

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

ΦYAST ΦLYER

The Department of Physics & Astronomy

The University of Oklahoma

Volume 1, Number 2 Winter 1993

Dick Henry, Editor

FROM THE CHAIR: REFLECTIONS ON 1992

The past year has been a remarkable one for our Department. It witnessed significant gains but also the passing of a pioneer figure, Dick Fowler.

The gains are easy to enumerate. Most important are the gains of new people. Mark Keil joined us as an associate professor from the University of Alberta. His enthusiasm and appetite for hard work make it apparent to all what a steal he is. (A similar comment could be made concerning the complete laboratory he took with him from Alberta!) This successful hiring was made possible by the hard work of the atomic, molecular, and chemical physics search committee chaired by Deborah Watson. Mark holds a chemistry Ph.D. from Cal Tech and specializes in reactive scattering, which is also theorist Greg Parker's area, so we are truly building on strength. (Greg was awarded the 1992 Regents' Award for Superior Research and Creative Activity.) A second faculty search committee, chaired by John Furneaux, was also successful in finding a person to fill our applied physics position associated with the MBE (molecular beam epitaxy) laboratory which will be operational late this spring. Mike Santos will join us this summer as a new assistant professor. He comes to us from AT&T Bell Labs, where he is post-docing after finishing a Ph.D. in electrical engineering at Princeton University. This year we also were able to recruit new staff members. Barry Bergeron stepped into Joel Young's position in the instrument shop when Joel became our instrument shop supervisor after Gene Scott's retirement last spring. Yousong Zhang (one of our own Ph.D.'s and now a post-doc at Columbia University) accepted the position of Research Equipment Specialist. We expect him to arrive early this year. Our staff now numbers nine! Wei-guo Sun joined our wonderful group of post-docs, now numbering eight, while 15 new graduate students came to the Department in 1992.

The Department's external funding in fiscal year 1992 reached \$1.34M, an all-time high, and we expect this funding figure to reach \$2M in the current fiscal year. While some of the credit for the handsome increases belongs to substantial new group funding in the Department, such as the grant supporting the MBE project and the magnificent group grants in the high energy physics group, much of our funding is still based on individual investigator grants, and the increases also reflect several new grants obtained by the faculty. Of course, money grubbing is not what we are all about; the real meaning of the increases in external funding is that we are doing exciting science and being recognized for it.

Our four research groups are all embarked on exciting directions for the 90's. The Astronomy and Astrophysics group has decided to seek funds to build a one-meter research telescope in western Oklahoma to be operated remotely from Nielsen Hall. The arrival of experimental reactive scattering at OU in the person of Mark Keil gives great impetus to the Atomic, Molecular, and Chemical Physics group. Heavy involvement of the High Energy Physics group in the development of the Superconducting Super Collider (SSC) will continue to grow. When the MBE machine is

installed in Nielsen Hall this spring, it will not only provide a showpiece of sophisticated research equipment, but a focal point for the research activity of the Solid State and Applied Physics group.

Success in research does not mean that we are slacking off on teaching and service. Two of our faculty garnered teaching awards in 1992; Dick Henry received the AMOCO Foundation Good Teaching Award and Stu Ryan was given the Regents' Award for Superior Teaching. Stu is also known for his statewide service to Oklahoma's school children as Dr. Indestructo. Tibor Herczeg and Bill Romanishin continue to offer monthly open-house nights at the OU observatory.

What do we wish for ourselves in 1993? Continued success in our teaching, research, and service mission is certainly our first wish. But right up there is our wish for a sorely needed annex to Nielsen Hall. The past year saw some progress when the item "Nielsen Hall Annex" was finally recognized as part of OU's master plan. Our present space limitation is a real factor in our ability to do our work and, with an annex, we would be able to carry out an expanded and more efficient program.

Anyone who reads Dick Fowler's history of the Department is impressed by his tremendous involvement over the many years of his career at OU with the welfare of the Department. Our accomplishments in 1992 build on this long tradition.

Ryan Doezema

SPRING COLLOQUIUM SCHEDULE

2/4	B.Stwalley	Iowa AM
2/11	S.Kravchenko	Nottingham SS
2/18	H.Hansson	Stockholm AST
2/25	K.Popper	OU Hist-Sci
3/4	TBA	
3/11	Spring break	
3/18	K.Liu	Argonne NL AM
3/25	TBA	
4/1	D.Deming	GSFC AST
4/8	TBA	
4/15	T.Herczeg	OU AST
4/22	H.Drechsel	Bamberg AST

RICHARD G. FOWLER (1916-1992)

Richard G. Fowler, George Lynn Cross Research Professor Emeritus at the University of Oklahoma, died in Norman, October 8, 1992, after a long struggle with cancer. His research in radiative lifetimes, lightning, and gaseous electronics was at the center of the department's graduate program as it grew in size and recognition during the decades following World War II.

Fowler was born in Albion, Michigan, on June 13, 1916. He graduated with a degree in chemistry and mathematics from Albion College in 1936,

worked for Dow Chemical for two years, and earned a Ph.D. in physics at the University of Michigan in 1942. His dissertation on radiation of low voltage areas was directed by Ora Duffendack. After teaching a year at North Carolina State University and three years of spectroscopic research at Michigan, Fowler joined the physics faculty at the University of Oklahoma in 1946, where he remained until his retirement in 1980. His tenure at Norman was punctuated by a Guggenheim Fellowship in 1953 at Oxford University and a NATO fellowship in 1971 at the University of Giessen in Germany. He chaired the department 1956-1960 and 1966-1968. At his invitation about a dozen visiting foreign scholars each spent a year or more at Oklahoma. This proved to be very stimulating to faculty and graduate students alike.

Fowler's work was both experimental and theoretical. He began in ultraviolet spectrochemical analysis and determination of organic structure by infrared techniques. He was fond of pointing out that his most cited book was one of his earliest--a report on the methods used for determining the structure of penicillin, which he co-authored with colleagues at Michigan, Harrison Randall, Robert Dangel, and Nelson Fuson. At Oklahoma, he became interested in electrically generated shock waves and plasma driven shock tubes. These interests led to the need for better data on lifetimes of atomic and molecular excited states to support refinements in diagnostic techniques. Among his contributions are the development of methods for optically measuring electron temperature transients, and clarification of the nature of electrical breakdown wave propagation. He established that precursors arising from shock waves are electron fluid dynamical in nature rather than electromagnetic. He supervised twenty-five doctoral students.

Fowler was active in the profession as well. He was a Fellow of the APS and headed the Fluid Dynamics Division from 1967 to 1969. When the Division established an annual lecture in memory of his old friend and mentor, Otto Laporte, Fowler was asked to deliver the first one, which was subsequently reprinted as the cover article in *Physics Today* (Nov. 1973). His terms as chairman of the OU Physics Department from 1956-60 and 1966-68 were periods of growth in both graduate enrollment and funded research. He recognized early the obstacles confronting women who want to pursue careers in physics. While department chair in the mid-1960's, he instigated a program to encourage young women by recruiting women role models to the faculty, and by providing tailored academic support, and mentoring.

Fowler was deeply concerned about the inequitable distribution of the world's wealth, the squandering of nonrenewable resources, and pollution of the planet. In the early 1980's, following his retirement, he was a co-founder of the Oklahoma Institute for a Viable Future. His papers using the mathematical tools of kinetic theory to model population growth are deserving of careful scrutiny by demographers.

Among the qualities his colleagues and former students will miss most are his enthusiasm, optimism and humor. His willingness to get his hands dirty and do what needed doing, which was seen daily in the laboratory, was typified by his hiking to the neighborhood park to lubricate the playground equipment. His voracious reading and his worldwide travels gave him a breadth of knowledge in history, literature, music and art that few could rival. He remained a role model to the end--showing remarkable dignity and courage dealing with the illness that took his life.

Robert St. John

Roger N. Blais (University of Tulsa)

WHAT'S UP IN SOLID STATE?

These are exciting times in the physics department's solid state and applied physics research groups. In the past year we have been involved in the beginning of a multi-discipline materials science laboratory, the purchase of a state-of-the-art crystal growing machine, and the hiring of a new professor and research staff for the laboratory. These changes will stimulate and broaden our current research programs and open many new areas for the future.

The "Laboratory for Electronic Properties of Materials" (LEPM) is a collaboration of physicists, chemists, electrical and chemical engineers here at the University of Oklahoma funded by the National Science Foundation and the state of Oklahoma. This eclectic group is tied together by an interest in the properties of the surfaces and interfaces of materials. The physicists and electrical engineers in this group are primarily interested in growing different semiconductors one on top of the other with nearly perfect interfaces between them. These "heterostructures" have electronic and optical properties that are different from anything seen in single material systems and have many applications in both physics and semiconductor devices.

The centerpiece of LEPM is a Molecular Beam Epitaxy crystal growing machine that will be housed in the southeast corner of the basement of Nielsen Hall. This revolutionary growth technique uses ultra-high vacuum and precise control over the atoms evaporating onto the sample surface to produce high purity crystals with structures possible down to a single atomic layer (about 5 Angstroms). Two different materials can be grown together with a perfect interface, as if they are a single crystal. Our MBE machine was ordered this past fall from Intevac, and is due to arrive this April. This 1.5M "Cadillac" of MBE machines has two growth chambers for two different materials systems, an analysis chamber for studying the samples being grown without taking them out of vacuum, and many customized additions for the study of the physics of crystal growth.

The operation of such an advanced crystal grower is as much an art as a science, and we have been lucky in hiring two top notch people for the job. Mike Santos, a recent graduate from Princeton University, has been hired as an assistant professor and will be in charge of the MBE machine along with Helmut Fischbeck. At Princeton, Mike was a vital member of a group that is recognized as producing among the highest quality MBE samples in the world. Mike's expertise will be invaluable for a fast start to our crystal growing ventures. We have also been fortunate in bringing Yousong Zhang, a 1991 Ph.D. graduate, back to Oklahoma as a research technician. Since leaving O.U., Yousong has been working as a postdoc at Columbia University running experiments to test materials grown there. He will have similar duties with LEPM, as well as helping with the operation of the MBE machine. LEPM has also been fortunate that Xue Sen Wang, an expert in surface science and tunnelling microscopy, has been hired by the electrical engineering department as a visiting professor. He is a great addition to the collaboration.

Of course, LEPM could not have been established without the abilities of the researchers already here. The infrared spectroscopy and high magnetic field laboratory, run by Ryan Doezema and John Furneaux and their students, is up and running after fights with helium dewars and spectrometers. Along with the current research on GaAs and InAs systems, this lab will be used to study the electronic properties of the new materials grown in the MBE machine. The venerable Van der Graff accelerator, still running under the care of Helmut Fischbeck and Stu Ryan, is a unique and useful tool for elemental analysis of materials grown in the lab. Finally, on the theoretical side, simulation programs for the electronic properties of heterostructures are being used to study a range of different systems. This work will be used to help interpret what the characterization experiments are telling us about the microscopic properties of our new materials.

The future looks bright for solid state physics and materials science here at the University of Oklahoma.

Bruce Mason

THE PAPER CHASE: RECENT PUBLICATIONS

"Limit on heavy neutrino in tritium beta decay", M. Bahran and G.R. Kalbfleisch, Phys. Let. B, 291, 336 (1992).

"The beta decay endpoint and heavy neutrino searches", M. Bahran and G.R. Kalbfleisch, Phys. Rev. D (Rapid communication), Feb. 1, 1993.

"Fermi theory of nuclear beta decay and heavy neutrino searches", M. Bahran, W.R. Chen, and G.R. Kalbfleisch, Phys. Rev. D (Rapid communication), Feb. 1, 1993.

"Type Ia supernovae as standard candles", D. Branch and G.A. Tammann, Ann. Rev. Astron. Astrophys. 30, 359.

"Analysis of the photospheric epoch spectra of supernovae Ia 1990N and 1991T", D.J. Jeffery, B. Leibundgut, R.P. Kirshner, S. Benetti, D. Branch, and G. Sonneborn 1992, ApJ 397, 304.

"The subluminal, spectroscopically peculiar Type Ia supernova 1991bg in the elliptical galaxy NGC 4374", A.V. Filippenko, M.W. Richmond, D. Branch, et al., 1992, AJ 104, 1543.

"The BL lacertai object 1E 1415.6+2557: host galaxy, possible optical jet, and environment", W. Romanishin, ApJ 401, L65.

PROPOSALS FUNDED

"Multiphotone probes of molecular spectroscopy and dissociation", M. O'Halloran, NSF, \$248,000, three years.

"Quantitative spectroscopy of supernovae", D. Branch, NSF, \$45,200, one year.

"Abundance gradients in spiral galaxies", R. Henry [with Pagel (NORDITA) and Edmunds (Cardiff)], NATO, \$3500, two years.

Undergraduate research support, B. Romanishin, American Astronomical Society, \$4630.

"Surface photometry of galaxies", B. Romanishin, American Astronomical Society, \$1900.

Workstations for reducing NURO data, B. Romanishin, Research Corporation and OU Research Administration, \$6000.

SEMINARS, INVITED TALKS, ETC.

"Continued fractions and the simplifying transformation", K. Milton, 11/92, University of Kansas.

"Casimir effect from quarks to the cosmos", K. Milton, 11/92, University of Kansas

"Type Ia supernovae and the Hubble constant", D. Branch, Aspen Winter Physics Conference, January.

VISITS:

John Cowan visited the Astronomy Department at Columbia University for a week in December. John is working on a project with individuals there.

MEETINGS ATTENDED:

Kim Milton attended the DPF '92 meeting at Fermilab, where he gave a talk on "Maxwell-Chern-Simons Casimir effect".

Michelle Lamkin, Adria Morris, Adam Fisher, Pete Nugent, Tom Vaughan, Tim Young, Francesca Boffi, Dave Minard, and Bill Romanishin attended the January meeting of the American Astronomical Society in Phoenix. Out of this impressive group, six posters were presented: "Photometric stability of the NURO photometrics CCD" (Lamkin, Morris, Ishibashi, Romanishin), "JHK surface photometry of spiral galaxies" (Romanishin), "Surface photometry and colors of cD galaxies" (Minard and Romanishin), "Post-maximum optical spectra of normal and peculiar SNe Ia" (Fisher, Nugent, Vaughan, and Branch), "Supernovae light curves: clues to the progenitor and explosions, using flux-limited diffusion" (Young, Baron and Branch), and "Filling factors in planetary nebulae", (Boffi).

David Branch attended the January Aspen Winter Physics Conference: The Extragalactic Distance Scale, where he presented a talk on Type Ia supernovae and the Hubble constant.

Tibor Herczeg attended the meeting on "The feedback of chemical evolution on the stellar content of galaxies" held at the Observatoire de Meudon in October.

Dick Henry attended the meeting on "The feedback of chemical evolution on the stellar content of galaxies", held at the Observatoire de Meudon, near Paris, October 12-16, 1992, where he presented a paper on "The effect of cluster environment on chemical evolution of galaxies".

GRADUATE STUDENT NEWS: Focus on Solid State

Graduate students in solid state physics have been keeping busy this year. Tim Kwiatkowski continues to work on transport measurements in the high field lab. He plans to present some of his results at this year's APS March meeting, as well as a followup to his talk there last year on WPQW's. Scott Wilkin spends weekends in the lab doing spectroscopy measurements for his master's thesis. He commutes from Dallas, where he works for TI during the week. Lihe Bu also is finishing work on his doctoral thesis which involves simulations in narrow band gap materials. He published a paper in Phys. Rev. this past summer on his work and is slated to give a talk at the March APS meeting. Chuck Hembree is working on simulations in WPQW's and plans to present a talk on his results at this year's March APS meeting. Hopefully, this work will lead to a followup publication to a paper published in Phys. Rev. last fall. Shuhua Zhang is also presenting his work on activation energies at the March APS meeting.

Jianhua Su is working on laser spectroscopic studies in the high field lab. In addition, Whitney Mason, Dwyane Appling, and Kory Goldammer continue their work in the high field lab, preparing apparatus for this summer's experimental work. Finally, Ping Long and Kevin Sullivan have begun studies in the solid state area. Chuck Hembree

ALUMNI NEWS

Ed Fast (MS 1941; PhD 1946) presently works for Westinghouse Idaho Nuclear Company as a contractor for the operation of the Chemical Processing Plant, doing calculations in criticality safety. Ed was a student of Dr. J.R. Nielsen. He moved to Idaho in 1951, when he went to work with Phillips Petroleum at the Materials Testing Reactor.

Arthur Altshiller (BS 1963) teaches physics at Van Nuys High School in the Math/Science Magnet program. This currently includes two advanced placement and three honors courses. In addition, he teaches math at Los Angeles Valley College in the evening. He recently presented a talk entitled "Dark matter, the pinch effect, and cosmology to reinforce A.P. physics curricula" at the November, 1992, meeting of the Southern California section of the American Association Of Physics Teachers, held at California State University, Northridge. Mr. Altshiller is included in the 1992-1993 edition of Who's Who In The West, In California, In American Education, and Among American Teachers.

John Shibley (BS 1941), now retired, went on from OU to obtain a doctorate in zoology. He spent the remainder of his professional life teaching biology at LaGrange College in Georgia.

The editor thanks those who sent in news and encourages others do so from time to time.

AD ASTRA PER ASPERA: Astro Undergrads Go Observing

The National Undergraduate Research Observatory (NURO) is a consortium of colleges and universities which runs a 31 inch research telescope at a site near Flagstaff AZ that allows undergraduates an opportunity to take part in all aspects of actual astronomical research. OU undergraduates have had the opportunity to participate in actual astronomical observing thanks to the enthusiasm of Bill Romanishin. Romanishin took eight undergraduates to the NURO site in March 1992, three students in September, and seven students over the recent holidays. Two undergraduates, Michele Lamkin and Adria Morris, presented the results of a project done in March at the Mid-America Regional Astrophysics Conference in Kansas City in April 1992. They are now writing up the results for publication. In addition, Lamkin and Morris, along with K. Ishibashi and B. Romanishin, presented a paper on the photometric stability of the NURO system at the January meeting of the American Astronomical Society in Phoenix.

FOCUS ON TEACHING

Two members of the Department are teaching special seminars during the spring semester in the Honors program. Mike Morrison is teaching a course entitled Science-in-Fiction. This course explores the interaction between science and culture via a wide variety of novels, short stories,

scientific essays, and films. The perspective of the course is that in the modern world this interaction is a dialogue, with the culture influencing science even as it tells itself stories about science and its impact. The course focuses on how scientific concepts and the figure of the scientist function in various cultural forms and on the ideologies and messages implicit in fictional renderings of science. The course begins with the prototypical 19th century SF novel {\bf Frankenstein} and the mechanistic model of science which predominated during the era of its composition, then moves rapidly into the 20th century, where students read generic SF works, scientific essays and excerpts from scientific biographies, mainstream novels, and short stories by American and British authors in order to understand how contemporary culture views the content, human dimensions, ethical implications, and moral consequences of science and technology. Broadly speaking, the goal of this course is to help students develop a critical understanding of scientific and literary issues that are germane to the culture in which they live. More specifically, this course seeks to help students understand the nature of modern science, its goals and limitations; sharpen their ability to perceive the various roles science plays in the culture, how science and technology have altered our conception of ourselves as human beings, and what our culture is saying to itself about science; introduce them to several different kinds of literature (including serious scientific writing); and help them learn how to develop and critique their own ideas, primarily through writing in various forms (private, impromptu, and in greater depth in essays).

Dick Henry has teamed up with Doug Elmore in Geology to teach a course entitled "Geological and Cosmological Evolution". The class is considering six topics centered on controversial issues related to both fields: "Why are the geologies of Venus and Earth so different?", "Solar evolution: where are all the neutrinos", "Rivers: should the Mississippi be allowed to change its course?", "The age of the earth", "The future of the universe: the problem of dark matter", and "The K-T boundary and dinosaur extinction: was it caused by an asteroid?" A continuing theme will be the physical laws which underlie all of these questions. The course will be highlighted by student presentations addressing specific questions related to each of these topics. Both science and non-science majors are enrolled in the course, which is a spin-off from an intense seminar taught by Doug and Dick in December and January in the College of Liberal Studies.

Finally, a couple of the more traditional style physics courses are being offered during the spring semester as part of the Honors program. John Furneaux is teaching "Physics II for majors" and Jack Cohn is teaching "Physics for engineering and science majors".

WELCOME BACK, TIBOR!

Tibor Herczeg returned in late December from a fall mini-sabbatical leave which was spent at the Observatoire de Paris. Tibor began studying the evolution of the helium abundance as part of galactic evolution. While in Europe, he gave lectures at the Observatoire de Meudon and Budapest Observatory ("Statistical Studies of Pulsars") and the Munich Observatory ("Neutron Star Masses"). He also attended the October meeting at the Observatoire de Meudon on "The feedback of chemical evolution on the stellar content of galaxies". He hopes to continue working on the helium problem. Bon chance avec l'evolution galatique, Tibor!

NIELSEN PRIZE LECTURE PRESENTED BY ROBERTS

Doug Roberts, who completed his doctorate in astrophysics in 1992, for which he received the Nielsen Award for his outstanding thesis "A study of the neutral and ionized gas in the interstellar medium and galactic H II regions", returned to present a Department colloquium on his research on January 22, on a related topic Doug is currently a postdoc in the Department of Astronomy at the University of Illinois. While he was a student at

OU, Doug's advisor was John Cowan. Doug also presented a summary of his thesis at the January meeting of the American Astronomical Meeting in Phoenix.

DEADLINE

The spring issue of the newsletter will be published during the last week of April. Please submit your news and gossip by Friday, April 23. I especially invited alumni to let us know what they are up to! Dick Henry