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That's fit to Print"

ΦYAST ΦLYER

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FROM THE CHAIR:

1995 In Review

It was another good year for Physics and Astronomy at OU! We did our job of teaching, research, and service well as usual and at the same time were able to make gains for the future.

We were fortunate in hiring faculty: **Neil Shafer-Ray**, our new experimentalist in atomic, molecular, and chemical physics and **Mike Strauss**, our new experimentalist in high energy physics have quickly become vital members of our departmental family. We were able to welcome a great new class of undergraduate students as well as new graduate students at the start of the fall semester. We were also delighted to welcome new post-doctoral fellows, **Stefan Boettcher** and **Rosemary Lasell**. Although we were lucky and delighted to gain **Amy Liu** as a research staff member, we said good-bye to staff members **Adrienne Wade** and **Yousong Zhang**.

The year was marked by several unusual events. Our triple alumnus and NSF Director, Neal Lane, visited in May and received his fourth OU degree, an honorary doctorate of Humane Letters. A couple of months later Nielsen Hall became a brief part of the filming of the movie, Twister, to be released later this year. Late in the year the Department acquired an IBM SP-2 supercomputer (see Baron's article below) with the generous help of IBM and the OU administration. This striking monolith is now installed in the basement of Nielsen Hall.

It also seems unusual and sometimes even unbelievable that, for the first time since it was built in 1948, we are planning for expansion of Nielsen Hall. Three faculty committees met frequently with architects during the fall semester and the general shape of things to come seems to be emerging. Current plans, still subject to University approval, envision a two-level lecture hall addition to the west of Nielsen Hall and a three or four story office building to the south. The plan calls for the renovated current building to become dedicated chiefly to classrooms, teaching laboratories, and research laboratories, much as it was originally in 1948.

A final high note for the year is the success to date of our funding drive to endow the Lin Graduate Research Fellowship. After first contacting Professor Lin's former students and making a great start on the endowment, we have turned to all our alumni and friends for help. Even though we

have sent letters to only just over half our listed alumni, the amount of gifts and pledges stands currently at $33K. (If you haven't been contacted, you should expect to receive a mailing during the next month or so.) This tremendous result goes a long way toward our goal of $60K to $100K! Because of this confidence-building response, we have begun to plan an inaugural celebration/symposium for the fall of 1998. Thanks again to all who have helped! We'll keep you posted.

Ryan Doezema

MORE FLOPS!

A New Supercomputer For Nielsen Hall

The computation power of the department grew significantly with the installation of an 8-node IBM SP2 scaleable power parallel computer with over 40GB of storage, and 2Gb of RAM this December. The machine will be managed by Adjunct Assistant Professor **Andy Feldt** and will be used by other members of the university faculty (and students) in addition to those in the department. The machine is housed in the basement of Nielsen Hall.

The installation of the SP2 places the University of Oklahoma into a group of world-class research centers already using SP systems including the Cornell Theory Center, an NSF-funded high-performance computing center, the U.S. Department of Energy's Argonne National Laboratory, the Fermi National Accelerator Laboratory, the University of Hong Kong, the Technical Institute of Monterrey, Mexico, the German National Research Center for Computer Science, the Leibniz Datacenter of the Bavarian Academy of Sciences in Munich, Germany and Brazil's new National Laboratory for Scientific Computing at the University of Campinas.

The IBM SP2 at the University of Oklahoma was acquired through the IBM Shared University Grant Program sponsored by IBM Research and additional contributions by IBM North America, in addition to OU's standard academic discounts. Both IBM and the University put up matching funds to get the machine installed at the Norman campus. Although the machine is just going into service, the Department is working with others in the college to seek National Science Foundation funding to expand the system.

One of the keys to attracting research dollars in an increasingly competitive environment is to have resident computing power and computing expertise. The installation of the IBM SP2 gives the University of Oklahoma an edge in that competition.

The nature of research funding for universities makes the SP2 an ideal long term computing platform. POWER2 has a scalable architecture that allows you to expand a system over time to meet changing computing requirements. Systems can range in size from four processor nodes up to a maximum standard configuration of 128 and beyond upon special request. Future models will support hundreds of processor nodes, providing performance in the TeraFLOPS range. In addition, the SP2's scalability and support for both serial and parallel processing lets users enter the world of parallel computing at their own pace. Faculty who have not written their modeling programs to take advantage of parallel processors can still take advantage of a high speed low-cost computing platform.

Ed Baron

RESEARCH UPDATE FROM JOHN FURNEAUX:

Our research is particularly involved with the fundamental properties of 2-Dimensional Electronic Systems (2DES). These systems are created by confining electrons to very small dimensions at an interface within a semiconductor crystal. This confinement can be at a semiconductor insulator interface, as is the case for Metal-Oxide-Semiconductor Field-Effect-Transistors (MOSFETs), which are the major electronic component of silicon chips, or it can be at a semiconductor-semiconductor crystal interface as is the case for GaAs-AlGaAs heterostructure systems. Studies of the MOSFET system in large (approx. 10 Tesla) magnetic fields by Klaus von Klitzing resulted in the discovery of the Quantum Hall Effect (QHE) in 1980 and a Nobel Prize. Further studies in the GaAs-AlGaAs system, where there is much less scattering due to the crystalline nature of the interface, lead to the even more startling discovery of the Fractional Quantum Hall Effect (FQHE), which results from cooperative behavior of the electrons within the 2DES, a couple of years later. We have been studying these systems for a number of years. Because the interesting collective behavior of the 2DES occurs at very low temperatures, below 1 K, and because large magnetic fields are necessary to observe the QHE, we have developed a state-of-the-art laboratory which includes a high field superconducting magnet (16 T) and a dilution refrigerator which can reach temperatures as low as 7 mK. Lately we have been concentrating on the behavior of specially prepared Si MOSFETs which were prepared in Russia and brought to our group by **Sergey Kravchenko**, who was a post-doc with us for three years.

Silicon MOSFETs are particularly interesting because the 2DES electron density can be systematically varied by changing the gate potential. We have been interested in the dramatic changes in conductivity seen in this system as the 2DES density and magnetic field are changed. In particular we have been interested in the Global Phase Diagram for this system. This is the phase diagram which maps out the boundaries between the various QHE states, the highest magnetic field insulating state and the B=0 state. In 1994 (Physical Review B, 49, 2250(1994)), these studies lead to the confirmation of the Hall insulator state which has no conductivity in the usual sense but has a well defined Hall resistance. This state is closely related to the QHE. Further studies lead to a relatively complete picture of the Global Phase Diagram (Physical Review Letters, 75, 910(1995)).

As we pursued these studies to lower and lower magnetic fields, we discovered a very unexpected behavior at B=0. Based on very general and powerful arguments, P. W. Anderson, the Nobel Prize winner, and others showed that the noninteracting 2DES is always an insulator at T=0 and B=0. This implies that there can be no conductivity transitions, in fact that there can be no phase transitions, for the 2DES for B=0. However we observed clear indications of such a transition (Physical Review B, 50, 2250(1994) and 51, 7038(1995)) including clear evidence for scaling behavior with 2DES density and temperature. We are now expanding these studies to include the effects of an applied electric field and a small applied magnetic field.

This has been an extensive and fruitful collaboration with researchers in Canada at the National Research Council in Ottawa, Marie Diorio; in Russia at the Institute for High Pressure Physics in Moscow, Vladimir Pudalov, and here at OU, Sergey Kravchenko, Post-doc.; **Whitney Mason**, doctoral student, Scott Wilkin and **Jason Smith**, masters students; Allison Japikse and George Bowker undergraduates from Bowdoin College, Bianca Nelson, undergraduate from Iowa University, Derrick Kiker and Nicole Belcher, OU undergraduates. **Sheena Murphy**, who joined us this past year, has also been involved with these studies lately. **Bruce Mason** and **Kieran Mullen** have also provided theoretical support for this effort with their students **Tim Kwiatkowski,** Chuck Hembree, **Terry Downard**, and **Tommy Ericson**. We have also been very successful in producing

publications, 21 in the past three years, 22 talks, including a prestigious invited talk at this year's American Physical Society March Meeting in St. Louis, and invited talks at two international conferences in Europe this summer, and external research support, over $1,500,000 in the last five years. We feel that we are truly putting OU on the map as far as solid state physics is concerned.

John Furneaux

THE PAPER CHASE:

Recent Publications

"Radio Observations of the Type Ia Supernova 1986G as a Test of the Symbiotic-Star Progenitor Scenario", **C. Eck, J. J. Cowan**, D. Roberts, F. R. Boffi, and **D. Branch**, ApJ, 451, L53.

"In Search of the Progenitors of Type Ia Supernovae", D. Branch, M. Livio, L. R. Yungelson, F. R. Boffi, and **E. Baron**, PASP, 107, 1019 (1995).

"Evidence for a Spectroscopic Sequence Among SNe Ia", **P. Nugent**, M. Phillips, E. Baron, D. Branch, and P. Hauschildt, ApJ, 455, L147 (1995).

"Non-Abelian Finite-Element Gauge Theory," **K. A. Milton**, Nucl. Phys. B 452, 401 (1995)

"Non-LTE Treatment of Fe II in Astrophysical Plasmas", P.H. Hauschildt and E. Baron, Journal of Quant. Spectroscopy and Radiative Transfer, 54, 987 (1995).

"Exact Results for Spatio-Temporal Correlations in a Self-Organized Critical Model of Punctuated Equilibrium," S. Boettcher and M. Paczuski, Physical Review Letters, 76, 348 (1996).

"Universality in Random Walk Models with Birth and Death," C. M. Bender, S. Boettcher, and P. N. Meisinger, Physical Review Letters, 75, 3210 (1995).

"First Measurement of the T-Odd Correlation Between the Z^0 Spin and the Three Jet Plane Orientation in Polarized Z^0 Decays to Three Jet Events", K. Abe, M. Strauss, et. al., (SLD Collaboration), Phys. Rev. Lett., 75, 4173 (1995).

"Measurement of the Average B Hadron Lifetime in Z^0 Decays Using Reconstructed Vertices", K. Abe, M. Strauss, et. al., (SLD Collaboration), Phys. Rev. Lett., 75, 3624 (1995).

"Measurement of the Left-Right Forward-Backward Asymmetry for Charm Quarks with D^{*+} and D^+ Mesons", K. Abe, M. Strauss, et. al., (SLD

Collaboration), Phys. Rev. Lett., 75, 3609 (1995).

"Aperture Effects and Limitations on the Accuracy of Ground-Based Spectrophotometry of Active Galactic Nuclei", B. M. Peterson, R. W. Pogge, I. Wanders. S. M. Smith, and **W. Romanishin**, PASP, 107, 579 (1995).

"A Snapshot of the Continuous Emission of the Active Galactic Nucleus in NGC 3783 from Gamma-ray to Radio Wavelengths", D. Alloin and 24 co-authors, including W. Romanishin, Astronomy and Astrophysics, 293, 293 (1995).

"The Galaxy Component and Nuclear Flux Measurements of NGC 5548 from Direct Imaging", W. Romanishin, T. J. Balonek, R. Ciardullo, H. R. Miller, B. M. Peterson, A. C. Sadun, G. M. Stirpe, K. Takagashi, B. W. Taylor, and V. Zitelli, Astrophys. J., 455, 516 (1995).

"Steps Toward Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei. VIII. An Intensive Study of NGC 5548 at Optical Wavelengths", K. T. Korista et al., - W. Romanishin is one of 111 co-authors, Astrophys. J. Supp., 97, 285 (1995).

"A New Look At Carbon Abundances In Planetary Nebulae I: PB6, Hu2-1, K648, & H4-1", **R.B.C. Henry**, K.B. Kwitter, and **J.W. Howard**, Astrophys. J., 458, 215 (1996).

OU OBSERVATORY NEWS

The new 16 inch Meade telescope is operational. The Departmental shop folks did a lot of nice work to adapt the Meade mounting to the existing concrete pier in the observatory.

We recently took delivery of a Santa Barbara Instrument Group ST-8 astronomical CCD camera. This has a 1530 x 1020 pixel Kodak CCD chip. The CCD, while not quite of the technical sophistication of those at the major observatories, is a serious educational and scientific research instrument. "First light" on the CCD (actually the inside of the dome, due to the cloudy weather this month!) has been achieved. I will use the CCD camera this spring in teaching ASTR 4512, "Observatory Methods". After we get a few more minor gizmos (dedicated PC, filter holder, electrical focuser) the telescope will be available for small student research projects in observational astronomy.

Bill Romanishin

NURO NEWS

Bill Romanishin led an expeditionary force of six OU astro undergraduates into the wilds of northern Arizona to attempt astronomical observations with the 31 inch telescope of the National Undergraduate Research Observatory (NURO) near Flagstaff, AZ. The late December weather did not cooperate, and the telescope was closed for all but one hour of the four nights scheduled. However, the trip for the undergrads (Dean Richardson, Sean Pullen, Jennifer Deaton, Tuck Goon, Hajime Muramatsu, and Andy Webb) wasn't a total loss-they took long detours on the way to Flagstaff to see the Very Large Array radio telescopes in New Mexico and the optical telescopes at the national observatory on Kitt Peak in southern AZ, and made the obligatory visit to the Grand Canyon.

At the annual NURO meeting in January 1996, held in conjunction with the American Astronomical Society meeting in Tucson, Bill Romanishin was elected to the position of Chair of the Steering Committee of NURO. He had the dubious distinction of chairing the NURO annual meeting in San Antonio, TX, in January, and looks forward to the same in Toronto next January (Toronto in January?).

LEAVE ME ALONE!

SABBATICAL NEWS

On my sabbatical I traveled extensively. In addition to the two meetings listed below, I made three research trips. The first was to Kitt Peak National Observatory in Tucson to collaborate with Chris Sneden, who is on sabbatical for the year from UT. Sneden and I are working on several long-term projects including HST observations (Cycle 4, Cycle 5 and this year Cycle 6) of metal-poor halo stars in the Galaxy. In addition, we finished writing up a paper on the very unusual star CS 22892. We have observed thorium in this star, leading to our lower limit age estimate for the Galaxy and the universe of 15 +/- 4 Gyrs.

I also visited Jim Truran at the University of Chicago. Jim is also part of our HST project. In addition, Jim, Chris and I are working on several other papers regarding chemical evolution of the Galaxy. Along with Friedel Thielemann, Jim and I are also working on a new graduate astrophysics text.

My next stop was to visit Friedel in Basel, Switzerland, where he is now Professor at the University of Basel. Friedel and I are working on a project to understand the formation of the very heavy, radioactive elements, in addition to collaborating on the new book.

While visiting Friedel in Basel (about the size of Norman), I thought I was pretty well separated from Oklahoma and OU. I was invited out to dinner with Friedel, one of his students and a Swiss visitor, who turned out to be a candidate for a solid-state faculty position. We were in a small Swiss restaurant having fondue when the visitor, Daniel Loss, asked me where I was from. I replied Oklahoma, and he said, "Oh, do you know my good friend Kieran Mullen at OU?" It is truly a small world.

John Cowan

TEACHING NEWS

Kim Milton continues work on his innovative textbook for graduate electrodynamics, scheduled for completion in June, 1997, and available in most airport bookshops soon thereafter. (Just kidding, Kim!)

Ed Baron had his Introductory Astronomy students read very current astronomy-related newspaper articles and write short essays on them. He says he received very favorable feedback on it, and it brought daily events into the classroom.

RESEARCH TRAVEL

Kim Milton, Mike Strauss, and **George Kalbfleisch** traveled to Fermilab on 1/19/96 to present an experimental proposal for monopole search

entitled "A Search for Low Mass Monopoles".

Ed Baron went to Stockholm in December to begin a collaboration with Claes Fransson's group in impact of circumstellar interactions on supernova spectra.

Stefan Boettcher visited his collaborator at Brookhaven Lab in NY in September.

Mike Strauss went to Fermilab on Nov 29-Dec 1 to attend the Upgrade meeting to discuss the detector upgrade, particularly OU's part in the silicon vertex detector upgrade.

VISITORS

Francesca Boffi of STScI and Bologna spent a week here in December working with the supernova group on predicting the radio emission from supernovae, and on interpretating recent ground- and space-based data that pertain to light echoes around supernovae.

Maarten Goltermann visited Kim Milton during 10/4-10/6/95, to work on species doubling in lattice gauge theories.

Maya Paczuski from Brookhaven Lab visited Stefan Boettcher during Nov. 29-Dec. 3 to work on Self-Organized Criticality.

CASH FLOW: NEW GRANTS

E. Baron (PI) and Faculty in Physics and Astronomy and Chemistry received $300,000 from the IBM Corporation under their Shared University Research Program in October for their proposal "A High Performance Computer for Physics, Astronomy and Chemistry Research, Development, and Training". (See Ed's discussion of the new supercomputer above.)

Ed Baron, along with S. Kahana (BNL) and J. Cooperstein (Oregon State) received 100 hours supercomputer time from the US DOE's National Energy Research Supercomputer Center Program. The grant runs from 11/95-9/96.

Bill Romanishin and John Cowan received $7,523 from NASA for their proposal "X-rays From The Central Radio Source in NGC 7331". Their work will involve the use of X-ray data from the ROSAT satellite.

Bill Romanishin received $11,425 from the NSF ILI Program for his proposal "A Modern Teaching Telescope for the OU Campus Observatory". (See Bill's blurb on the new OU Telescope above.)

MEETINGS ATTENDED

Kim Milton attended the Third Workshop on "Quantum Field Theory Under the Influence of External Conditions", Leipzig, September 18-22, 1995, where he was the lead speaker and chair of a session. He spoke on "Casimir Energy for a Spherical Cavity in a Dielectric: Toward a Model

for Sonoluminescence,".

Tad Thurston attended the 11th IAP Astrophysics Meeting in Paris, France, on 'The Interplay Between Massive Star Formation, the ISM and Galaxy Evolution", July 3-8, 1995. He presented a poster on his thesis work on "N/O in Spiral Disks: A New Algorithm for Abundance Determinations", by T. Thurston, M.G. Edmunds, and R.B.C. Henry.

Several astronomers attended the January meeting of the American Astronomical Society in San Antonio, and presented posters. Individuals and posters are:

1. Tad Thurston: "N/O in Spiral Disks: A New Algorithm for Abundance Determinations", by T. Thurston, M.G. Edmunds, and R.B.C. Henry.

2. Dick Henry: "Nitrogon-rich and Sulfur-rich Gas in the Crab Nebula", by R.B.C. Henry, G.M. MacAlpine, S.S. Lawrence, and R.L. Sears (U. Michigan).

3. **Jim Buell**: "AGB Models, Yields of Helium and CNO Products From Intermediate Mass Stars, and Planetary Nebula Abundances", by J. Buell**,** R.B.C. Henry, and E. Baron.

4. **Scott McCartney**: "A Statistical Study of the O'Connell Effect of W UMa Binaries", S.A. McCartney.

5. Joe Howard: "A Detailed Abundance Analysis of Nine Halo Planetary Nebulae", J.W. Howard, R.B.C. Henry, & S. McCartney.

6. Pete Nugent: "Evidence for a Spectroscopic Sequence Among SNe Ia", P. Nugent.

Ed Baron attended the "Symposium on Nuclear Astrophysics", Pasadena, CA, in Dec, 1995.

Stefan Boettcher went to the meeting on "Dynamics Days" in Houston, TX, Jan. 3-6, where he presented a poster entitled "Exact Results for Self-Organized Critical Model of Punctuated Equilibrium".

Ken Eack recently attended two meetings: 1) USAF Phillips Lab Workshop on Sprites (upper atmospheric discharges), October 16 and 17, Hanscom AFM (Boston MA), presenting the paper "Observations of X-rays and Electric-Field Above Thunderstorms: Relevant to Optical Sprites?", K. Eack, W. Beasley, W.D. Rust, T. Marshall, M. Stolzenburg; and 2) American Geophysical Union Fall Meeting, December 11-15, San Francisco, presenting the paper "Simultaneous Observations of X-rays and Electric Field in Thunderstorms", K. Eack, W. Beasley, W.D. Rust, T. Marshall, M. Stolzenburg.

John Cowan has recently attended two meetings: 1) "Nucleosynthesis Constraints on the Early Evolution of Galaxies and the Universe, " Cambridge, MA (September 21-23, 1995) (Al Cameron's 70th birthday party meeting); and 2) "Symposium on Nuclear Astrophysics: A Celebration of Willy Fowler," Pasadena, CA (December, 13-15 1995)

COLLOQUIA, INVITED TALKS

Kim Milton, "Finite Element Gauge Theory", OU, 10/19/95.

Stefan Boettcher presented the talk "Exact Results for Self-Organized Critical Model of Punctuated Equilibrium" at Lancaster U in UK on Oct. 19 and at Imperial College in London on Oct. 16.

Ed Baron presented the talk "NLTE Modeling of Supernovae", at Stockholm Observatory, Saltsjoebaden, Sweden, Sept., 1995. Also, he spoke on "The Application of SNe Ia to Cosmology", at Rice University in November.

DREAMS AND PLANS

Hopefully, Fermilab PAC will approve the HEP proposal to search for magnetic monopoles in discarded detector material from D0 and CDF experiments at Fermilab. "We will be able to reduce cross section limits by at least three orders of magnitude, increase mass limits to several hundred GeV, and maybe even find the elusive beast!" says Kim Milton.

Mike Morrison will be in Australia for an extended stay later this year beginning after the end of the spring semester. He will be working at the Australian National University in the Atomic and Molecular Physics Laboratories with Robert Crompton, Malcolm Elford, and Steve Buckman. He will also be giving lectures at several universities around Australia on Teaching Science to Non-science Students (ie, about the Science in Contemporary Cultures courses he's been teaching at OU). Support for this trip comes from the Fulbright Foundation on a Senior Scholar Grant he's been awarded.

ALUMNI NEWS

OU Physics Alum Fields Nation's Top High School Science Team

A marching band and feature articles in major newspapers heralded the return of Arthur Altshiller, BS '63bs, and the Van Nuys (Calif.) High School Science Team following the team's triumphy in the National Science Bowl Championship in May, 1995.

Altschiller coached the Van Nuys science team to a victory over 54 high school teams at the national competition in Washington, D.C. The team answered questions dealing with biology, chemistry, physics, astronomy, earth science, computer science and mathematics.

The team won a 4'9" trophy and an all expense paid trip to Prudhoe Bay, Alaska, in the summer. They spent a week exploring glaciers and doing field work for an oil company. The team was honored at Los Angeles City Hall and with free tickets to Disneyland. The Los Angeles Times and Daily News wrote feature articles about the team which also received broadcast coverage.

Altschiller has taught physics at Van Nuys Math/Science Magnet High School since 1971. He also is the Mensa Club sponsor and is a math instructor at Valley College, Van Nuys.