"All The ν's That's Fit To Print"

ΦYAST ΦLYER

The Department of Physics & Astronomy
The University of Oklahoma

Volume 12, Number 1 Autumn, 2003 Dick Henry, Editor; Sonya Brindle, Production
Website: http://www.nhn.ou.edu

QFEXT03

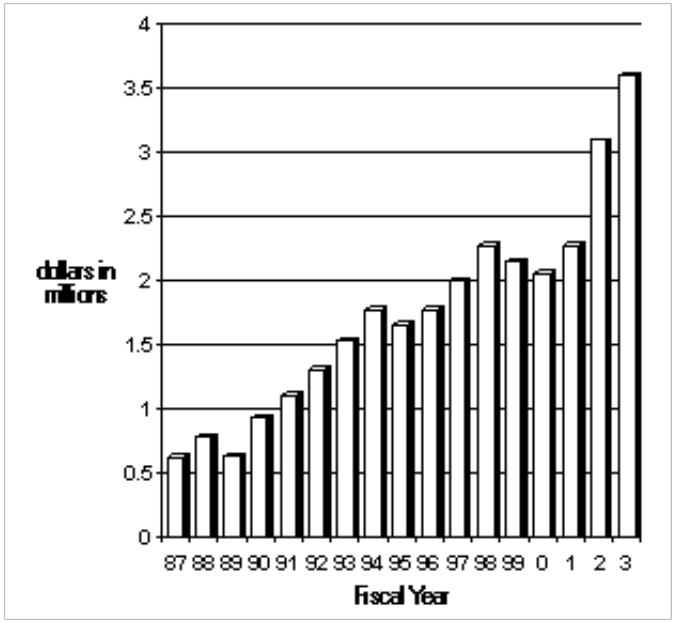
by Kim Milton

The 6th Workshop on Quantum Field Theory Under the Influence of External Conditions, which I hosted here (at the OCCE conference site) was a "brilliant" success (to quote a remark from more than one satisfied participant). More than 70 participants from 16 different countries, including 4 from the FSU (in spite of the best efforts of
Homeland Security to block their visas) met to discuss various aspects of what could be lumped under the heading of the Casimir effect. There were a number of experimental talks as well as theoretical papers, on everything from new forces to extra dimensions, properties of real materials as well new interpretations of black holes. Heated controversies erupted on many issues including, quite appropriately, temperature effects, and there was a divergence of opinions concerning the meaning of divergences in quantum field theory. Although the meeting had a distinguished international advisory committee, as well as a local organizing committee, and a number of graduate student drivers and helpers, 95% of the work involved was mine. Referee proceedings are now in the process of being put together and will be published early next year.

Funding Trends

By Ryan Doezema

Our external research expenditures grew by 17% to $3.6M from FY02 to FY03 as seen in the chart nearby. It's interesting to note that the contributions to this excellent result were broadly distributed across the department.



ΦBK Scholar Visits Department

by Kieran Mullen

Prof. James Trefil, noted author of such books as "101 Things you don't know about Science and No One Else Does Either," and editor of "The New Dictionary of Cultural Literacy," visited the Department of Physics and Astronomy at the start of October. His visit was funded by the National ΦBK Society.

Prof. Trefil gave a general colloquium on "Scientific Literacy." The talk was advertised in the campus paper, publicized on posters put up on campus, and listed in departmental colloquium webguide (http://www.nhn.ou.edu/colloquium/). He discussed the critical minimum that all citizens need to understand about science in order to participate in political and cultural debates, and how best to teach that minimum. The talk was well attended, with undergraduates, graduates and faculty in the audience. A question and answer period continued for some time.

In addition Prof. Trefil met with undergraduates, both in and out of the department. He met with the *"Introduction to Physics for Majors"* class, a course that not only attempts to train and inspire the next generation of physicists, but also a cadre of people who will enter technical fields of all sorts. Prof. Trefil discussed his own career trajectory, the nature of scientific research, and then the importance of being able to discuss technical issues with a non-technical audience. For the rest of the class Prof. Trefil engaged the students in a dialog on these issues.

Later that morning he led an informal roundtable for PAISOT, the Physics and Astronomy Informal Seminar on Teaching. A number of issues in the teaching of physics were raised in this forum for faculty and graduate students. This was an informal meeting with lots of discussion about the nitty gritty details of the teaching of science.

He also met with members of the History of Science department, reviewed their collections and met with Honors College students. In coordinating this visit the Department not only tried to promote science education, but to promote OU to an important visiting scholar.

Alumni News 

From Don Williams (EP, 1954):

Just got the copy of the Phyast Phlyer and it reminded me of past times and memories.

One is the article about the second expansion of Nielsen Hall. Of course that name change happened after I left, but I do recall that the original design provided very properly for expansion with blanks areas set aside for walkways on all floors. I also know, from reading Dr. Fowler's book, that the first expansion was scheduled for many years before it actually came about. In fact I didn't know until I got the newsletter that it ever happened, nor do I know what direction it took, but based on Fowler's comments I would guess it didn't go in the planned direction. That it happened at all, once Dr. Cross left, is a minor miracle. I don't know exactly when Dr. Fowler passed away, but I think it was around 1992, so he never got to see his dream completed. Now that a second expansion is underway I see that a minor miracle is happening on the campus.

The article about the expansion mentions a Foucault Pendulum. I may have built the very first one in the original building in the '53-'54 time frame, for the Engineers' Open House. There are a couple of interesting things about that one. First of all, someone had the foresight to design into the "New" physics building an open shaft from the roof to the basement, probably 3X4 ft, with doors at each floor level. Although the doors were never locked (or else I had a key) the designers had the foresight to put removable metal grids at each level so someone wouldn't open a door and fall to the basement.

As to the pendulum itself there is some interesting history. In the far right corner of the basement, (that would be N.W. I think) there were experiments which required lead bricks for shielding. Over time they
collected enough radiation that they were affecting some results, but not to the point where they were a danger to anyone. I found a print shop and told them I'd like to trade them, perhaps 2 for 1, this lead for some of their type casting metal (a mostly lead alloy), and they took the deal. (They had to re-formulate the metal anyhow from time to time so starting with plain lead was not a problem for them.) I then undertook the job of making the weight for the pendulum. I got a couple of rough 6-7 inch hemispheres cast, maybe they were done by the print shop or maybe I did that, don't remember- but as anyone knows, turning lead on a lathe requires a bit of skill. I asked the principal machinist (who always had many round imported Pumpernickel(?) bread cans sitting around), for some advice on how to do it without locking up the tool bit. A few hours later I came back to consult and found two perfect hemispheres ready to be bolted together. I did that, made a cable attachment, and ran it to the roof. I don't remember its period, but it did swing long enough without any external drive to show clearly the earth's rotation at our latitude.

From Zoe Learner (AP, 2002, now a grad. student at Cornell):

Hey y'all! I thought I'd take this opportunity to let you know how I'm doing since this is the first time I've been able to stop and catch my breath since I got here a year ago. And what momentous event has brought about this respite? I broke my foot. But that's a whole other story involving beer, pizza, and an evil rock . . . Things are great here: long cold winters, short mild summers, and lots of hard graduate courses--I love it! I managed to maintain a 3.99 GPA through
my first year, so I guess you can say I survived :). Best of all has been working on the Mars Exploration Rover mission with my advisor, Steve Squyres. I've been given a mission critical position. I am a Science
Operations Working Group Documentarian. Fancy-sounding, huh? In addition to being a member of the general science group, I will sometimes be responsible for taking notes during the meetings and writing daily reports of mission progress. I've made several trips out to California to JPL for meetings and mission
training, and I got to go down to Florida to see the second launch. WOW, that was an experience! With all the delays, though, I ended up staying down there for two and a half weeks instead of just a few days. But, as we all admitted, there are a lot worse places to be stranded than Cocoa Beach. It took weeks for me to get out of my beach bum state-of-mind! I've also been getting involved with Education and Public Outreach. In fact, there's an article online about me aimed at kids. It's at http://athena.cornell.edu/kids/cool_scientist.html. I've got several real-time training sessions coming up in the next few months, and I'm starting to prepare for a temporary move. Right after New Year's I'll be leaving for JPL and will stay out there until at least the end of April, maybe longer depending on how durable the rovers are. Our first landing is January 4th, so be thinking happy rover thoughts for me! I have to admit, though, I do miss Oklahoma. I miss the town, the university, the department and all of you. I'm sure everyone around here is sick of hearing me talk about OU and Norman. Believe it or not, people around here just aren't that into football--go figure. Sometimes I'd give anything for a decent thunderstorm, a Sooner football game, or just a straight, flat road. But Ithaca is lovely, and hiking the gorges and spending time on the lake is fun. I've made lots of new friends here in my new department and around town. And of course I love all the snow. What could be better than getting 15 inches of snow on Christmas Day!

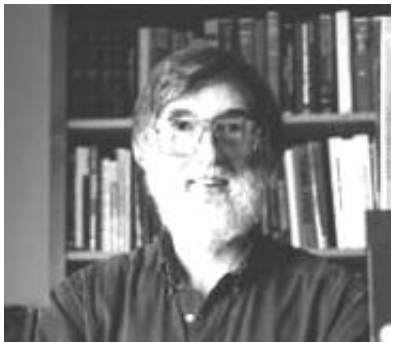
Group Research Updates

High Energy

-

Chung Kao: Chung Kao joined our high energy theory group in Fall 2000. He received his Ph.D. from the University of Texas, was a post-doctoral fellow at Florida State University and Rochester University, and a visiting assistant professor at the University of Wisconsin before coming to OU. Chung is the principal investigator of our recent EPSCoR State-DOE Laboratory Partnership Award from the U.S. Department of Energy to build a partnership between the University of Oklahoma and
the Brookhaven National Laboratory. This award provides research funding to support postdoctoral research associates and graduate students for OU. The proposed projects are directly relevant to high energy experiments at the D0 detector for Fermilab,
and the ATLAS detector for the CERN Large Hadron Collider. His research program addresses important issues in particle theory such as the mechanism by which elementary particles acquire mass and the reasons why the top quark is so heavy while the neutrinos are so light, the supersymmetry between bosons and fermions, unification of fundamental forces, and the identity of cold dark matter. The Higgs boson is a hypothesized particle which would give the mechanism by which particles acquire mass. Supersymmetry is a symmetry between fermions and bosons. This symmetry provides an elegant mathematical structure for elementary Higgs bosons;
the supersymmetric standard model can lead to grand unification for the strong, the weak, and the electromagnetic interactions; most supersymmetric models can provide a good candidate for cold dark matter favored by observations in astrophysics and cosmology. To predict the production rate of Higgs bosons or supersymmetric particles at high energy colliders, Chung and his collaborators employ Feynman diagrams to illustrate high energy reactions, then apply Feynman rules of interactions to calculate the cross section for the relevant process. The cross section is an effective area that corresponds to the probability and expected production rate for a reaction
in terms of number of events at high energy colliders.

From Brad Abbott: I have been continuing my work in B physics at D0. Over the past few months, the D0 experiment has produced many nice analyses on B lifetimes, rare B decays and reconstructing exclusive B decay modes. All of these results were presented in August at one of the major conferences in high energy physics, the Lepton-Photon conference which was held at Fermilab this year.



From Kim Milton: Although I have active projects concerning magnetic monopoles (we are fighting with the referee on the final experimental paper, and I have just signed a contract to produce a review article next year) and on non-Hermitian PT-symmetric quantum field theories (where I proposed a new version of QED this summer in Prague), the focus of my work this year is on the Casimir effect. There are two burning controversies: 1) What is the nature of the temperature dependence of the Casimir force between real metals (not yet observed experimentally). Here I have changed my position 180 degrees from 1978 when I was one of the co-authors of the Schwinger-DeRaad-Milton prescription, which in effect said to retain the transverse electric zero-mode in the permittivity for a metal. Not doing so, which seems correct physically, leads to a significant temperature effect which should be observable in the new future. But this view has its detractors, because, superficially, it seems to violate the third law of thermodynamics (of course, it does not). 2) Are the old calculations for the stress on a ideal spherical shell, first carried out by Glashow's student Tim Boyer, which give a small repulsive Casimir stress on the shell, meaningful? (These calculations have been generalized to cylinders and to hyperspheres by yours truly.) The MIT group, led by Bob Jaffe, and somewhat less aggressively, Gabriel Barton at Sussex, now say no. There are large divergent terms that they claim are erroneously omitted ("renormalized") in the conventional calculations. However, as Barton certainly realizes, the terms that Boyer calculated, while small, are unique. It is my view that the divergent terms, which I was one of the earliest to recognize in 1979, do not contribute to an observable effect, being subsumed in a description of macroscopic
matter. I believe that Jaffe's shrill attacks (one of his papers is entitled "Unnatural Acts") are based on a rather limited view of quantum field theory in the presence of bulk matter. (He also is extremely careless in reading the literature.)

This Fall I will be writing a review article for J. Phys. A (publishers like controversy!) in which I will try to present both sides of these arguments, and come up with the truth, as I see it!

Atomic & Molecular

From Eric Abraham: Our group recently demonstrated loading and confinement of ultracold (T =0.001 K) rubidium atoms in novel ring-shaped traps made from both red-detuned and blue-detuned Laguerre-Gaussian laser beams. This work in conjunction with previous work on laser cooling rubidium and study of the
Laguerre-Gaussian laser beams will constitute the PhD thesis of Sharon Kennedy, who defended in November, 2003.

Our lab has recently observed output of cold Nitric Oxide (NO) from a new apparatus designed to produce ultracold molecules where laser cooling cannot work. Our model predicts the temperature of this output should be 15 mK, which would be a record for cold temperatures without laser cooling. We are currently implementing a multi-photon scheme that can experimentally determine the output temperature. This scheme, which involves optical pumping, can then immediately be used for loading the molecules into a trap. The near-term goal is to measure the output speed
distribution of cold NO, optimize the total transmission, trap the ultracold samples, and study ultracold molecular collisions.

From Mike Morrison: Two recently published papers are the result of an ongoing collaboration between my group (electron-molecule scattering theory) and two experts in statistical mechanics (Profs.~Rob Robson and Ron White) both of whom work in Australia (Rob at the Australian National University, Ron at James Clark University). Both Rob and Ron have visited OU in the past (for extended stays). This collaboration is especially exciting to me for two reasons. First it extends my long-standing OU/ANU collaboration from scattering physics (where it has been since it started in 1979) to statistical mechanics and kinetic theory of gases (the new stuff). Second, it is giving me a chance to learn about aspects of statistical mechanics and kinetic theory that relate to collision phenomena that have been of interest to me for over two decades. This work constitutes a significant part of the NSF renewal proposal I submitted in late September. Its long-term goal is to resolve a very significant discrepancy between theoretical and experimental state-of-the-art cross sections for vibrational excitation of molecular
hydrogen, a scattering problem on which I have been working for several years with experimentalists Bob Crompton and Steve Buckman, both of whom have frequently visited OU. (Bob is an adjunct professor here.)

The third paper is a collaboration with a former postdoc, Weiguo Sun, who spent three years in my group some time ago. Weiguo is now a professor at Sichuan University, Chengdu, Sichuan, P.R.China. We hope the work reported in this paper will be just the first stage of a long-term collaboration. The work concerns the physics of polarization of molecules that occurs when charged particles collide with those molecules and how polarization alters the collision cross sections and other important scattering quantities. In the past, this interaction has been treated in a quite ad hoc way, using model potentials that contain one or more adjustable parameters or physically sensible but theoretically unjustifiable approximations. The approach Weiguo and I are taking goes beyond these methods to a model potential that is based on a more sound theoretical model and that has no adjustable parameters. In

this paper, we applied this model to vibrational excitation of molecular nitrogen by electrons with energies below about 10 electron volts. We picked this test case because such collisions are known to be extremely sensitive to the treatment of polarization. So far so good. Our results agree very well with experimental data for this system. Now
we're developing our resources to allow us to study more complicated molecular systems.

From Neil Shafer-Ray: Through hard work and long hours in the laboratory by undergraduate student
Chris McRaven, we have finally published a new technique for the detection of OH radicals. This new spectroscopic technique employs laser radiation at
~120nm and represents the biggest breakthrough in OH detection sensitivity since the landmark paper of Bersohn in 1983. We need this improved sensitivity to study reactive scattering dynamics. We have also initiated a new project that might get the late-night-TV name "molecular spectroscopy meets particle physics." Specifically we intend to explore time-reversal asymmetries outside the Standard Model by probing the spectroscopy of PbF molecules cooled to ultracold temperatures. We (George Kalbfleisch, Kim
Milton, Eric Abraham, and myself) have just completed a collaborative proposal that asks the NSF for a pile of money to help us fund the project. Wish us luck! In other interesting news, I have shown that two wires bent in a U shape can be used to confine ultracold polar molecules to a point in space. This was my first and last work to be published in Physical Review A under the keyword "electrostatics." It seems that teaching intro. E&M has paid off.

Astrophysics

From Dick Henry: Our research on the abundances of S, Ar, and Cl in planetary nebulae (gaseous objects which form during the final stages of

evolution of stars like the sun when part of a star's outer atmosphere is ejected) recently came to a head with the submission for publication of the culminating paper in the series with Karen Kwitter (Williams College) and Bruce Balick (U. Washington, Seattle). The principal goal of the project all along has been to gather new observational data for a large sample of objects, determine S, Cl, and Ar abundances, and use the results to study the chemical evolution of these three elements in the disk of the Milky Way. The surprise was that there is a real problem, origin unknown, in measuring S abundances in these objects, in that they are systematically much lower than expected. Work on this project has included valuable contributions from my former graduate student Jackie Milingo, whose thesis was based upon the observation and analysis of a large portion of these objects.

Another set of projects deals with the origin of nitrogen. Currently I'm interested in nitrogen abundances in high redshift objects called damped Lyman alpha systems. DLAs are located along the line of sight between QSOs and the observer and consequently produce absorption features in the spectra of the latter, allowing the determination of chemical abundances in the former. An interesting twist, first pointed out by Jason Prochaska (UCSC) and myself, is that some DLAs appear to have significantly less nitrogen than most objects of this type. We have proposed that these low N DLAs have experienced star formation which produced stellar populations with relatively few of the stellar types which normally produce significant amounts of nitrogen, namely stars between 4 and 7 solar masses. A competing proposal is that these low N DLAs are really in their infancy, such that stars between 4-7 suns have not evolved to the point where they eject their nitrogen, and thus internal environments of these DLAs are yet to be fully enriched with this element. Work is continuing with graduate student Aida Nava in an effort to clarify this finding. Aida is currently rederiving and refining all of the nitrogen abundances in a standard set of objects which we use to compare with the DLA observations.

CSPIN Impresses Midterm Reviewers

By Kieran Mullen

The Center for Semiconductor Physics in Nanostructures (CSPIN) received a strong positive evaluation from the recent National Science Foundation external review committee. CSPIN is one of the NSF's Materials Research Science and Engineering Centers (MRSEC) of which there are only about two dozen in the entire country. CSPIN is unusual in that it is a collaboration between two well separated universities, the University of Oklahoma and the University of Arkansas (UA). It is composed of seventeen scientists from a variety of departments all united in their interest in understanding how to make and study small semiconductor structures. The site visit involved ten external scientists who were brought in to review all aspects of the Center: research, education, and outreach to the broader community. The panel visited both OU and UA, and met with both faculty and students. The review was critical to the program since the NSF can (and has, at other institutions) reduced funding if it deems the progress to be inadequate.

"While we are very pleased by the review, we are not surprised," said Center Director Matthew Johnson. "We run our own external reviews in order to keep ourselves on track, and they have been quite positive."

The Center has benefited from the recent addition of Susan Walden, who is now the *Program Manager* for the Center. Walden, who has a Ph.D. in Chemistry from OU, has extensive experience in science outreach and education as well as science research. Until now most of the project administration has had to be handled by the research scientists. Walden, with her background in research, can take over those administrative tasks and communicate well with the scientists in the project.

Susan is one of the leaders of SeeS, (Sooner Elementary Engineering and Science), an after school program that works with parents and K-5 students to understand the science of everyday life. She also has helped run CSPIN's Research Experience for Teachers program over the summer, where high

school and middle school teachers learn about science research and how to incorporate modern science into their classrooms.

Research Activities

Publications

O. Gessner, M.Z. Zgierski, A. Stolow, A.M.D. Lee, D.M. Wardlaw, J.P. Shaffer, T. Schultz, E. Chrysostom and C.C. Hayden, "Non-adiabatic Intramolecular Photodissociative Dynamics Studied by Femtosecond Time Resolved Photoelectron and Coincidence Imaging Spectroscopy," Faraday Discussions, 127 (2003).

T. Schultz, J. Quenneville, B. Levine, A. Toniolo, T. Martinez, S. Lochbrunner, M. Schmitt, J.P. Shaffer, M. Zgierski and A. Stolow, "Mechanism and Dynamics of Azobenzene Photoisomerization," Journal of the American Chemical Society Communications, 125, 8098(2003)

D. Branch, P. Garnavich, T. Matheson, E. Baron, et al.,Optical Spectra of the Type Ia Supernova 1998aq, Astronomical Journal, 126, 1489 (2003)

D. Branch, When a White Dwarf Explodes, Science, 299, 53 (2003)

D. Branch, The Extravagant Universe: Exploding Stars, Dark Energy, and the Accelerating Cosmos, by Robert P. Kirshner (a book review), Physics Today, 56, 65 (2003)

J. S. Hoye, I. Brevik, J. B. Aarseth, and K. A. Milton, Does the Transverse Electric Zero Mode Contibute to the Casimir Effect for a Metal?, Phys. Rev. E. 67, 056116 (2003)

K. A. Milton, Calculating Casimir Energies in Renormalizable Quantum Field Theory, Phys. Rev. D 68, 065020-1--11 (2003)
K. A. Milton, Dark Energy as Evidence for Extra Dimensions, Grav. Cosmol. 9, 66-70 (2003).

E. Baron, E. J. Lentz, and P. H. Hauschildt, The Detectibility of Mixed Unburnt C+O in Type

Ia Supernova Spectra, Ap. J. (Letters) (2003),588, L29--L32.

D. Kasen, P. Nugent, L. Wang, D. A. Howell, J. C. Wheeler, P. Hoeflich, D. Baade, E. Baron, and P. H. Hauschildt, Analysis of the Flux and Polarization Spectra of the Type Ia Supernova SN 2001el:
Exploring the Geometry of the High-Velocity Ejecta,
Ap. J., (2003), 593, 788-808.

B. Abbott, P. Gutierrez, M. Strauss, D0 Collaboration,
Search for large extra dimensions in the monojet + MET channel with the DZero detector, Phys. Rev. Lett. {90}, 251802 (2003)

Mukherjee,P., and Wang, Y., Wavelet Band Powers of the Primordial Power Spectrum from CMB Data
ApJ, 593, 38 (2003)

Wang, Y., Freese, K., Gondolo, P., Lewis, M.,, Future Type Ia Supernova Data as Tests of Dark Energy from Modified Friedmann Equations, ApJ, 594, 25-32 (2003)

Gezari, S., Halpern, J.P, Komossa, S., Grupe, D., Leighly, K. M., Follow-up Hubble Space Telescope/Space telescope Imaging Spectroscopy of Three Candidate Tidal Disruption Events, ApJ, 592, 42

Jenkins, E. B., Bowen, D. V., Tripp, T. M., Sembach, K. R., Leighly, K. M., Halpern, J. P., Lauroesch, J. T.,
Absorption-Line Systems and Galaxies in Front of the
Second-brightest Quasar, PHL 1811, AJ, 125, 2824

Evgueni Nikitin, Elena Dashevskaya, Janis Alnis, Marcis Auzinsh, E. R. I. Abraham, Brendan R Furneaux, Mark Keil, Chris McRaven, Neil Shafer-Ray, and Richard Waskowsky, Measurement and prediction of the speed-dependent throughput of a magnetic octupole velocity filter including nonadiabatic effects, Physical Review A 68, 023403 pages 1-8 (2003)

N. E. Shafer-Ray, K. A. Milton, B. R. Furneaux, E. R. I. Abraham, and G. R. Kalbfleisch, Design of a biased Stark trap of molecules that move adiabatically in an electric field, Physical Review A 67, 045401 pages 1-4 (2003)

Janis Alnis, Kaspars Blushs, Marcis Auzinsh, Sharon Kennedy, Neil Shafer-Ray, and E. R. I. Abraham, The Hanle effect and level crossing spectroscopy in Rb vapour under strong laser excitation, Journal of Physics B: Atomic, Molecular, and Optical Physics, 36 1161-1173 (2003)

Tegler, S., and Romanishin, W., Resolution of the kuiper belt object color controversy: two distinct color populations, Icarus v. 161, p. 181 (2003)

K. Noll etal (includes W. Romanishin), Detection of Two Binary Trans-Neputunian Objects, 1997 CQ29 and 2000 CF105, with the Hubble Space

Telescope
Astronomical Journal v. 124, 342 (2002)

Romanishin, W., et al., Minor Planets Electronic Circulars (MPECs), announing recoveries of KBOs and/or discovery of new binary KBOs, 2003

T.D. Mishima, J.C. Keay, N. Goel,
M.A. Ball, S.J. Chung, M.B. Johnson, and M.B. Santos, Anisotropic Structural and Electronic Properties of InSb/AlInSb Quantum Wells Grown on GaAs (001) Substrates, Journal of Crystal Growth 251, 551 (2003).

G.A. Khodaparast, D.C. Larrabee, J. Kono, S. King, S.J. Chung, and M.B. Santos, Relaxation of quasi-two-dimensional electrons in a quantizing magnetic field probed by time-resolved cyclotron resonance, Physical Review B67, 35307 (2003)

Mukherjee, Pia; Coble, Kim; Dragovan, Mark; Ganga, Ken; Kovac, John; Ratra, Bharat; Souradeep, Tarun
Galactic Foreground Constraints from the Python V Cosmic Microwave Background Anisotropy Data, 2003, ApJ, 592..692M

R. E. Robson, R. D. White, and Michael A. Morrison,
Some fundamental questions concerning the kinetic theory of electrons in molecular gases and the e-H_2 vibrational cross section controversy, Journal of Physics B, 36, 4127-4143 (2003)

C. Sneden, J. J. Cowan and J. E. Lawler, Observations of Neutron-Capture Elements in the Early Galaxy, Nucl. Phys. A, 718, 29c (2003)

C. Sneden, J. J. Cowan, J. E. Lawler, et al., The Extremely Metal-Poor, Neutron-Capture Rich Star CS~22892-052: A Comprehensive Abundance Analysis, Astrophys. J., 591, 936 (2003)

C. Sneden, G. W. Preston and J. J. Cowan, Binary Blue Metal-Poor Stars: Evidence for AGB Mass Transfer,Astrophys. J., 592, 504 (2003)

E. A. Den Hartog, J. E. Lawler, C. Sneden and J. J. Cowan, Improved Laboratory Transition Probabilities for Nd II and Application to the Neodymium Abundances of the Sun and Three
Metal-Poor Stars, Astrophys. J. Supp., 148, 543 (2003)

J. J. Cowan, Elements of Surprise, Nature, 423, 29 (2003)

R. Frech, V. Seneviratne, Z. Gadjourova, P. Bruce Vibrational Study of the Crystalline Phases of $(CH_3(OCH_2CH_2)_2OCH_3)_2LiSbF_6$ and $P(EO)_6LiMF_6$ (M=P,As,Sb), Journal of Phys. Chem. B, 107, 11255 (2003)

Seneviratne, R. Frech, J.E. Furneaux, Phases and phase transitions of $P(EO)_6LiSbF_6$, Electrochimica Acta, 48, 2221 (2003)

K. Zhang, G.A. Parker, D.J. Kouri, D.K. Hoffman, S.S. Iyengar, Periodic Distributed Approximating Functions (PDAF): Theory and Application to the Quantum Reactive Scattering using Hyperspherical (APH) Coordinates, J. Chem. Phys, 118, 569 (2003)

F.D. Colavecchia, J.P. Burke, W. Stevens, M.R. Salazar, G.A. Parker, R.T. Pack, The Potential Energy Surface for Spin-Aligned Li_3 ($1^4A'$) and the Potential Energy Curve for Spin-Aligned Li_2 ($a^3\Sigma^+_u$), J. Chem. Phys., 118, 5484 (2003)

F.D. Colavecchia, F. Mrugala, G.A. Parker, R.T. Pack, Accurate Quantum Calculations on Three-Body Collisions in Recombination and Collision-Induced Dissociation II. The Smooth Variable Discretization-Enhnaced Renormalized Numerov Method, J. Chem. Phys. 118, 10387 (2003)

-

Meetings Attended 

David Branch: "Three Dimensional Signatures of Stellar Explosions: a Workshop in Honor of J. Craig Wheeler," Austin, Texas - June 2003, invited talk: "Type Ia Supernovae: Spectroscopic Surprises." "Thermonuclear Supernovae," Trento, Italy - September 2003, invited talk: "Spectra of Type Ia Supernovae."

Kim Milton: "QFEXT03," Norman, September 15-19, 2003, invited talk, "Perspective on the Temperature Dependence of the Casimir Force Between Real Metals." "Marcel Grossman X," Rio de Janeiro, July 20-26, 2003, invited talk, "Calculating Casimir Energies in Renormalizable Quantum Field Theory." "Workshop on Pseudo-Hermitian Quantum Field Theory," Prague, June 16-17, 2003, invited talk, "Anomalies in PT-Symmetric Quantum Field Theory." "Colloquium on Quantum Groups and Integrable Systems," Prague, June 12-14, 2003, invited talk, "PT-Symmetric Quantum Field Theory."

Yun Wang: AAS meeting, May 2003, Nashville, TN, invited talk at topical session (`Observational Probes of Dark Energy') "Dark Energy with Type Ia Supernovae"; "CMB after WMAP" workshop, June 2003, Aspen Center for Physics, invited talk, "Model-Independent Reconstruction of the Primordial Power Spectrum"; "Quantum Field Theory Under the Influence of External Conditions", September 2003, OU (Chaired the astrophysics/cosmology session)

Karen Leighly & Darrin Casebeer: "AGN Physics with the SDSS", Princeton University, July 27 - July 30. Posters: "Modeling AGN with PHOENIX," D. Casebeer, D. Branch; PHL 1811: The Local Prototype of the Lineless High-z SDSS QSOs, K. Leighly, J. Halpern, and E. Jenkins.

Pia Mukherjee: "CMB after WMAP", 9th June to 21st June; Aspen, Colorado

Tetsuya Mishima gave a talk at the North American Conference on Molecular Beam Epitaxy in Keystone CO (September 28 to October 2). His talk was
entitled "Effect of Buffer Layers on InSb Quantum Wells Grown on (001) GaAs Substrates," by T.D. Mishima, J.C. Keay, N. Goel, M.A. Ball, S.J. Chung,
M.B. Johnson, and M.B. Santos.

Tetsuya Mishima and Niti Goel presented posters at the International Conference on Modulated Semiconductor Structures in Nara, Japan (July 13 to

18). Tetsuya's presentation was entitled "Effect of Structural Defects on InSb/AlxIn1-xSb Quantum Wells Grown on GaAs (001)," by T.D. Mishima, J.C.
Keay, N. Goel, M.A. Ball, S.J. Chung, M.B. Johnson, and M.B. Santos. Niti's presentation was entitled "Effect of Temperature on Ballistic Transport in InSb Quantum Wells," by N. Goel, K. Suzuki, S. Miyashita, S.J. Chung, M.B. Santos, and Y. Hirayama.

Giti Khodaparast presented an Invited Talk at the International Conference on Narrow Gap Semiconductors in Buffalo NY (June 16 to 20). It was entitled "Spin Effects in InSb Quantum Wells," by G.A. Khodaparast, R.C. Meyer, X.H. Zhang, T. Kasturiarachchi, R. E. Doezema, S.J. Chung, N. Goel, and M. B. Santos, and Y.J. Wang.

Tetsuya Mishima and Niti Goel presented posters at the International Conference on Narrow Gap Semiconductors. Tetsuya's presentation was entitled "Effect of Structural Defects on InSb/AlInSb Quantum Wells Grown on GaAs (001)" by T.D. Mishima, J.C. Keay, N. Goel, M.A. Ball, S.J. Chung,
M.B. Johnson, and M.B. Santos. Niti's presentation was entitled "Ballistic Electron Transport in InSb Quantum Wells at High Temperature" by N. Goel, K. Suzuki, S. Miyashita, S.J. Chung, M.B. Santos, and Y. Hirayama.

Members of the Solid State group presented 10 talks at the APS March Meeting in Austin, Texas from March 3 to 7. The titles and coauthors are listed below, with the name of the speaker listed first:Negative bend resistance in InSb quantum wells with AlInSb barriersN. Goel, K. Suzuki, S. Miyashita, S. J. Chung, M. B. Santos , Y. Hirayama

TEM Study of InSb/AlInSb Quantum Wells Grown on GaAs (001) Substrates T.D. Mishima, J.C. Keay, N. Goel, S.J. Chung, M.B. Johnson, M.B. Santos Exciton Photoluminescence Study of InSb Quantum Wells
X. H. Zhang, N. Dai, F.H. Zhao, Z.S. Shi, R.E. Doezema, N. Goel, S.J. Chung, M.B. Santos

Spin dependent magneto-optical properties of InSb quantum wells R.C. Meyer, X.H. Zhang, T. Kasturiarachchi, G.A. Khodaparast, R.E. Doezema, S.J. Chung, M.B. Santos

Quantum Hall Ferromagnetism in InSb based Two Dimensional Electronic Systems
Jean Claude Chokomakoua, Niti Goel, Seokjae Chung, Michael Santos, Sheena Murphy

Photoluminescence of Silicon Nanostructures Fabricated using Anodic Aluminum Oxide Templates and Self-Limiting Oxidation Techniques P. R. Larson, A. M. Elliot, J. C. Keay, M. B. Johnson , M. Keil, X. Wang, M. Xiao

TEM Study of Self-assembled InGaAs/GaAs Quantum-dot Chains T.D. Mishima, M.B. Johnson, Yu. I. Mazur, W.Q. Ma, X. Wang, Z.M. Wang, G.J. Salamo, M. Xiao

Nano-Rings Fabricated by Ion Beam Etching and Redeposition through a Nano-Porous Anodic Aluminum Oxide Template K.L. Hobbs, P.R. Larson, J.C. Keay, L.A. Bumm, M.B. Johnson

Polarization Transitions in Quantum Ring Arrays,
Bahman Roostaei, Kieran Mullen

R-Matrix Theory of Quantum Wire Systems,
Thushari Jayasekera, Michael Morrison, Kieran Mullen

John Cowan attended a meeting on "The Nuclear Physics of Core Collapse Supernovae," held in Aspen, May 25-31, invited talk, "The r-Process: Observations." He also traveled to Austin June 9-13 to attend a meeting on "3-D Signatures in Stellar Explosions," invited talk, "Stellar Abundances: The r-Process and Supernovae."

Varuni Seneviratne attended the 59th Southwest Regional Meeting of the American Chemical Society, October 26 to 28th , 2003, Oklahoma City, and made the following presentations: Poster presentation, "Local Structures in Diglyme:$LiBF_4$ and PEO:$LiBF_4$ Systems," Varuni Seneviratne, Roger Frech, John Furneaux, Massod Khan; and "Structure and Order in Amorphous Phases of Polymer Electrolytes: $P(EO)_xLiSbF_6$ and $P(EO)_xCF_3SO_3$." Roger Frech, Varuni Seneviratne.

Some members of the AMO group attended the DAMOP meeting in Boulder recently and presented the following papers: Eric Abraham, Bryan Bichsel, Neil Shafer-Ray: DAMOP, Boulder, talk, "Sources and Studies of Cold Molecular NO"; Bryan Bichsel, Jim Farnsworth, Brendan Furneaux, Brady Longenbaugh, Sam Meek, Eric Abraham, Neil Shafer-Ray, "Guides and Traps Based on the Stark and Zeeman Effects for Ultracold NO."

Eric Abraham: Texas Section of the APS, San Marcos, March 7, talk: "Experiments with Ultracold Molecules."

Lloyd Bumm: OK Microscopy Soc. Annual Meeting, Nov. 7, U. of Sci. and Arts, talk, "An STM and TEM Study of Atomically-flat Single-Crystal Gold Nanoparticles on Indium Tin Oxide," Dahanayaka, Hossain, Ross, and Bumm.

Colloquia, Seminars, Invited Talks

Kim Milton, "Does the Transverse Electric Zero Mode Contribute to the Casimir Effect for a Metal?" LANL, May 22; "Calculating Casimir Energies in Renormalizable Quantum Field Theory," LANL, May 23, and Washinton U., April 3.

Ed Baron, "Highlights of Modeling Stellar Objects with PHOENIX," LANL, Sept. 18.

Yun Wang: "Probing Fundamental Physics with Cosmological Data," October 2003, Oklahoma State University.

Brad Abbott: "Recent D0 Results on B, QCD, Electroweak, Top and Higgs Physics," Fermilab Wine and Cheese Seminar, March 14, 2003

Karen Leighly: "The Highs and Lows of Narrow-line Seyfert 1 Galaxies, or The Wind Comes Sweeping Down the Plane," Columbia U., May 12, Ohio U., May 14, Ohio State U., May 15, Harvard CfA, June 26.

Lloyd Bumm: Synthesis of 5-Bromo-8-Methoxyquinoline as a Precursor to Thiol-Functionalized Electroluminecsent Compounds," Nov. 14, UCO Research Day.

Dick Henry, "Galactic Chemical Evolution, A Review," invited talk presented at the workshop on Nuclear Astrophysics held in conjunction with the AIP meeting in Tucson, October 29.

Research Travel 

Ed Baron: Paris and Lyon, France; Hamburg, Germany, to work with collaborators on the Supernova Factory in France and Peter Hauschildt in Germany.

Mike Strauss: Fermilab D) Collaboration Meeting, Fermilab, October.

Brad Abbott: Beaune, France, June, D0 collaboration meeting; Fermilab, as necessary.

Karen Leighly: Boston, served as Chandra AO5 proposal review deputy chair in June; FUSE Observers Advisory Committee meeting, Johns Hopkins U., October.

Bill Romanishin: Keck Observatory, Hawaii, March.

Ryan Doezema, to National Magnet Lab, Tallahassee, May/June,

John Cowan: U. of Chicago, June, to perform calculations relevant to the synthesis of heavy elements in supernovae.

Visitors Hosted 

Peter Hauschildt visited Ed Baron in September and October to improve their general model atmosphere code PHOENIX and finish up two papers.

Toshihiro Kawaguchi (Obs. Paris) visited Karen Leighly in June and July. He learned to to do X-ray data analysis, and then analyzed the XMM-Newton data from a narrow-line Seyfert 1 galaxy.

Grants Awarded 

Chung Kao, Mike Strauss, Brad Abbott, Pat Skubic, Kim Milton, and Phil Gutierrez, "Searching for Higgs Bosons and New Physics at Hadron Colliders," DOE/EPSCoR/National Lab. Partnership, $150K, 3 years.

Ed Baron, "New Standard Stellar Population Models," NSF, $179K.

Karen Leighly, "UV Spectroscopic Observations of Luminous Narrow-line Seyfert 1 Galaxies," STScI, $60K.

Bill Romanishin, "Photometry of Transneptunian Objects and KBOs," NASA, $75K; "Reduction for HST Binary KBOs," STScI, $6.2K; and "Observing KBOs with Keck," JPL Keck Travel Grant, $1.26K.

L.A. Bumm, "CAREER: Optoelectronics and Nanometer-Scale Photonics of Single Molecules, Nanometer-Scale Assemblies, and Nanoparticles," NSF, $510K; "NUE: Nanolab -- A Hands-on Introduction to Nanoscience for Scientists and Engineers," (NUE = Nanotechnology Undergraduate Education), NSF, $100K, (with Matt Johnson); "Optical, Electrical, and Structural Properties of a Single Emitter LED," (with W.T. Yip, X. Peng, and Matt Johnson), NSF/MRSEC Seed Project, $25K.
This Spring Niti Goel received a Robberson Research Grant of $1000 from the Graduate College, for travel and research expenses related to her doctoral
project. She spent the money as partial support for a five-week trip to Japan in July and August. While there, she presented a paper at the International Conference on Modulated Semiconductor Structures and performed experiments on InSb quantum point contacts at NTT Basic Research Laboratories.

John Cowan: "The Age, Formation, and Evolution of the Elements," NSF, $210K, 3 years.

Dick Henry: "Damped Lyman Alpha Systems as Probes of Nitrogen Synthesis in the Early Universe," NSF, $85K, 3 years; and "C III] Imagery of Planetary Nebulae and H II Resions-A Snap Program," HST, $22K, 1 year.

Defenses and Beyond 

Rollin Thomas defended his thesis, "Synthetic Spectrum Methods for Three Dimensional Supernova Models," during the summer and is now a postdoctoral fellow working on the Supernova Factory project at Lawrence Berkeley National Lab. Rollin was a student of David Branch.

Chris Stockdale, a former student of John Cowan, has just completed his two year NRC postdoc at NRL and is now an assistant professor at Marquette U.

Jackie Milingo, a former student of Dick Henry, completed her third year as a visiting member of the Physics Department at Gettysburg College and has now taken up a similar position at Franklin & Marshall U. in Lancaster, PA.

Small (but significant) Additions

Cian Christopher Mullen was born at 8:18pm on Saturday, March 24. He is the first child for Kieran Mullen, and his wife Theresa Vaughan. Cian ("Key-un") was 8lb. 10oz. at birth, and measured 20.5 inches long. His name means "ancient" or "ancient wisdom" in Gaelic. Mother and child came through in great health.

Born with a full head of brown hair and blue eyes, Cian takes after his mother. With one parent a professor of Physics, and the other a professor of Humanities, he has yet to declare a major. His current hobbies mostly involve depriving his parents of sleep.

Postdoctoral Visitors 

Dr. Ramaz Khomeriki is visiting OU under a NATO-NSF postdoctoral fellowship. Ramaz is a native of the country of Georgia, formerly part of the Soviet Union. He is working with Prof. Kieran Mullen in theoretical condensed matter physics. Ramaz is an expert in nonlinear dynamics and in magnetic systems. He is accompanied by his wife, Nino, and his son Georgi.

Their collaboration started via the Internet. Dr. Khomeriki found a description of Kieran's research on OU's webpages closely matched his own interests. After a brief email correspondence they decided to apply for a grant to allow Ramaz to come to the US for a year. Both are keen to see how to continue their fruitful collaboration into the future.

Ramaz joins Dr. Ramin Abolfath, and Dr. Milica Milavanovic, who are also working with Prof. Mullen. Ramin will stay for another year and to work on quantum Hall physics as well as magnetic semiconductors. Milica will be leaving at the end of the summer to look for a position on the East Coast, to join family there.

In the Fall, Prof. Jean-Marie Ndjaka will visit for a semester from Cameroon. This visit is funded by the NSF International Programs office. In addition to helping start a research collaboration between Profs. Ndjaka and Mullen, it will strengthen the tie between OU and the University of Yaounde, which has brought several graduate students to OU.

The University of Oklahoma is an Equal Opportunity Employer Institution 3/2001

460 copies of this publication, printed by the Physics and Astronomy Department, have been prepared and distributed at a cost of $155.52 to the taxpayers of the state of Oklahoma.