study, \$7500, NASA.

M.B. Johnson (PI), M.B. Santos (Co-PI), P.J. McCann (Co-PI), "Acquisition of a Variable-Temperature Scanning Probe Microscope for a Multi-Chamber Molecular Beam Epitaxy System," \$123,650, NSF.

Mike Morrison, "Scattering Processes Involving Low-Energy Electrons," August 1997---July 2000, NSF.

MEETINGS ATTENDED

Bill Romanishin and Chris Stockdale attended the January meeting of the American Astronomical Society in Toronto. They presented a poster: "A Comparison of X-ray and Radio Observations of NGC 7331", C. Stockdale, W. Romanishin, J.J. Cowan

John Cowan attended the meeting on "Observational Tests of Cosmology", Aspen Winter Meeting, Aspen, CO (January 1997)

John Walkup and Martin Dunn presented a poster each at the Spring APS Meeting in Washington, D.C. Martin's poster was titled "On the Origin of the Exact Interdimensional Degeneracies." John's was "Diamagnetic Hydrogen Energy Level Reordering as a Function of Angular Momentum." Deborah Watson co-authored both posters, and Martin co-authored John's as well.

Gamini Dharmasena presented a poster entitled "Angular Dependence for v_j -Resolved States in $F+H_2 \rightarrow HF+H$ Reactive Scattering" at the Modern Trends in Chemical Dynamics conference at Ventura, California in January, 1997. His poster was recognized by the conference organizers as one of those presenting the most important new results.

Kory Goldammer gave a talk entitled "Effect of substrate temperature on Si autocompensation in delta-doped InSb" at the APS March Meeting in Kansas City.

Xiao-Ming Fang presented several papers at the 8th International Conference on Narrow Gap Semiconductors in Shanghai, April 21-25.

VISITORS

Bob Nesbet (IBM Almaden) visited OU in late December 1996 to collaborate with Mike Morrison and Stephane Mazevet. This is the first in a series of visits focusing on several projects on which these individuals are collaborating, including new theoretical techniques for studying dissociative attachment in electron-molecule collisions, adaptation of density functional theory to bound-free correlation in continuum states, and the quantum

Boltzmann equation.

Francesca Boffi (MS degree, 1995, currently at Space Telescope Science Institute, Baltimore) visited David Branch for a week for collaborative work and to present an astrophysics seminar on "The Search for Light Echoes from Supernovae."

Chris Sneden from UT at Austin spent a week with John Cowan working on reducing and analyzing recent Hubble Space Telescope (HST) observations. Chris was one of the first Big XII Faculty Fellows and as part of his visit also gave the last colloquium of the semester.

Carl Bender visited Kim Milton 1/27-31/97, when they worked on supersymmetry and parity breaking.

Eric Smith returned from Fermi Lab in March and April to work on the monopole experiment headed up by George Kalbfleisch (see Hot Flashes below).

RESEARCH TRAVEL

Kim Milton, 1/10-12/97, to Houston to initiate collaboration with Jagdish Mehra on biography of Julian Schwinger, and 4/14-18/97 to St. Louis (Washington University) to collaborate with Carl Bender on the new delta expansion applied to a supersymmetric quantum field theory.

Bill Romanishin comments, "I have been spending too much time on Southwest Airlines, going back and forth to Arizona- 6 trips in the last year to observe with Steward Observatory's 2.3 and 1.6 meter telescopes, in collaboration with Steve Tegler, of Northern Arizona University. We have been observing TNOs (Trans- Neptunian Objects)."

Jackie Milingo and Dick Henry sampled southern skies and Chilean cuisine during six perfectly clear nights at Cerro Tololo Interamerican Observatory during March/April. Jackie obtained spectra of a large sample of planetary nebulae in hopes of establishing reliable sulfur and argon abundances for these objects as she attempts to map the distributions of these elements in the disk of the Milky Way. Ask Jackie to make you a Pisco Sour.

HOT FLASHES:

Recent Advances

From Kim Milton: Non-Hermitian Hamiltonians can have positive spectra! We are using a complex Lagrangian to provide models with symmetry breaking, which we explore by using a nonperturbative expansion parameter, the so-called delta expansion.

Analysis of our state-resolved $F+H_2 \rightarrow HF+H$ reactive scattering data suggests quantum effects never before seen in chemical reaction dynamics. It appears that both our experimental results and earlier quantum calculations show strong "forward" (i.e., very small angular deflection) scattering into the first vibrational state of the product HF molecule, an effect not predicted by previous quasi-classical calculations. We are currently setting up experiments to explore the dynamics of these results further.

From HEP: If you stroll through the basement these days you might be lucky enough to have George Kalbfleisch grab you and show you the exciting project he and his collaborators are working on. Located somewhere within the deep Van de Graaff cave is a new apparatus for studying magnetic monopoles. The instrument is nearing completion and should be ready this summer.

SUMMER PLANS

Kim Milton will be traveling to Dubna, Russia, in June to continue his collaboration with Igor Solovtsov on "analytic" and "variational" perturbation theory. Last fall they showed that the requirements of analyticity necessitate significant and observable changes in the running coupling in QCD. Now they are applying this idea to tau lepton decays, where it seems there will be significant phenomenological impact.

This summer John Walkup will be working with Kieran Mullen on Landau-Zener Tunneling, which may result in a collaboration between Kieran's group and Deborah Watson's, of which John is a member.

VIEWPOINT

Last spring I took a graduate course in education and received an A. (Aww shucks, hold the applause. It was nothing, really.) Now it would be easy to write this occurrence off by noting my extreme mental capacity, but there are two other explanations: (1) many other disciplines grade far easier than physics, and (2) no prior knowledge of the field is required to do well in these courses. The first is easily shown by examining the average grades given out in different disciplines. (Physics grades do not rank high, if you get my drift.) We also know that many of these disciplines teach upper-level courses that require little previous knowledge. However, the fact that many of these same disciplines have busied themselves examining the problems in physics education is crucial to understanding why physics instruction has been given such a bad reputation.

If there is one common aspect that dominates most critiques of physics education arising from other fields it is that only introductory courses are examined. These researchers don't have any qualms about having their students enroll in upper division English courses, but advanced courses in physics are avoided. This isn't hard to explain; those students without the proper prerequisites may have little idea what kind of abilities a typical graduate student must possess in order to succeed. The very act of learning may be impossible to decipher by someone who has no idea what is going on.

As an example, Sheila Tobias once wrote an article titled "They're Not Dumb, They're Different" about the problems of science instruction. Even as an examination of physics instruction at the introductory level her article isn't of much use. "They're Not Dumb, They're Different" is so heavily loaded with mistakes, vague statements, and poor logic that the result is laughable. For example, her belief that college physics instruction causes too many technical-minded students to switch fields is supposedly supported by the fact that only 1.3% of high school sophomores planning on studying physics or engineering go on to receive doctorates. (Is it the goal of every engineering student to receive a doctorate? For that matter, how many high school sophomores planning on becoming educators go on to achieve a doctorate in that field?) But more importantly, the failure to consider the skills needed at the upper level of physics was exemplified by the Tobias' views on the purpose of the course. The instructor was asked why there was such a heavy emphasis on problem-solving skills, as opposed to conceptual development. "I assume that students in 103 are preprofessionals who have already decided on a career in science and are in class to learn problem-solving techniques that will be required of them

in their careers." This attitude is called a "structural problem" by Tobias, even though to some extent, and only to some extent, the professor is correct. After all, the class is called "Physics for Scientists and Engineers." But Tobias completely discounts the instructor's view without having any idea how much problem-solving skill is needed for physics and engineering students to succeed. Without this understanding how can she evaluate the job he is doing? The answer is "she can't."

Since I received an "A" in the education course (again, your applause is very gratifying but please stop) I am confident that I can at least understand what kind of abilities an education student must have to succeed at the graduate level. But can you imagine if researchers from the education department enrolled in graduate physics courses? ("I got buried sometime after the instructor said 'Hello, I'm Dr. Cohn.' ") But unless researchers understand what is required of physics students at the upper level they cannot understand why physics is taught the way it is at the introductory level. Therefore, it is far too easy to claim that physics classes are not sufficiently entertaining, or that too much time is spent on teaching the basic tools of physics and not concentrating on the societal implications of Sir Isaac Newton's gender.

I am not certain what can be done about this problem. Can education students examine upper division physics courses and appreciate what is going on there? If not, what merit do their opinions have? Should we take the advice of education experts who do not have any understanding of what challenges the physics instructor faces? In my opinion, until physics instruction at all levels is studied and understood, maybe physicists will have to lead the way towards physics education reform.

John "Me No Watch Babylon-5" Walkup

PAPER CHASE

Recent Publications

S. Abachi et al., including G. Kalbfleisch, P. Gutierrez, M. Strauss, "Measurement of the W Boson Mass," Phys. Rev. Let., 77, 3309 (1996).

S. Abachi et al., including G. Kalbfleisch, P. Gutierrez, M. Strauss, "Search for Anomalous WW and WZ Production in pp^- Collisions at $V_s=1.8\text{TeV}$," Phys. Rev. Let., 77, 3303 (1996).

S. Abachi et al., including G. Kalbfleisch, P. Gutierrez, M. Strauss, "Isolated Photon Cross Sections in the Central and Forward Rapidity Regions in pp^- Collisions at $V_s=1.8\text{TeV}$," Phys. Rev. Let., 77, 5011 (1996).

C. M. Bender and K. A. Milton, "Nonperturbative Calculation of Symmetry Breaking in a Quantum Field Theory," Phys. Rev. D 55, R3255-R3259 (1997)

K. A. Milton, "Vector Casimir Effect for a D-Dimensional Sphere," Phys. Rev. D 4940-4946 (1997).

K. A. Milton and Y. J. Ng, "Casimir Energy for a Spherical Cavity in a Dielectric: Applications to Sonoluminescence," Phys. Rev. E 55, 4209-

4216 (1997)

K. A. Milton and I. L. Solovtsov, "Analytic Perturbation Theory in QCD and Schwinger Connection between the Beta Function and the Spectral Density," Phys. Rev. D 5295-5298 (1997)

S. C. Tegler and W. Romanishin, "The Extraordinary Colors of the Trans-Neptunian Objects 1994 TB and 1993 SC," ICARUS vol. 126, p. 212. 1997.

W.K. Liu, J. Winesett, Weiluan Ma, Xuimei Zhang, and M.B. Santos, "Molecular Beam Epitaxy of InSb on Si Substrates Using Fluoride Buffer Layers," Journal of Applied Physics 81, 1708 (1997).

John. J. Cowan, Andrew McWilliam, Christopher Sneden and Debra L. Burris, "The Thorium Chronometer in CS 22892-052: Estimates of the Age of the Galaxy," Astrophys. J., 480, 246 (1997)

Michael A. Morrison, Weiguo Sun, William A. Isaacs, and Wayne K. Trail, "Ultra-simple Calculation of Very-Low-Energy Momentum Transfer and Rotational Excitation Cross Sections: e^- -N₂ Scattering," Physical Review A (1997).

J.W. Howard, R.B.C. Henry, & S. McCartney, "A Detailed Abundance Study of Nine Halo Planetary Nebulae," MNRAS, 284, 465 (1997).

W.P. Blair, et al., including R.B.C. Henry, "Hubble Space Telescope WFPCZ Imaging of the Crab Nebula .I. Observational Overview", Astrophys J. Suppl., 109, 473 (1997).

INVITED TALKS, COLLOQUIA, & SEMINARS

David Branch, Colloquium: "Thermonuclear Supernovae and the Cosmic Age Problem," Department of Physics, Southern Methodist University, in April.

Kim Milton, Colloquium: "Sonoluminescence and the Casimir Effect" OU 2/13/97 Seminars: "Quantum Finite-Element Method: From Quantum Mechanics to Gauge Theories" OU 4/29/97, and "Analytic Running Coupling Constant in QCD" OU 2/6/97.

Dick Henry, Invited Talk: "Planetary Nebula Abundances, Stellar Yields, and the Chemical Evolution of C-12 and N-14" 6th TexMex Astrophysics Symposium, Rice University, March, 1997.

George Kalbfleisch, Colloquium: "A New Search For Low Mass Magnetic Monopoles," University of Kansas, Feb 3.

Mark Keil gave a Departmental colloquium on April 24, 1997 entitled "Chemical Reaction Dynamics for a Simple Exchange Reaction: $F+H_2 \rightarrow HF+H$," which is a collaborative project with Greg Parker, ably assisted by post-doctoral fellows Gamini Dharmasena and Timothy Phillips in our Department. Mark also gave an invited talk at the Himeji Institute of Technology (Japan) on December 18, 1996, entitled "Angular Distributions for

Specific Vib-Rotational States from F+H₂ Reactive Scattering." This talk was given on the way back from a conference in Taiwan honoring the 60th birthday of Yuan T. Lee, 1986 Nobel Laureate, where Mark chaired a session on Reaction Dynamics and presented a poster on his laboratory's recent F+H₂ results.

SCRATCHPAD

From the wires of AEDN (Association of Editors of Departmental Newsletters)...

A thermodynamics professor had written a take home exam for his graduate students. It had one question: "Is Hell exothermic or endothermic? Support your answer with proof."

Most of the students wrote proofs of their beliefs using Boyle's Law or some variant. One student, however, wrote the following:

"First, we must postulate that if souls exist, then they must have some mass. If they do, then a mole of souls can also have a mass. So, at what rate are souls moving into Hell and at what rate are souls leaving? I think that we can safely assume that once a soul gets to Hell, it will not leave. Therefore, no souls are leaving.

"As for souls entering Hell, let's look at the different religions that exist in the world today. Some of these religions state that if you are not a member of their religion, you will go to Hell. Since there are more than one of these religions and people do not belong to more than one religion, we can project that all people and all souls go to Hell.

"With birth and death rates as they are, we can expect the number of souls in Hell to increase exponentially.

"Now, we look at the rate of change in volume in Hell. Boyle's Law states that in order for the temperature and pressure in Hell to stay the same, the ratio of the mass of souls and volume needs to stay constant.

"So, if Hell is expanding at a slower rate than the rate at which souls enter Hell, then the temperature and pressure in Hell will increase until all Hell breaks loose.

"Of course, if Hell is expanding at a rate faster than the increase of souls in Hell, then the temperature and pressure will drop until Hell freezes over."

Dick Henry

HAVE A WONDERFUL SUMMER!!