

Spectrum

a Newsletter for Alumni and Friends of the Department of Physics and Astronomy and the University of Nebraska-Lincoln

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Timothy Gay, Editor

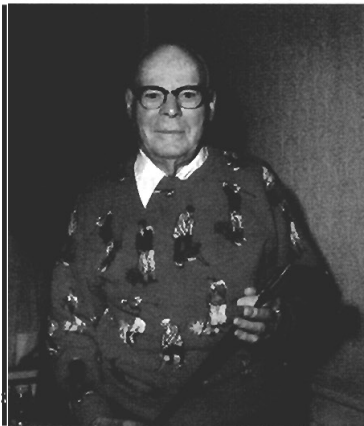
Jorgensen Golf Book Feted by Publisher

The publication of the book entitled *The Physics of Golf* by Professor Emeritus **Theodore P. Jorgensen, Jr.** was celebrated on January 21st, 1994 at a wine and cheese reception sponsored by the American Institute of Physics (A.I.P.) and the Department and organized by Professor **Robert Fuller**. The reception was held in the French Room of the Lincoln University Club. Invitations were sent to neighboring physics departments, golf teachers in Lincoln, local booksellers, and a wide cross section of the University and local community. About 60 friends and avid golfers attended.

Michelle Matozzo, of the A.I.P. Press, led off the program with the news that Jorgensen's book was A.I.P.'s best selling publication for the month of December 1993. She also mentioned that a Japanese translation was in the works. Stan Liberty (Dean of Engineering), Donal Burns (Associate Executive Vice President & Provost), Ken Hambleton (*Lincoln Journal-Star* sportswriter), and Dale Hardy (professional golfer) followed with remarks on the book and their experiences with Ted both on and off the golf course. Ted

Jorgensen then related how the book came to be. He said he didn't actually start playing golf until he was in his 50s and, "after five years of frustration, began taking a close look at the theoretical aspects of the game."

The book has been favorably reviewed in both *Physics Today* (June 1994) and *Nature* (24 March 1994). The former review is by Robert K. Adair of the Yale Physics Department, the latter by Stephen Salter of the Mechanical Engineering Department at the University of Edinburgh. The *SPECTRUM* review, by Professor Donal Burns, appears on p. 4 of this issue. The book is now in its second printing.



Ted Jorgensen in golf regalia at the reception in honor of the publication of his book, 'The Physics of Golf'.



Attendees of the Rudd Festspiel gathered in May to honor M. Eugene Rudd (front row center, flanked by conference co-chairmen Anthony Starace[l] and Timothy Gay[r]).

Department Holds *Festspiel* For Rudd

A scientific symposium in honor of **M. Eugene Rudd** upon his retirement was held by the Department last May. Its topic was "Two-Center Effects in Ion-Atom Collisions." The Symposium was organized by Professors **Gay** and **Starace**, former UNL faculty member **Joseph Macek** (now at Oak Ridge National Lab and the University of Tennessee), one of Rudd's former students, **Robert DuBois** (UNL Ph.D.'74, now at Battelle Labs), and scientific colleague Yong-Ki Kim of the National Institute of Standards and Technology. Support for the two-day meeting was provided by both the University and the National Science Foundation. More than fifty scientists from the United States, England, Germany, the Netherlands, and Argentina were present. Four scientific sessions comprised twelve talks and a number of poster presentations by leading physicists in areas that were pioneered by Professor Rudd. The primary emphasis of these sessions was on phenomena

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Chairman's Letter

We live in interesting times! Just when newly-fledged Federal science policies were beginning to have an influence on science funding agencies, government research labs, and university science departments, the political complexion of Congress has changed. The new policies emphasize the application of science research to national needs, including particularly economic development, industrial competitiveness, matters of health, and environmental preservation. The recently elected Congress, however, has indicated its lack of confidence in the ability of government to select the most promising research directions for the future. While it is too early to determine what changes in science policy will occur, it seems likely that scientists will get less direction from Congress than in the recent past as to what research to pursue. These recent political events have confirmed for me the virtues of a balanced approach to charting the future course of a department such as this one. Our approach must seek balance between the various subdisciplines of our field, between experiment and theory, and among the three missions of the department: research, teaching, and service.



Anthony F. Starace

Academic Program Review

Such a balanced approach for future development was strongly endorsed by the Review Committee which visited the Department last March for two intensive days and subsequently made its recommendations to the Department and upper level university administrators. The review committee members were: Helmut Abt (of Kitt Peak National Observatory and the editor of *The Astrophysical Journal*), Jack Bass (a condensed matter experimentalist from Michigan State University who chaired the Review Committee), Thomas Ferbel (a high energy experimentalist from the University of Rochester), Dan Larson (an atomic experimentalist and department chair at the University of Virginia), Gerry Johnson (of the UNL Math & Statistics Dept.), Kenny McLaughlin (a graduate student and member of the Department's Graduate Committee), Mary Krasovec (a physics major and former SPS Vice President), and Craig Eckhardt (of the UNL Chemistry Dept. and UNL Academic Program Committee Monitor). Academic Program Reviews (APRs) are carried out by UNL departments every 6 years. The department involved develops a self-study document pulling together data on all aspects of its activities, its staff, and the students it serves. It also presents its own plans for its future development. The data and its plans are then considered by the Review Committee, which includes experienced faculty from other institutions. The Self-Study exercise is extremely useful to the department involved as a means of taking stock of its activities and their effectiveness and of the directions it wishes to pursue. The Review Team also

serves a valuable role in bringing to the department's attention alternative ways to accomplish its goals and activities.

We still have a number of copies of our Self-Study Report, which I would be happy to send to interested alumni and friends. Briefly, *in research* the Department plans to complete the formation of significant research groups in four mainstream areas of our discipline: (1) astronomy and astrophysics, (2) atomic, molecular, and optical physics, (3) condensed matter and materials physics, and (4) high energy physics. In addition, the Department wishes to have a significant effort in research in physics education. Growth of the number of faculty in these areas will be achieved by reallocating faculty lines currently outside these areas. In addition to thus achieving a "critical mass" in each of these areas, we intend to have a balance between experimental and theoretical faculty. In most cases this means hiring new experimental faculty.

In teaching we are currently reviewing our entire undergraduate curriculum. The majors program may in future be changed to begin in the Fall of the freshman year rather than in the Spring, after calculus is begun. The latter is currently an anachronism since most freshmen intending to study physics have already studied calculus in high school. Also, majors in the future may be expected to complete most of the upper level courses in their program by the Fall semester of their senior year so that they are better prepared for the GRE exams at that time. Our large enrollment courses for premeds, for engineers, and for liberal arts students are also evolving. Currently we have begun introducing multimedia laboratories in our pre-med courses and our goal is to have such labs in all of our introductory courses.

The Review Committee was very supportive of the Department's plans. It found specifically "that the Self-Study [report] represents an honest appraisal of the existing situation and provides a well-reasoned and realistic plan of action;" that it finds "the rationale and specifics provided for these [research] choices compelling, and supports these proposals with only minor changes..."; that "the teaching program is quite strong...;" and that "the service program is relatively strong..." The Committee made a large number of specific recommendations, on nearly all of which the Department has begun to act.

Thus I am pleased to report that there is widespread consensus on the Department's future course. Both the faculty and the Review Committee agreed on the constitution of our mid-sized Department and the activities it should pursue as part of a large Land Grant university. This bodes well for the achievement of our goals.

Facilities Modifications

Currently \$300,000 in new building renovation projects are underway or about to begin in the Department. Just about complete is a new hood room facility on the second floor of Behlen Lab. The facility will have four vented hoods for the use of the condensed matter group. The hoods will enable them to safely prepare the sometimes toxic materials they study in their experiments.

The creation of an office with divided workspaces for senior researchers and visitors is the object of a second remodeling project. The office will replace a small classroom on the second floor of

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Brace (205N). The office is needed because of the large increase in grant-related personnel being hired in the Department as a result of several large new grants our faculty have received. The classroom is being moved to a larger room (Brace 202) across from our Lecture Hall which had been used for demonstration equipment storage. However, the Department has invested in new lecture demonstration equipment that is lighter and that occupies less space thereby reducing our storage space needs.

The largest project involves a fairly complete renovation of the north end of Ferguson basement. The goal of this project is to create two new research laboratories from space that is currently used by our instrument shops. Part of the renovation project will involve renovations of the shop facilities to enable them to carry out the same functions as before but within a smaller space. In addition, all asbestos will be removed from the area.

The fourth project involves new equipment to control the temperatures in Behlen basement, sub-basement, and accelerator room. The project's goals are to install preheat coils in the air handlers serving these areas. Without such coils, the existing air handling equipment is unable to handle the normal flow of fresh air during temperature extremes in summer and winter. This has hampered research activities in the affected areas.

When this year's projects are finished, the Department will have completed a decade of fairly continuous remodeling in all three buildings we occupy. Over the decade we have created 6 new labs and a meeting room which didn't exist before; we have remodelled our large lecture hall as well as two smaller classrooms, a seminar room, and our advanced labs; and we have relocated and remodelled our main offices, the business office, and the library. The result is that we now have (or will shortly have) adequate space for our larger number of experimental research programs; we have greatly improved a large fraction of our classroom and teaching laboratory space; and our administrative spaces and library are more centrally located and accessible.

Privatization

As indicated in the beginning of this letter, the Department is subject to decisions made in Washington, D.C. as well as in the State Capitol in Lincoln that have an impact on our budget. Through the generosity of alumni and friends, however, we are becoming in some respects independent of the ups and downs of government support. For example, the large endowments established by Jim and Jessie Coe currently provide us about \$24,000 annually for teaching and research equipment. Since we can often use those funds as leverage by applying for matching grants, their impact is far greater. The Department is also grateful to the donors of a number of other large endowments which provide us currently with undergraduate scholarships and graduate fellowships, and which in the future will provide also a chaired professorship.

However, I want to emphasize that even small donations are helping us to invest for the future of the Department. Starting in 1984 we began to invest a portion of the unrestricted funds donated to us annually by private donors (alumni and friends of the Department) in endowments whose income would support visiting lecturers, freshman scholarships, and our outreach

projects. Back then it seemed not worth the trouble. But over time large oaks from small acorns grow. The endowments we started are now valued at close to \$50,000. They provide an annual spendable income of the same order of magnitude as our annual total of small donations. This income now permits us to compete for the best high school applicants to UNL by offering them scholarship support. It completely funds one of our Departmental Colloquium speakers out of the 15 or so that we invite to the Department annually. And it supports the annual get-togethers of our faculty and staff with Lincoln and Omaha area high school physics teachers to discuss our mutual interests in physics education in Nebraska. If we continue to invest a portion of the unrestricted funds donated annually to us by alumni and friends and if the endowment principal continues to grow as it has, it is conceivable that in 15-20 years we may be able to do much more with our own private resources. For example, we may be able to support half our colloquium speakers (or to invite more speakers to campus than we are able to invite now), we may be able to provide much more generous scholarships to our best students, and we may be able to fund many more science outreach activities in Nebraska.

This year we have taken a further step toward generating the income we know we will need to stay abreast of the latest technology in our instructional programs. A new lab manual for our premed physics course (Physics 141) entitled "Multimedia College Physics Laboratory I" was authored by Lab Manager Vicki Plano, Christopher Moore (MS 1992), Professor Robert G. Fuller, and Dr. Charles R. Lang of Omaha Westside H.S. Royalties from the sale of this book throughout the U.S. and (maybe) abroad will be directed to a University-managed endowment fund whose income will be used to improve the Department's instructional programs. The income will be used primarily to purchase modern equipment and computers for our teaching labs and resource rooms. Because a number of other projects of the Physics Education Group may generate royalty income in the future, we are hoping that this new endowment fund will grow rapidly and thereby benefit our instructional programs significantly.

As always, therefore, I want to thank you, our alumni and friends, for your financial support. I hope I have indicated how beneficial even small annual donations are in furthering our growing research stature and our high-quality teaching programs. I also encourage you to keep in contact and to let us know of your activities. A postage-paid card is included with this newsletter for this purpose. We do enjoy hearing from you and welcome you to visit should your travels include a stop in Lincoln. Best wishes until next year.

Sincerely,



Anthony F. Starace
Professor and Chairman

Spectrum Book Review: *The Physics of Golf*

Ted Jorgensen's book, *The Physics of Golf* (American Institute of Physics Press, New York, 1993), is a virtual cornucopia of golf facts, ideas and concepts that every golfing physicist should read carefully. It is the result of 30 years of thought and on-course experimentation to try and understand the makeup of the golf swing and the design of golf clubs. The first printing of 2500 copies is sold out, the second printing has been completed, and there is a contract with Oxford University Press to translate the book into Japanese.

The golf swing is analyzed in terms of the so-called "standard model." This is basically a two-rod model in which the left arm is the first rod articulated to the second rod or club through the wrist of the left arm. A forward shift of the pivot point of the left arm is also incorporated. A generalized coordinate system allows analysis of the effect of various input parameters on this system, through a solution of Lagrange's equations. The success of this model probably resides in the fact that the effective golf swing is more dependent upon the action of the left arm on the club rather than the right hand. (I distinctly recall this was impressed upon me by Fred Daly, a British Open winner at my first golf lesson in Belfast.) Amazingly this simple approach combined with a constant torque input to the system, reproduces the golf swing. Sample solutions in the book show both the orientation and speed of the club throughout the swing. Time lapse representations of the arm and club are then compared with strobe photos of the golf swing of a professional taken by Dr. Jorgensen.

Now one can experiment with various parameter changes to determine the likely effectiveness of a given approach to the swing. Thus a torque increase of 5% beyond the standard constant torque of 57 ft. lbs leads to a mere 1.7% increase in clubhead speed. So do not try to hit the ball too hard. The standard swing model is consistent with one surprising fact:

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that involve two Coulomb force centers acting on a third particle, typically an ionized electron. A fifth session dealt specifically with Rudd's contributions to atomic physics.

The Symposium's festivities included three receptions, a tour of the Sheldon Art Gallery, and a showing of Rudd's collection of antique scientific instruments, books, and cameras. A banquet on the conference's final evening was attended by almost one hundred. Prof. Eugen Merzbacher, Past President of the American Physical Society, delivered an address on "The Current Crisis at the *Physical Review*."

Copies of the *Festschrift* volume, to be published by the American Institute of Physics, will be available from the Department. This book will contain the scientific papers presented at the conference, as well as a biography of Rudd.

viz. the speed of the hands actually decrease just before impact, almost as if the golfer were quitting on the shot. This is evident in the strobe photos and is a dynamic effect of interaction between the club and the hands.

Hints for improving your game abound. One of the most interesting involves an analysis of the backswing. If you watch the pros on Sunday, the only clubs which they take to the horizontal on the backswing are the woods and the 1 or 2 irons; other clubs are hit with a shorter backswing. What effect does this have on distance? In the standard model if the backswing is reduced by 30 degrees and the ball is hit late with the hands forward or wrists still slightly cocked, then only 2.5% of clubhead speed is lost. Surely there is a great message in this for us amateurs. In fact many teaching pros are now citing the book and using it in instruction. Students are said to be learning faster and hitting the ball further and straighter.

There is a wonderful chapter on the matching of irons, describing a method of matching the swing weights so that the masses, location of the centers of mass, and moments of inertia relative to the hands, are matched for each club. The resulting set should feel and swing the same. This method has become of particular importance with the availability of a wide variety of lightweight composite shafts. The idea of swing weighting in this manner has attracted the attention of several professional club makers, all of whom have great difficulty understanding the concept of moment of inertia.

Other chapters analyze the aerodynamics of the golf ball in flight, subtleties of the Harry Vardon swing, and the flex of golf shafts, an area of deep mystery to those of us who make our own golf clubs. Another chapter analyzes statistical variations in your golf score and the relationship to the handicap system. From one distribution you might try to calculate the number of millennia required for a 14 handicapper to shoot a 70 on his or her home course.

Some of us have been fortunate to be the direct recipient of many of these discoveries as they were made. For example, I know that the role of the left shoulder in the initiation of the downswing has helped me avoid the moments of despair that accompany poor drives. But few others have had the privilege of having Ted act as caddy during a round. (I have only dared to try this on one occasion.) He offers wonderful advice, usually of a conservative nature and is always encouraging—so much so that I was able to shoot the best score of my life at 2 over par. But on the second to last hole he came and stood behind my ball which was just blocked from a direct shot to the green. He looked, shrugged his shoulder and said, with a slightly naughty snigger, "Glad that's not my ball" and then stomped off into the fairway. I was so annoyed by this attitude that I manufactured a magnificent hook onto the green and brought it home in style. Maybe Ted knows psychology, too. From all your golfing and non-golfing friends, Ted, thanks for the many joys arising from your fascinating and challenging ideas.

—Donal J. Burns

Research Highlights

We present here a selection of recent research results by the Department's faculty and staff that have been accorded rapid publication in *Physical Review Letters* (PRL) or in the Rapid Communications section of *The Physical Review* (PR).

In the 14 February 1994 issue of PRL, the DØ collaboration at Fermilab, of which Associate Professor **Gregory R. Snow** is a member, reported on a search for leptoquarks using the DØ detector at the Fermilab Tevatron proton-antiproton collider at energies of 1.8 TeV. The article notes that "leptoquarks are conjectured exotic particles that carry both color and lepton quantum numbers. They occur in a wide variety of extensions to the Standard Model that connect the quark and lepton sectors. Leptoquarks are fractionally charged and can decay directly to a quark-lepton pair." So-called "first generation" leptoquarks decay either to an electron + quark or to an electron neutrino + quark. The experiment found no leptoquark events, but was able to set limits on the leptoquark mass for particular assumed values of the branching ratio between its two decay modes.

In the 21 February 1994 issue of PRL, graduate student **Kenneth W. McLaughlin** and Assistant Professor **David W. Duquette** report on a novel experiment for resonant production of the Ca^- ion in collisions of Rydberg and ground-state Ca atoms. The authors note that "the close spacing of Rydberg levels allows for selective excitation of atoms into states with small and nearly arbitrarily selected binding energies. Atoms in a sufficiently high level can then transfer the Rydberg electron in collisions with atoms or molecules that have a small electron affinity, producing pairs of oppositely charged ions." Because the collisional process is resonant, negative ions which are otherwise difficult to produce may appear when the excitation level n of the Rydberg electron is precisely at the resonance energy for the process. Since lasers can be used to produce particular Rydberg levels n , one has in this way a novel means to determine the electron affinity of negative ions with very small electron affinities. In the experiment, McLaughlin and Duquette found the $\text{Ca}^*(n) + \text{Ca}$ collision to be resonant for $n=25$. This led them to predict the binding energy (electron affinity) for Ca^- to be 24 meV with an uncertainty of 1.4 meV. Previous theoretical predictions and experimental measurements for the Ca^- electron affinity cover the range from 0 meV to 100 meV.

In the 4 April 1994 issue of PRL, Associate Professor **Gregory R. Snow** and the rest of the DØ collaboration at Fermilab reported on a search for the top quark. The top quark is the only quark predicted by the Standard Model which has not yet been observed. At the energies of the reported experiment, the strong interaction is expected to produce top quark - anti-top quark pairs in preference to single top quarks. According to the Standard Model, the top quark decays via the weak charged current into a bottom quark and a W boson. The

latter particle can decay into various pairs of leptons or into various quark - anti-quark pairs. This experiment searched for several relatively rare decay modes. The Letter concludes that "we see no conclusive evidence for top production in the four modes presented here. The final event sample contains three candidate events, consistent with our background estimates...We obtain a 95% confidence-level lower limit on the top quark mass of $131 \text{ GeV}/c^2$."

In the 15 April 1994 issue of PRB, a Rapid Communication by Professors **Roger D. Kirby**, **Robert J. Hardy**, and **David J. Sellmyer** and graduate student **Jian-Xiang Shen** reported on a joint experimental-theoretical study of magnetization reversal for a class of nanoscale magnetic films. Developing the ability to understand and design structures on nanometer length scales is a goal of materials science. As the authors note, "these structures and the technologies based on them will be important in areas such as information storage, electronic devices, and biotechnology. As the dimensions of the fundamental building blocks or cells of magnetization, polarization, etc., become smaller and smaller, the temporal stability of an ordered phase within the cell becomes of crucial importance. This problem is also intimately connected to the mechanism by which a reversal or switch of the order parameter in the cell occurs as the result of an applied stimulus." The authors report here on their work on amorphous magnetic multilayers with layer thicknesses of only a few atomic diameters, which have possible applications in ultra-high density data storage devices. The experiment concerned hysteresis loop measurements and constant-field magnetization vs. time measurements for such materials. The theoretical model assumes the sample is divided into single domain cells that interact through dipolar fields and a nearest-neighbor domain-wall interaction. Theory and experiment were found to be in good agreement and the model demonstrated the importance of thermal activation in the magnetization reversal process.

In the 23 May 1994 issue of PRL, Professor **James A. R. Samson**, postdoctoral research associate **Zhong-Xiang He** and two colleagues at Los Alamos National Lab and S.F.A. Inc. presented the first experimental measurements of Compton scattering cross sections in which the He atom is ionized to He^+ . The authors note that "ionization produced by incoherent scattering from bound electrons in helium can occur at any incident photon energy above 24.6 eV." However, "no information exists regarding how much energy is transferred from the scattered photon to the atomic system nor how that energy is distributed." Total incoherent cross sections have been tabulated, but these include both ionization and excitation of the atom target. Very recent theoretical work for helium at high photon energies does not distinguish between single and double photoionization. The measurements reported were for the Compton scattering cross section of helium for photon energies between 2.5 keV and 5.5 keV using a method which exploits a high collection efficiency for "zero" energy ions (0 -

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Nebraska Joins Midwest Superconductivity Consortium

Through the efforts of Senator Robert Kerrey and NU Vice President J.B. Milliken, the University of Nebraska is now a member of the Midwest Superconductivity Consortium (MISCON). Other universities in MISCON, which is funded by the U.S. Department of Energy, are: Purdue, Indiana, Ohio State, Notre Dame, and Missouri. Nebraska researchers involved in the program are Professors **Sy-Hwang Liou** and **John R. Hardy** of UNL, and J. Betanabhatla of UNO. J.B. Milliken is a Steering Committee Member and **David J. Sellmyer**, Director of the Center for Materials Research and Analysis (CMRA), is a Program Committee Member.

The goals of MISCON are: (a) to develop, utilizing effective group efforts, the scientific and technological foundation for the industrial applications and commercialization of high-temperature superconductivity; (b) to facilitate the transfer of technology from the Consortium research laboratories into the industries of

the Midwest; and (c) to ensure that there is a continuing supply of scientists and engineers trained in this important field.

The two major research thrust areas of the Consortium are: (1) novel high-temperature superconducting materials, including phase relations, reactions, synthesis and processing, and (2) transport properties of high-temperature superconductors, including optimization of critical currents, magnetic screening, dynamical behavior, and other limiting factors.

Among the group efforts supported by MISCON is one including Professor **John R. Hardy**, with J. Betanabhatla (Department of Physics, UNO) and R. Berliner (University of Missouri-Columbia). They have been awarded \$80,000 for experimental studies on the synthesis of novel high T_c superconductors which do not contain copper. The objective is to attempt to enhance the transition temperature T_c of doped barium bismuth oxide. Previous work at AT&T Bell Labs has produced a potassium-doped system with T_c of 30-35°K. This appears to be a classic Bardeen-Cooper Schrieffer (BCS) system with only modest coupling strength. There appears to be fundamental difficulty to raising T_c into the "high" range ($T_c > 60^\circ\text{K}$) by synthesis of related systems, possibly with different levels of doping. This is important because a "high" T_c in a BCS system would have fundamental implications for all "high T_c " systems. Copper-free systems on the other hand might not have many of the problems that bedevil the practical applications of copper-based superconductors.

Electronics Shop Personnel Probe Greenland Icecap

In what has become an annual event, Electronics Technician **Brian Farleigh** and Electronics Manager **John (Bob) Kelty** visited the Arctic this summer, this time for three weeks at Summit, Greenland (72° 34' 42" N, 37° 37' 57" W, 3230 m) where two deep boreholes have recently been drilled. There they launched a revised version of the Thermal Probe, a device made to provide *in situ* meltwater data of the icecap. This time, the probe was sent to a depth of over 135m. A new probe design which includes "autopilot" steering is now being tested and readied for deployment in 1995. Brian and Bob have been the subject of several local news articles due to their involvement with the Polar Ice Coring Office (PICO) grant, which NSF recently awarded to UNL. Bob also had his picture in "Model Railroader" for his adaptation of a Lionel toy train TV camera, which was used to find a stuck drill in Greenland. A Departmental colloquium entitled "Summer on Ice: Scientific Exploration of the 3km Thick Greenland Icecap" was presented on September 15, 1994. It recapped the highlights of their adventures. The thermal probe is supported by NASA Grant NAGW-3106 and the Greenland Ice Core Project (GRIP), a European Science Foundation program.

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50 meV) as compared to more energetic ions. Compton scattering is thus distinguished from photoabsorption in this energy region (the ion recoil energies for photoabsorption are calculated to be in the range from 0.34 eV to 0.75 eV for the incident photon energies used.) The presence of Compton ions in measurements of the $\text{He}^{2+}/\text{He}^+$ ratio (a current hot topic) becomes important at photon energies greater than 2 keV. Thus, this is an interesting region in which to study Compton scattering.

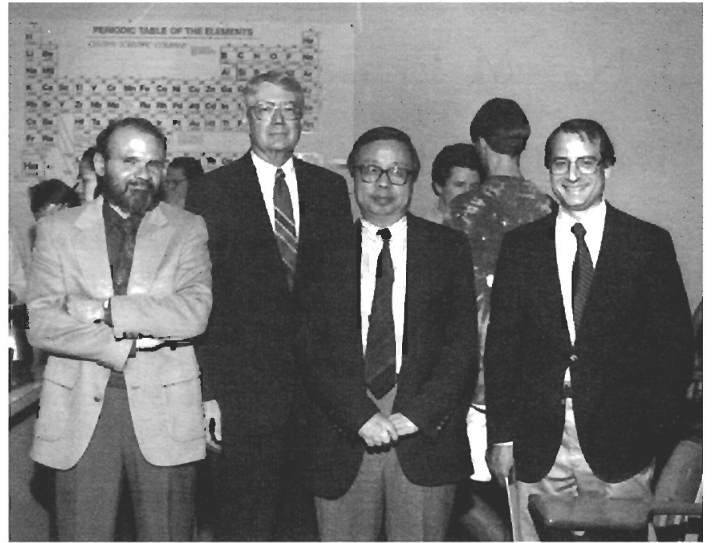
Schmidt Returns From NSF

Professor **Edward G. Schmidt** returned to the Department at the beginning of the fall semester after spending two years at the National Science Foundation. He served as the Program Director for Stellar Astronomy and Astrophysics. The Astronomy Division at the Foundation has five grant programs and supports the operation of several national optical and radio observatories. The Stellar Astronomy and Astrophysics program provides grant support for research in all aspects of stellar astronomy. This includes such topics as black holes and neutron stars, star formation, all stages of stellar evolution, solar astronomy, and even the detection of neutrinos from celestial sources. Schmidt was responsible for all aspects of the grant process including management of the reviewing of proposals, analyzing the reviews, and making funding recommendations. While at the Foundation, Schmidt continued his research in ultraviolet astronomy through his long-standing collaboration with Dr. George Carruthers at the Naval Research Laboratory. He also used the facilities of the Dominion Astrophysical Observatory in Victoria, British Columbia to conduct optical spectroscopy of variable stars.

Beginning this fall, Professor Schmidt became the new Vice Chair of the Department. He replaces Professor **William B. Campbell**, who has served as Vice Chair since 1989.

Famous Chinese Dissident Packs Brace Lecture Hall

Professor Li-Zhi Fang of the University of Arizona delivered a Departmental colloquium on "How Does One Show That the Universe is Big?" on March 17, 1994. Aside from being a world-renowned astrophysicist, Professor Fang is also a very famous Chinese political dissident. Most notably, he spent over a year at the US Embassy in Beijing after seeking sanctuary following the 1989 Tiananmen Square incident. His life story would read like a political thriller. He started his research career as a nuclear reactor theorist at the Institute of Physics, Chinese Academy of Sciences, after graduating from Peking University in 1958. Due to his outspoken political views, his academic career took many turns: teaching solid state physics and laser physics at the University of Science and Technology of China; working at hard labor in both the countryside and in a coal mine during the Cultural Revolution, and finally being elected a member of the Chinese Academy of Sciences and a Vice-president of the University of Science and Technology of China. At the beginning of student unrest in 1987, Fang was accused of promoting "bourgeois liberalization" and was discharged from both the Party and the University. Subsequently he was transferred to the Beijing Astronomical Observatory as a research Fellow. After intense negotiation between the US and Chinese governments, he was allowed to leave China in August 1990 for the Institute of Astronomy at Cambridge University, England for one year. Subsequently, he spent another year at the Institute of Advanced Study in



Astronomy Professor Norman Simon, Past University President Martin Massengale, Fang, and Chairman Anthony Starace (l-r) at the reception prior to Fang's colloquium talk.

Princeton before taking up a professorship in Physics and Astronomy at the University of Arizona. Professor Fang has won 27 awards and honors for both his scientific and humanitarian achievements. The most notable humanitarian award he received is the Robert F. Kennedy Human Rights Award. He is a very productive scientist, having published over 200 articles. He is also the co-author or editor of 23 books. The faculty and students enjoyed Fang's lively colloquium and their meeting with him during his March visit.

Among Other Department Visitors . . .

•**Dr. Neil Mitchell Boag.** During September and October 1994, Dr. Neil Boag came to the Department as a Visiting Professor. He is the Associate Director of the Science Research Institute (which is similar to the Nebraska Research Initiative Centers here at UNL). Though he is a chemist, in his role in the Science Research Institute he coordinates the scientific research programs in both the Department of Chemistry and the Department of Physics at Salford University, Salford, England. While at UNL, he collaborated in a recently-funded materials fabrication research program with Profs. **Dowben** and **Woods** in Physics, Prof. Langell in Chemistry, and Prof. Inno in Electrical Engineering.

•**Prof. E.W. Plummer.** Among the colloquium speakers in 1994 was Prof. E.W. Plummer, Distinguished Professor of Physics at the University of Tennessee. His talk was entitled "When is a Metal Metallic?" Before coming to Tennessee, Plummer was the William Smith Professor of Physics at the University of Pennsylvania and the Director of the Laboratory for Research on the Structure of Matter at the University of Pennsylvania. He won the Davisson-Germer Award of the American Physical Society in 1983. Recently he has been col-

laborating with Prof. **Peter Dowben** at UNL.

•**Prof. Stephen J. Buckman.** Dr. Stephen J. Buckman of the Electron Physics Group in the Research School of Physical Sciences of the Australian National University in Canberra visited the AMO group from May 18th to June 9th, 1994. His trip was financed by a grant from the Australian government to explore collaborative efforts with Prof. **Paul D. Burrow's** group in measurements of absolute differential scattering cross sections. Dr. Buckman's research program is one of the most active in the world in carrying out such studies. In addition to a variety of other electron scattering experiments, he is involved also in measurements of scattering from atoms in excited states, an area which is being pursued here by Prof. **Gay's** group.

Buckman's long experience with electrostatic energy analyzers was very beneficial and during his visit several suggested modifications to the UNL apparatus were carried out resulting in improved performance. "In trade," he has adopted a method used by Burrow's group to improve the stability of his apparatus, resulting in more precise measurements. Plans are in place to collaborate on "benchmark" measurements to be carried out in the heavier rare gases.

I N M E M O R I A M

Walter Dietrich Behlen 1904-1994

Walter D. Behlen of Columbus, Nebraska was very well known at the University of Nebraska, especially among the people in the Department of Physics and Astronomy. We were all very saddened to learn from his family that he passed away on 26 July 1994 after a long illness. The memorial service took place on 1 August 1994 at the Columbus High School Auditorium. The Department sent flowers for the memorial service and Professor Kam-Ching Leung attended the service and spent much of the day meeting many members of the Behlen family, including Ruby Behlen (wife), Mary Ann Hruska (daughter), and Kent Behlen (son). Mary Ann sent a lengthy note thanking Leung and the Department and expressing how much her father had enjoyed seeing the development of the Observatory and the Behlen Laboratory.

Mr. Behlen was born October 16, 1905 in Columbus, one of nine children in a third-generation German immigrant family. *Walt Behlen's Universe*, a biography written by William H. McDaniel and with a foreword by James H. Zumberege, former Chancellor of UNL, was published in 1973 by the University of Nebraska Press. Behlen was a self-educated scientist, inventor, industrialist, and philanthropist. He traveled widely and was an intense family man. And above all, he loved astronomy! There are many philanthropic projects in different buildings on the campus that were named for Walter Behlen and his family, but the projects which have had the most impact on our Department are the Behlen Laboratory of Physics and the Behlen Observatory. The contributions of the Behlen family will always remain an important chapter in the history of the Department of Physics and Astronomy at the University of Nebraska-Lincoln.



Walter Behlen, Kam-Ching Leung, and Don Taylor (l-r) admire the new 30" Cassegrain-Coude Telescope prior to its installation in the Behlen Observatory, 15 March 1972.

NSF to Support Ducharme's
Collaboration With Moscow Lab

The National Science Foundation has awarded a grant of \$89,260 to Professor **Stephen Ducharme** to support a cooperative research program entitled, "Novel Photonic Materials," between Ducharme and distinguished senior scientist Dr. Vladimir M. Fridkin, Head of the Electronic Materials Laboratory at the Institute for Crystallography of the Russian Academy of Sciences in Moscow. One of Fridkin's colleagues, Dr. Valeri Lazarev, will work with Ducharme at UNL for the next two years. In addition, Fridkin will spend two months with Ducharme's group at UNL in the summer of 1995 and Ducharme will visit Fridkin's group in Moscow in 1996.

The research program comprises several related research projects which combine the common interests and unique strengths of the UNL and the Institute of Crystallography groups. These projects are: "Photorefractive Studies of Ferroelectric Polymers," "Study of Pyro-Electro-Optical Modulation and Transient Phase Gratings," "Bulk Photovoltaic Studies of Amorphous Polymers," and "Development of a Hybrid Spatial Light Modulator."

The cooperative research between Ducharme and Fridkin began in 1993 when Fridkin spent three months working with Ducharme at UNL and Ducharme spent one month in Fridkin's Laboratory in Moscow. These planning visits were funded by Ducharme's National Science Foundation Research Initiation Award, by the Nebraska Research Initiative through the Center for Materials Research and Analysis, and by the Department of Physics and Astronomy.

The grant is funded jointly by NSF's Divisions of International Programs and of Electrical and Communications Systems. Matching funds totaling \$5,000 have been provided by the Center for Materials Research and Analysis.

Weymouth Appointed to Editorial Board

Professor **John W. Weymouth** has been appointed one of the Associate Editors of a new journal, *Archaeological Prospection*, published by John Wiley and Sons. The editorial board includes members from the UK, Japan, Poland, France, Greece, Slovakia and the USA. The journal was initiated to fill the need for communication among geophysicists (and between geophysicists and archaeologists) in the expanding field of the application of non-destructive methods to the exploration of archaeological sites. To quote from the journal statement: "Over the past forty years, pioneering work in aerial photography, earth resistivity, and magnetometry has been advanced to encompass a variety of techniques applied to the location and identification of archaeological remains. The appearance of geophysical equipment specifically designed for archaeology has been paralleled by advances in computer amenability, leading to the increased power of ground penetrating radar and resistivity tomography when harnessed to dedicated software. It is to the results of this wide, yet related, range of survey procedures that this journal is dedicated."

Other Faculty/Staff Notes:

• **Blanche L. Breen**, a long-time secretary in the Department, died in Minnesota on February 15, 1994. She is survived by a daughter, son, and two grandchildren. Her husband, Ray, preceded her in death. She was on the staff from 1961 to 1973, a time when one person took care of all the Departmental secretarial and reception duties with the help of one or two part-time assistants. Those who were students or faculty members in that period will remember her friendly smile, pleasant personality, and her willingness to help.

• The Department's Research in Physics Education Group made many contributions to the summer American Association of Physics Teachers meeting at Notre Dame University in South Bend, IN, from August 8 through 13, 1994. The UNL group was represented by Professor **Robert G. Fuller**, Lab Manager **Vicki Plano Clark**, **Christopher J. Moore** (M.S. 1992), **Brian Adrian**, and **Weijia Zhang** (M.S. 1994). All of the members of the group gave at least one presentation.

• The DOE-supported research group of Professors **David Sellmyer** and **Sitaram Jaswal** has been invited to be a member of the DOE Center of Excellence for the Synthesis and Processing of Advanced Materials. The group is one of four university programs in the project, "Tailored Microstructures in Hard Magnets." Several DOE laboratories and industrial firms are also participating.

• Professor **David Sellmyer** has been appointed to a second five-year term as director of the Center for Materials Research and Analysis, and is serving on the State of Nebraska Science and Technology Planning Task Force.

• **Robert G. Fuller** and **Christopher J. Moore** attended

the Fifth Inter-American Conference on Physics Education at Texas A & M University in July. The conference was organized around the theme "Building Bridges" and was attended by about 60 physicists from the Americas. The majority of the participants were from Central and South America. Dr. Fuller gave an opening address on the puzzle of the Tacoma Narrows Bridge collapse. The conference sessions were conducted in both Spanish and English.

• **Christopher Moore** (M.S. 1992), a research associate in the Department's Research in Physics Education Group, was invited to give a series of workshops at the "New Trends in Physics Teaching" conference that was held July 23-28, 1994, in Puebla, Mexico. The objectives of the conference included: a) disseminating the idea of educational research as an integral part of learning; b) presentation of first-hand information on physics education in the U.S.; c) communication of research done by Mexican physics education groups; and d) establishment of a platform for projects and activities in conjunction with U.S. investigators in the development of new curricula in Mexico. The workshops, given in Spanish, were titled "Teaching and Learning Physics with Interactive Video," "Designing Interactive Video Lessons," and "Discussion and Sharing of Interactive-Video Lessons."

• For the last six years, the UNL Parents Association and the UNL Teaching Council have asked UNL parents, in consultations with their sons or daughters, to recommend teachers who have been particularly effective in contributing to the educational life of undergraduates at UNL. This year, three teachers in our Department were thus recognized: Visiting Instructor **Brad Jacobsen**, Associate Professor **Gregory R. Snow**, and Visiting Assistant Professor Dr. **Orhan Yenen**. This is a real honor for them and for the Department!



1994 saw a number of departures and arrivals of Physics and Astronomy Departmental Staff. The present staff members are (l-r): front row—Shelly Sorensen (Accounting Clerk III), Kay Haley (Word Processing Specialist), Beth Wilhelm (Staff Secretary III), Shelly Krupicka (Staff Assistant, CMRA), Bev Wisehart (Library Assistant III, Physics Library); second row—Jack Loos (Instrument Shop Manager), Jean Rolofson (Staff Assistant and Secretary to the Chairman), Denise Kremer (Staff Secretary II), Michele Morgan (Accounting Clerk II), Patty Christen (Business Manager); third row—Bob Kelty (Electronics Shop Manager), Walt Lueken (Instrument Maker III), Jack Gilliam (Instrument Maker III), Loren Marks (Instrument Maker III), Gerry Moore (Instrument Maker III), Brian Farleigh (Electronics Technician III). Not shown: Gordon McConnell (Instrument Maker III).

Multimedia Labs Developed for Introductory Physics Course

Thanks to support received from the Howard Hughes Medical Institute, the University, and the National Science Foundation, the past year has brought about significant change in the Physics 141 general introductory physics laboratory. These laboratory lessons accompany the algebra-based introductory physics course taken primarily by pre-medical and life science students. The new laboratory structure strives to take what has been shown best by physics educational research and combine it with a strong commitment to the use of multimedia tools to increase student learning.

Following the educational works of Robert Karplus and Jean Piaget, the laboratory period is organized around the "Learning Cycle." Each lab period is divided into three different activities: (1) Exploration Activity/Invention Discussion; (2) Applications; and (3) Assessment.

The first, which is called the *exploration*, gives students a hands-on opportunity to explore the fundamental concepts of the lesson. After finishing and discussing this exploration, students complete three *applications* based on the physics concepts. Finally, there is an *assessment* activity at the end of each lesson that allow the lab instructor and the student to assess what was learned during the lesson.

The three *applications* are the heart of the new laboratory lessons. Each student, working in a group of three, completes a separate activity at each of three types of learning centers in a single lab period. Each of the three centers has its own particular advantages in helping students study physics and scientific techniques.

The learning centers are:



Hands On

Equipment: traditional collection of carts, ramps, springs, beakers

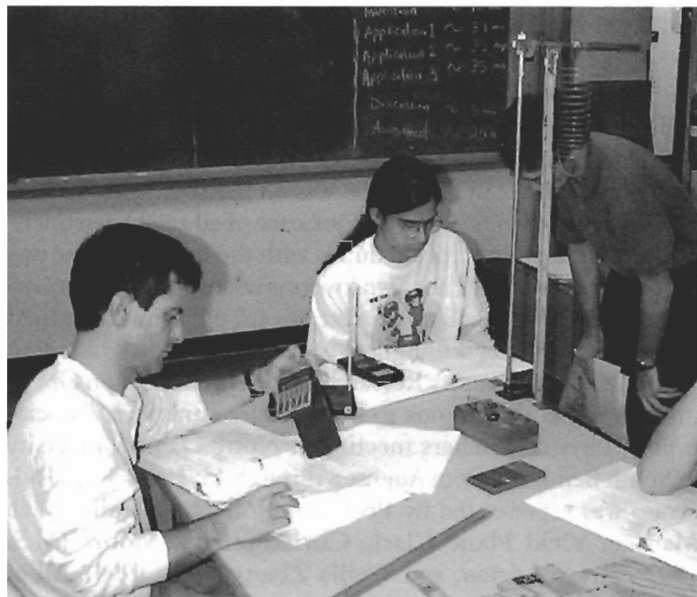
At the HO learning center, students work through activities based on traditional hands-on laboratory experiments. While studying the physics, they are also building their data-taking, calculator, and graphing skills.



Microcomputer-Based Laboratory (MBL)

Equipment: Macintosh computer, Universal Laboratory Interface, probe-ware (including motion sensor, force probe, temperature sensor, etc.), data acquisition & display software

At the MBL learning center, students use the power of the computer to build their understanding and intuition for basic



Physics 141 students explore the energy characteristics of a spring at a hands-on station in the Multimedia Labs.

physics principles, especially relating to graphical manipulation and interpretation. Students are able to collect and display data in real time. The speed of the computer also lets them change parameters and redo an experiment in a relatively short amount of time. Typical experiments include graphically displaying the motion of an object (such as a student's body), measuring impulse by determining the time over which a varying force is applied, and determining mathematical relations between quantities of interest.



Interactive Video (IV)

Equipment: videodisc player, monitor, bar code reader, transparency sheets and marking pens, and assorted videodiscs including *Physics: Cinema Classics* and *Physics of Sports*.

At the IV learning center, students are able to apply their study of physics to real-world applications by using interactive video. These images can be more interesting and motivating for students and help train them to study and question the world around them. The videodisc player also allows events to be brought into the classroom which would otherwise be too dangerous, too big, or too fast. Examples of such applications include the work done in shooting an arrow, the impulse felt in a car collision, and the collapse of the Tacoma Narrows Bridge.

These multimedia lessons have been used with UNL students since January 1994. A complete laboratory manual entitled *Multimedia College Physics Laboratory I* has been published. Currently work is underway to bring similar revisions to the second semester (Physics 142) course.

Department Welcomes New Graduate Students

The Department welcomed thirteen new graduate students during the Spring 1994 and Fall 1994 semesters. These students, as is usual, have a variety of backgrounds and the faculty has reported that they are a bright and enthusiastic bunch. The new students, and their most recent degrees are listed below.

Scott Atkins, B.S. University of South Dakota
Diane Eschliman, B.S. Nebraska Wesleyan (Avery Fellow)
Adam Green, B.A. Gustavus Adolphus
Angela Jensvold, B.S. Mary Washington College
John (Mark) Meldrim, M.S. So. Illinois U. (Avery Fellow)
Vasile Munteanu, B.S. Bucharest University (Hungary)
Takashi Oe, B.S. Fort Hayes State University
Benjamin Pippitt, B.A. Gustavus Adolphus
Zhenhua Sun, M.S. Changchun Inst. of Applied Chemistry (PRC)
Scott Wadewitz, M.S. University of North Dakota

Carlo Waldfried, M.S. University of North Dakota
Robyn Wilde, B.S. Utah State University

Several of our new students are already involved in research. Diane Eschliman worked with Assistant Professor **David W. Duquette** while still an undergraduate at Nebraska Wesleyan. Vasile Munteanu is working with Professor **David J. Sellmyer** on a project in collaboration with Dale Electronics. Ben Pippitt is now heavily involved in research in physics education with Professor **Robert G. Fuller**. Zhenhua Sun is studying the optical and dynamical properties of polymers with Professor **C.H. (Jim) Wang** (Department of Chemistry). Carlo Waldfried is working with Associate Professor **Peter Dowben** to investigate the electronic structures of a variety of materials by means of photoemission measurements at Brookhaven National Laboratory.

Priscilla Laws is 1994 Ruckman Lecturer

Professor Priscilla Laws of Dickinson College, a leader in physics education, gave the 1994 Ruckman Lecture. Her workshop physics course at Dickinson has attracted national attention (cf. "Calculus-based Physics Without Lectures," *Physics Today*, December 1991). Her lecture at UNL was entitled "Using the Outcomes of Physics Education Research to Improve Curriculum."

She discussed three related activity-based curricula she has developed which use computer tools for the collection, display, and analysis of data. These are Workshop Physics, Tools for Scientific Thinking, and RealTime Physics. These curricula are based on the findings of physics education research and have undergone classroom testing. These curricula use conceptual examinations to evaluate student performance. Dr. Laws discussed the role of educational research and microcomputer tools in enhancing curricular effectiveness in the teaching of: (1) kinematics, (2) Newton's Third Law, (3) latent heat, and (4) the behavior of DC circuits. Dr. Laws also visited with the Physics Education group and discussed its research and development in the use of multimedia and interactive video.

The Ruckman Lecture is the focal point of the Department faculty's annual get-together with Lincoln and Omaha-area high school physics teachers. After the lecture, lively discussions take place over dinner at the Nebraska Union on current physics education issues. An after-dinner program of lecture demonstrations typically rounds out the get-together. The lecture and other events are supported by private funds donated by **Jerry E. Ruckman** (B.S. 1962).

In other departmental teaching news...

•**1994/95 Equipment Allocation.** The Department was awarded over \$20,000 by the College of Arts and Sciences, provided by the Senior Vice Chancellor for Academic Affairs, Dr. Joan Leitzel. This money will be used in part as a matching contribution for a NSF-funded project to construct a telescope and dome on the Ferguson Hall rooftop. In addition, the elementary labs will benefit from new optics sets, electric field mapping kits, low-friction dynamics carts, and basic power supplies. A programmable power supply and printer will be purchased for the advanced laboratory courses. In addition, two Power Macintosh 6100/60 computer systems will be obtained for the Physics Learning Center. These computers, capable of running both PC and Macintosh-based software, will make the latest spreadsheet, word processing, symbolic-algebra, and presentation software available to all physics students.

•**Traineeship Program Funded by NSF.** The Department received a five year grant under the Innovation in Teaching and Learning Focus of the Graduate Research Traineeship Program of the National Science Foundation. The traineeship will support full time graduate students to obtain M.S. and Ph.D. degrees in physics at UNL with a special emphasis on research and development in using hypermedia for physics education. The program is under the direction of Professor **Robert G. Fuller**. A trainee must be a U.S. citizen or permanent resident. The traineeship pays a stipend of \$14,100. The first two trainees will be **Brian Adrian** from Hastings, NE, and **Benjamin Pippitt** from Rockford, Illinois.

Dixie Mager Speaks at 1994 Recognition Luncheon

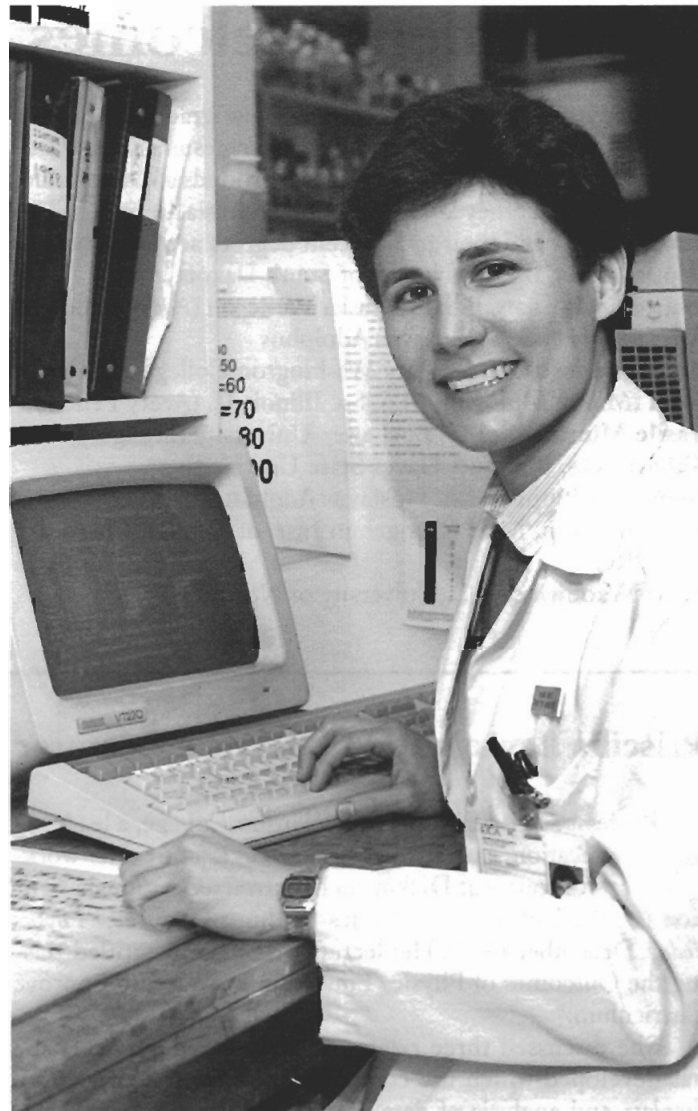
Dr. Dixie L. Mager (B.S. 1975), an Associate Professor in the Department of Medical Genetics at the University of British Columbia and a senior scientist with the Terry Fox Laboratory of the British Columbia Cancer Agency, was the speaker at the Department's 1994 Recognition Luncheon. The luncheon, held annually since 1985, serves to recognize B.A., B.S., M.S., and Ph.D. graduates of the Department. Faculty, staff, local alumni, undergraduate majors, and graduate students are all invited to attend.

Dixie Mager is a native of Crete, Nebraska. As an undergraduate at UNL she was awarded Regents, U.S. Harkson, and John E. Almy Scholarships and was admitted to Phi Beta Kappa. She received her B.S. in physics "With Distinction." She received her M.S. and Ph.D. degrees in medical biophysics from the University of Toronto, where she was a Connaught Fellow. During 1981-85 she held a postdoctoral appointment in the Laboratory of Genetics at the University of Wisconsin. Thereafter she moved to Vancouver, British Columbia to take up her current two positions.

Dixie's talk was titled *Mobile Genetic Elements in Human DNA* or *What's a Physics Graduate Doing in Molecular Biology?* She answered the latter question at the beginning. When she was a junior, her best friend from high school died of cancer. She decided then to make a switch to biology at the graduate level. The medical biophysics program at Toronto was an ideal means of making the transition since there were many physicists both on the faculty and in the program. She found that the methods of problem-solving and analysis she had learned were also important in genetics.

Dixie then described her research. All genomes contain mobile genetic elements, which were first postulated by Barbara McClintock. Such mobile elements can alter gene expression. Her research is specifically concerned with elements called retrotransposons, which move within cells, and specifically with how these mobile genetic elements affect gene expression in primates. Nowadays, genetic alterations in primates remain stable over millions of years. This is in contrast with the high rate of transposals in flies or in yeast. The reason for the universal existence of mobile genetic elements in all species is not known. Some researchers think they permit a rapid way to alter gene functions, which provides an evolutionary advantage to species.

Mager gave our graduates her thoughts on the necessary ingredients for success in science: good ideas, luck, and perseverance. Also, one must communicate well both orally and in writing. And, one must publish! She remarked that her most challenging task now is in selecting potential graduate students and postdoctoral researchers. Their ability has a great bearing on the success of her lab.



Dixie L. Mager

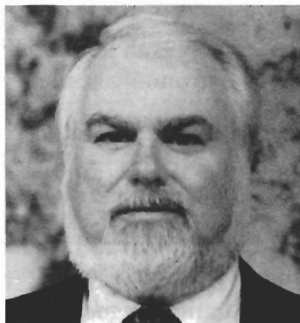
As for being a woman in science, Mager remarked that she has not come across any overt discrimination. But then, in medical genetics 50% of the researchers are women. She said that higher professional ranks, however, had lower percentages of women. In all the sciences at the University of British Columbia, only 2% of the faculty are women.

Lastly, Mager urged our graduates to have a balance in their lives. She expressed her opinion that a career should not be all-consuming. One needs to have some fun, too.

Currently, Mager supervises three graduate students, is the Principal Investigator of a \$100K/year research grant from the Medical Research Council of Canada, has about 40 research publications (in journals such as *Nature*, *Gene*, *Proceedings of the National Academy of Science*, etc.), and has presented invited talks recently in meetings at Ulm, Frankfurt, Innsbruck, and Lake Tahoe.

Hieggelke Awarded AAPT Distinguished Service Citation

We learned recently that **Curtis J. Hieggelke** (M.S. 1966, Ph.D. 1971) has been cited by the American Association of Physics Teachers (AAPT) for his distinguished service. The following condensed description of his service is taken from *The Physics Teacher* (Vol. 32, p. 201, April 1994):



Curtis J. Hieggelke

Curtis J. Hieggelke has a history of involvement with and contributions to physics education. He earned a B.A. in physics and mathematics from Concordia College (Minnesota) in 1963 and both his M.S. (1966) and Ph.D. (1971) in physics from UNL. He has served on the faculty of Joliet Junior College since 1971, with a stint as department chair from 1985 to 1989.

Dr. Hieggelke has become well known for organizing workshops for two-year college teachers. He was the founder and first president of the Illinois Macintosh Users Group. He was editor of the *Illinois Physics Teacher Newsletter* from 1987 to 1991 and he was founding editor of the *TYC Physics Newsletter* and first editor of the *Physics Educators Macintosh Users Group*.

Within the AAPT, Curt has served as council member and president of the Illinois Section, as Chairman of the Committee on Two-Year Colleges, and member of the Committee on Research in Physics Education. In addition, he served as regional coordinator for the "Topical Conference on Critical Issues in Two-Year College Physics and Astronomy."

Perera Wins AAPM Award

Harold Perera (M.S. 1985, Ph. D. 1990) was selected by the American Association of Physicists in Medicine (AAPM) as the winner of the 1994 Farrington Daniels Award for the best paper on Radiation Dosimetry published in the journal *Medical Physics* in 1993. The title of his paper is "Comparison of calculated and measured heterogeneity correction factors for ^{125}I , ^{137}Cs , and ^{192}Ir brachytherapy sources near localized heterogeneities." The award was presented at the annual meeting of the AAPM in Anaheim on July 25, 1994.

Perera did his Ph.D. thesis research in experimental atomic physics under the direction of Professor **Donal Burns**. His research involved the experimental measurement of scattering parameters for electron impact excitation of helium atoms. After graduation Perera was hired as a Research Associate by the Department of Radiation Oncology of the Mallinckrodt Institute of Radiology, which is associated with the Washington University School of Medicine in St. Louis. His research on cancer therapy and medical physics was supported by the National Institutes of Health. This research work during the period 1990-1992 is the basis for the AAPM Award.

In 1992, Perera entered a two-year medical physics fellowship program at Mallinckrodt Institute and switched from research to clinical work in radiation oncology. Upon completion of this fellowship in July 1994, Perera accepted an Assistant Professorship in the Department of Radiation Oncology of Hahnemann University in Philadelphia. He is responsible for quality assurance of the radiation equipment, treatment planning and review, and radiation dosimetry. He teaches both radiation therapy technologists and radiation dosimetrists. He says that he's still getting up to speed on his clinical and teaching duties, but he hopes to free up some time for research in

A Letter From David Keifer

We are proud of our graduates and are always pleased to hear from them. A letter back in January came from **David Keifer** (B.S. 1968) about his activities since graduation. David says that he reads all of the issues of the "Spectrum" from cover to cover and especially enjoys hearing about the people he knew when he was a student here.

While at graduate school at the University of Maryland, David was drafted into the Army, where he spent two years, mostly at Fort Lewis, Washington. He continued graduate work at the University of Oregon and again at Maryland, where he majored in biophysics for his M.S. degree in 1973. He then went to Cornell, where he studied the electrophysiology of plant cell membranes and ion transport processes for his 1978 Ph.D. His postdoctoral work was done at Washington University Medical School in St. Louis and at the University of California in Davis. While in St. Louis he met and married his wife Janet. They now have two children, Sarah, 8, and Joe, 5.

Since 1982, Dave has worked for the FMC Corporation's Agricultural Chemicals Group in New Jersey. He says he has progressed from physics to biophysics to plant physiology and now calls himself a plant biologist or weed scientist. He assesses potential liabilities of

his company's herbicides and tries to find ways to minimize that liability. In some cases where his recommended solution was for the company not to market the product, he says that his recommendation did not make him any friends in the marketing division.

He is also interested in energy conservation and has built a well-insulated passive solar house which is heated by gas for \$100-\$120 per year. He is also converting to high-energy fluorescent lighting and is considering photovoltaic panels.

Dave writes, "I have always felt that I got an outstanding education at the University of Nebraska, and I enjoyed my experiences in the Physics Department. As I went on, I never felt that I was handicapped in comparison to people who have been to more prestigious universities." He was employed by Professors **Duane Jaecks** and **Eugene Rudd** in the accelerator laboratory doing work which he says not only financed his education but also provided an enjoyable and educational experience.

Because of the fundamental nature of physics, it serves as a good basis for work in other areas. Many physics graduates have found that their education in physics is good preparation for a variety of occupations. David's career is a good example of a successful conversion from physics to a related field. Keifer's address is: 42 Springhill Rd., Skillman, NJ 08558. Thanks for your letter, Dave.

We Heard From...

Allen, Glenn E. (BS 1989) 1004 Camino Del Gusto, Santa Fe, NM 87505-5167. Is a Graduate Research Assistant in the Physics Department at the University of Maryland.

Beza, Michael (BA 1992) 4395 Gwinnett St., Apt. 4504, North Charleston, SC 29418. Is a Disbursing Officer for the U.S. Navy.

Bijanki, Sudhir (MS 1972, PhD 1974) 1940 Greensboro, Wheaton, IL 60187. Is a Technical Manager for AT&T Bell Laboratories.

Brakhage, Jane Elizabeth (BS 1990) P.O. Box 178, Osborn, MO 64474. Is Co-Pastor of her United Methodist Church. *"My husband, Daniel and I are currently co-pastors of a church in Missouri, while attending school at Saint Paul School of Theology in Kansas City. And yes, I know how far away from Physics my career path has taken me and I am just as suprised as anyone else."*

Bruegman, Otto (B.S. 1984, M.S. 1987) 9101 Sheridan Ct., Seabrook, MD 20706. Is a Manager of Scientific Operations for Omitron, Inc. *"I currently provide system engineering and management consulting for NASA's x-ray timing explorer (XTE) spacecraft and the advanced composition explorer (ACE) spacecraft. The XTE will launch in August, 1995 and ACE will launch in August 1997. I recently received a Masters degree in Program Management from Johns Hopkins University."*

Calabrese, Dominic University of Nevada, Reno, Dept. of Physics, Reno, NV 89557-0058. Is a postdoctoral research assistant in the experimental atomic physics group.

Crooks, Geoffrey (BS 1965, MS 1967, PhD 1972) 417 S. Cotner Blvd., Lincoln, NE 68510. Is President of Spectrum Biochromatography. *"If anyone ever sees Lou Caplan, tell him Geoff says, 'Hey.' Ditto for Larry Boyer."*

Darland, Jeffrey J. (BS 1978) 314 E Apollo, Garland, TX 75040. Is a member of the Group Technical Staff at Texas Instruments. *"Congratulations to Theodore Jorgensen on the publication of his book on the physics of golf, and to Kam-Ching Leung on his book on Binary Star Systems."*

Dubois, Robert (BS 1970, MS 1972, PhD 1975) 7721 W 13, Kennewick, WA 99337. Is a Senior Scientist for Batelle-Pacific NW Laboratories. *"I thoroughly enjoyed (both socially and scientifically) my visit to UNL for the Rudd Symposium. My best wishes to Gene on enjoying his retirement and to Tim on filling the void."*

Ferris, Walton (BS 1952) 326 Holly Drive, San Rafael, CA 94903. Is self employed.

Gallagher, Jay 3309 Heatherdell Lane, Madison, WI 53713. Is now a Professor of Astronomy at the University of Wisconsin.

Gao, Bo (MS 1986, PhD 1989) University of Toledo, Toledo, OH 43606. Is an Assistant Professor in the Department of Physics & Astronomy at the University of Toledo.

Hancock, Walter H. (MS 1969, PhD 1976) RR 1 Box 106B, Denton, NE 68339. Is the Electronics Supervisor in the Chemistry Department at UNL.

Hieggelke, Curtis J. (MS 1966, Ph.D. 1971) 2314 Mason Ave., Joliet, IL 60435-5428. Recently awarded a Distinguished Service Citation by the American Association of Physics Teachers (AAPT). [See article.]

Hollman, Kyle W. (BS 1988) 6032 McPherson, St. Louis, MO 643112.

Jacobsen, Bradley W. (B.S. 1990) Department of Physics, University of California at San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0354. Enrolled in the graduate program at the University of California, working toward his Doctorate degree, specializing in Biophysics. *"Thank you for having me teach Physics 141-42 during the 1993-94 academic year and Physics 141 during the 1994 first five week summer session! I sincerely appreciate the employment and invaluable experience! I fully enjoyed my first year teaching! I would like to thank Professor Campbell for his help with the 'technical' aspects of working at UNL. Also, I would like to thank Professor Duquette for his help with teaching Physics 141. Your department is a friendly place to work and I hope to find as good a department when I become a professor."*

Keifer, David W. (BS 1968) 42 Springhill Rd., Skillman, NJ 08558. Is a Research Associate for the FMC Corp. Agricultural Chemicals Group.

Kirby (Wiese), Kathryn Helen (BS 1988) 4904 E. Ashton Avenue, Castle Rock, CO 80104. Is working on the technical staff at Hughes Aircraft Company. Is now married to author William S. Kirby. In March 1993, she completed her M.S. in Physics at the University of Denver with support from the Hughes Aircraft Company Fellowship Program and is now continuing her work on remote sensing at Hughes as a member of the technical support staff.

Lee, Albert (BS 1979) 1723 Northern Viola Lane, Rochester, MN 55906. Is a staff programmer at IBM.

Linetsky, Anna M. (MS 1994) 2286 Bowdoin Street, Palo Alto, CA 94306. Is job hunting.

Maclay, James E. (BS 1959) P.O. Box 14939 N.E., Albuquerque, NM 87191. Is retired.

Marquard, Paul J. (MS 1986) 1624 Begonia Street, Casper, WY 82604. Is an Instructor at Casper College.

Meyer, Daniel A. (BS 1992) 107 Rogers Hall, F.S.U. Box 65611, Tallahassee, FL 32313. Is a Graduate Assistant at William Moulton/National High Magnetic Field Laboratory.

Meyer, Kurt 2200 Canyon Blvd. Apt. #21, Boulder, CO 80302. Is a Graduate Researcher at JILA (Joint Institute for Laboratory Astrophysics) at the University of Colorado.

Moudry, Brian W. (M.S. 1989) Is a Physics Instructor at Vermillion Community College in Ely, Minnesota.

Oliver, Forest (BS 1965) 105 Becky Terrace, Harrison, AK 72601.

Pareek, Prem N. 2504 Panorama Place, Birmingham, AL 35216. Is an Associate Professor of Medical Physics at the University of Alabama at Birmingham. *"I enjoy the Spectrum. It helps in keeping me in touch with the departmental activities. Thank you."*

Perera, Harold (MS 1985, PhD 1990) Department of Radiation Oncology, Hahnemann University, Box 102, Broad & Vine, Philadelphia, PA 19102. Is an Assistant Professor at Hahnemann University Medical School. [See article.]

Pinkerton, Frederick E. (BS 1976) Physics Dept. #32 Bldg 1-6, GM NAO Research and Development Center, 30500 Mound Road, Box 9055, Warren, MI 48090-9055. Is a Staff Research Scientist for General Motors.

Qi, Rui (MS 1991), c/o Hsiao-Ming Lu, Jt. Ctr. for Radiation Therapy, Harvard Medical School, 50 Binney St., Boston, MA 00115.

Roper, Steve (BS 1979) Route 1 Box 32A, Davey, NE 68336.

Schlegel, Mark O. (BS 1987) 8727 Contee Rd Apt. 103, Laurel, MD 20708-1912. Is an Associate Technical Specialist with the Computer Sciences Corporation. Is also a Telescope Operator at the Telescope Operations Center for the IUE project.

Schlissel, Dan (BS 1993) P.O. Box 84163, Lincoln, NE 68501-4163. Is a proofreader for the CD-Rom Toolkit project.

Schneider, Donald (BS 1976) Department of Astronomy, Pennsylvania State University, 525 Davey Lab, University Park, PA 16802. Has moved from the Institute for Advanced Study in Princeton to take an Associate Professor of Astronomy position at Penn State.

Smith, Andrew Nowell (BA 1947) HCR-1 Box 33, Eldridge, MO 65483-9802. Is self-employed as an Engineering Physicist and is *"still travelling back and forth to Iceland and Sicily working on Navy low-frequency communications antenna systems."*

Synowicki, Ron (BS 1990, MS 1993) 3717 S 117th Street, Omaha, NE 68144. Is an Engineer for the J.A. Woollam Company, Inc.

Tipton, Ted (BA 1990) 877 N 26th #17, Lincoln, NE 68508. Is the Assistant Stage Manager for the Lied Center for the Performing Arts.

Tonder, Steven (MS 1992) 221 Satellite Ln NE #3, Fidelity, MN 55432. Is a Computer Networking Consultant for Banyon Data Systems. *"I began a new position at Banyon Data Systems in October of '92. I build computers, troubleshoot hardware problems, and install Novell Networks."*

Vemury, Sastri K. (Ph.D. 1973) Smart Scientific Management and Applied Research Technologies, Inc., 1734 Elton Road, Suite 204, Silver Spring, MD 20903. Sastri informed Professor Kam-Ching Leung that he left the Institute for Space Studies, NASA some time ago. He started his own company in Silver Springs, Maryland. His "beltway company" is called SMART, which stands for Scientific Management & Applied Research Technologies, Inc. There are 12 Ph.D.'s in the firm working on long-range global weather forecasting research problems. His wife, a UNL Ph.D. in nutrition, received her MD about 10 years ago and is currently practicing in the Maryland area.

Weseley, Scott A. (B.S. 1990) Educational Testing Service, Mail Stop 11-P, Princeton, NJ 08541. Was a Research Scientist, working with the Educational Testing Service in Princeton, NJ on the GRE mathematical reasoning test. Recently Scott returned to Lincoln to serve as the Office Coordinator for Nebraskans Against the Death Penalty (NAPD).

Xiong, Yi-Ming (Ph.D. 1993) Division of Electronic & Info. Engineering, Tokyo Univ. of Agriculture & Technology, Koganei, Tokyo 184, JAPAN. Is an Assistant Professor, working with Professor Saitoh on ellipsometry studies of semiconductor multilayers.

"We left Austin for Tokyo [in January 1994] and have somewhat got ourselves settled down. We found an apartment near the University (it takes about 10 minutes to walk from our apartment to the campus), which is quite a convenience for me. My wife, Mitsuko, goes to work at downtown Tokyo by train. It takes an hour or so to commute each way...I feel very excited about the new research environment, for I can still apply my expertise to new materials characterization here. Meanwhile, I am also very thankful for the education and training I received at UNL. Winter in Tokyo is quite mild. I have seen two heavy snow falls so far, but the snow did not really stay for a long time. People say the spring here is especially beautiful, and so I will be looking forward to that. I have sensed living in Tokyo is very expensive. From apartment rent to food cost, everything seems to be at least twice the price one pays in the States. I hope I will soon get used to it. Please also express my greetings to other professors in the Department."

Yilk, Todd A. (B.S. 1986, M.S. 1990) 710-214 SW 16th Avenue, Gainesville, FL 32601.

Acknowledgments

The Department is very grateful to the following individuals and corporations for their new and continuing financial contributions during the period 1 November 1993 – 31 October 1994. These contributions have been made in support of major items of capital equipment, an endowed professorship, graduate fellowships, undergraduate scholarships, and invited lectures as well as for unrestricted purposes. Those who have not been contacted by one of the University of Nebraska Foundation's telephone campaigns or who might be considering an additional tax-deductible gift to us should note that we have the following general accounts at the UN Foundation:

- 1) Physics & Astronomy Development Fund
(for unrestricted gifts; account no. 2557.0)
- 2) Physics & Astronomy Lecture Endowment Fund
(account no. 3321.0)
- 3) Physics & Astronomy Scholarship Endowment Fund
(account no. 3303.0)

Contributions to any of these may be made conveniently using the contribution card and return envelope enclosed with the mailing of this newsletter. Checks should be made payable to the University of Nebraska Foundation and should indicate for which account the money is intended. Those contributors whose employers have a matching gift program should indicate this. Thank you very much!

William A. Barrett (BS 1952)
Roger Bengston
Sudhir Bijanki (MS 1972, PhD 1974)
Thomas E. Bullock (MS 1979)
William L. Burmester (PhD 1975)
Jessie Coe
Geoffrey B. Crooks (BS 1965, MS 1967, PhD 1972)
Jeffrey J. Darland (BS 1978)

David C. Doerr (BS 1987)
Julie M. (Schuldt) Doerr (BS 1987)
Robert D. DuBois (BS 1970, MS 1972, PhD 1975)
Cathy L. (Schneider) Engelhardt (MS 1983, PhD 1987)
Michael A. Engelhardt (MS 1983, PhD 1988)
FMC Foundation
Robert G. Fuller
John S. & Mary L. Gallagher
Greg R. Gruzalski (PhD 1977)
Bert H. Hartzell (AB 1939)
Gregory G. Henry (BS 1972)
Kyle W. Hollman (BS 1988)
IBM Corporation
Theodore P. Jorgensen (BA 1928, MA 1930)
David W. Keifer (BS 1968)
Charles Kurtzman (BS 1969)
Robert E. Little (BS 1970)
Joseph H. Macek
James E. Maclay (1959)
Paul J. Marquard (MS 1986)
Martin Marietta Corp. Foundation
Robert L. McKenzie (BA 1948)
Charles B. Minnich (BScEE 1937)
Burton E. Moore
Raymond L. Murray (MA 1941)
Joseph L. Parker (PhD 1940)
James D. Reiersen (BS 1963)
Kevin D. Reilly (MS 1962)
Jerry E. Ruckman (BS 1962)
M. Eugene Rudd (PhD 1962)
James J. Schmidt (BS 1956, MS 1957)
David J. Sellmyer
Charles E. Skov (PhD 1963)
Andrew N. Smith (BA 1947)
Anthony F. Starace
Terry J. Teays (PhD 1986)

No Known Address:

Please let us know any information you may have on these "missing alumni."

S. Elwood Bohn (M.A. 1951, Ph.D. 1961, Math/Physics)
Richard L. Bretthauer (B.S.ED. 1975, Math/Physics)
Harvey E. Clark (B.S. 1968)
Debra J. Cleveland (B.S. 1988)
Robin L. Collins (B.A. 1979)
Duane A. Courter (M.S. 1960, Physics/Ed. Psych.)
Richard V. Denton (B.S. 1965)
Clarence M. Deyong Jr. (B.S. 1958)
James A. Eder (M.S. 1966)
Burrell O. French (B.S. 1961)
Jimmie D. Gordon (B.S. 1960)
Andrew T. Groebner (B.S. 1989)

Vincent D. Harmon (B.S. 1988)
Gerald J. Henderson (B.S. 1965, M.S. 1967)
Medhi Homayoonfar (M.S. Ph.D. 1971)
King-Chung A. Ip (B.S. 1980)
William C. Keller (B.S. 1981)
Kisik Kim (M.S. 1983)
Roy B. Kreigh (B.A. 1949, M.A. 1950, Math/Physics)
Chulan Kwon (M.S. 1983)
Sharon L. Lackey (M.S. 1974)
Yan-Feng Li (M.S. 1984, Ph.D. 1986, M.S. 1989, Physics, Elec. Eng.)
Mei L. Lin (M.S. 1962)
Arthur C. Lindberg (M.A. 1951, Math/Physics)
Donald E. McArthur (B.S. 1959, Ph.D. 1967)
Jing Meng (M.S. 1993, Elec. Eng./Physics)
Daniel J. Miller (B.S. 1979)
Edward E. Morceland (M.A. 1954)
Albert C. Mueller (M.S. 1941, Ph.D. 1943, Physics/Chemistry)
Venkataraman Natarajan (M.S. 1981, Ph.D.

1984, Physics/Engineering)
Keanmun Ng (B.S.ED. 1990, Physics/Phys. Ed., M.P.E. 1993)
William H. Odell (B.S. 1965)
Winfred P. Pikelis (B.S. 1980)
Labros E. Pillalis (B.A. 1978)
David E. Rodgers (B.S. 1971)
Frank P. Ross (B.A. 1958)
Leroy G. Schulz (M.S. 1941)
David P. Sheetz (M.S. 1951, Ph.D. 1952, Physics/Chemistry)
Gregory E. Stephens (B.S. 1990)
John Taube (B.S. 1966)
James A. Thomassen (B.S. 1969)
Ter-Hsin Tsai (Ph.D. 1978)
Richard J. Welch (B.S. 1978)
Robert A. Worsing (M.A. 1949, Math/Physics)
Albert D. Yeye-Odu (B.A. 1975, Math/Physics, M.A. 1978, Ed. Psych.)
Suriyati B. Yusoff (B.S. 1986, M.S. 1990)

The Record

a Documentary Record of Facts and Figures for the Department of Physics and Astronomy of the University of Nebraska-Lincoln

No. 10 Fall 1994

Anthony F. Starace, Editor

1993-94 DEGREE RECIPIENTS

Bachelor of Science

Michael D. Anderson (Astron., December 93). Is working in Lincoln and applying to graduate schools.

Jon J. Dokter (Astron., December 93). Is enrolled in the graduate college at UNL.

Conrad D. Engel (With High Distinction, Astron., May, 94). Is enrolled in the graduate physics program at Ohio State University in Columbus, OH.

Eric S. Green (With Distinction, May 94). Is enrolled in the graduate physics program at the University of California at Berkeley in molecular biology.

Daniel T. Hagrman (December 93). Is a private consultant with Studsvick of Idaho in Idaho Falls, ID.

Mi Un Kim (December 93). Is a Quality Assurance Manager for Raven Biological Laboratories in Omaha.

Mark D. Kocourek (December 93). Is a technical support representative for Health Care Communications in Lincoln. He provides technical support for the company's software products.

Brett A. Poffenbarger (August 93) Is enrolled in the graduate physics program at UNL.

Randy R. Porter (December 93). Is a technical writer for Cliffs Notes in Omaha.

Samuel P. Rankin (With Distinction, May 94). Is enrolled in the graduate physics program at Arizona State University in Tempe, AZ.

Dan Schlissel (August 93). Is a proofreader for CD-Rom Toolkit in Lincoln.

Master of Science

Mark A. Freeling (May 94). Is enrolled in the UNL Teacher's College and is mentoring gifted students in the Lincoln Public Schools.

Arosha W. Goonasekera (May 94). Is engaged in doctoral research with Professor Stephen Ducharme.

Brian E. Jones (August 93). Is a Materials Research Specialist in the UNL Center for Materials Research and Analysis.

Anna M. Linetsky (May 94). Is in Palo Alto, California job hunting.

Alan P. Runge (May 94). Is pursuing graduate studies with Professor David Brooks in the Center for Curriculum and Instruction in the Teachers College at UNL.

Efren A. Serra (May 94). Is engaged in doctoral research with Professor Paul Burrow.

Bao Q. Vu (August 93). Is in Lincoln job hunting.

Rashidah Zachariah (December 93). Has returned to Penang, Malaysia.

Weija Zhang (May 94). Is engaged in doctoral research with Professor Robert Fuller.

Doctor of Philosophy

Dominic Calabrese (August 93). Is a postdoctoral research associate in the physics and astronomy department at the University of Nevada in Reno.

Huazhe Cao (December 93). Is a postdoctoral research associate with Professor John R. Hardy.

Yang Soo Chung (August 93). Is engaged in postdoctoral research at the Joint Institute Laboratory for Astrophysics (JILA) at the University of Colorado in Boulder, CO.

Ying-Yuan Hsu (December 93). Is living in Lincoln and teaching at the Metropolitan Community College in Omaha.

Jaegwon Yoo (August 93). Has returned to Seoul, Korea.

HONORS

1993-94 Fellows

Chien-Nan Liu	Avery Fellowship
Kenneth W. McLaughlin	Presidential Fellowship
Alan P. Runge	CMRA Summer Fellowship
Efren A. Serra	Richard H. Larson Fellowship
Jian-Xiang Shen	Maude Hammond Fling Fellowship
Kenneth W. Trantham	Avery Fellowship
Lisa M. Wiese	Hazel V. Emley Fellowship, American Ass'n. of Univ. Women Fellowship
Todd S. Young	Avery Fellowship

1993-94 Scholarships

Scott A. Annin	Barry M. Goldwater Scholarship
Joan R. Knight	Henry H. Marvin Memorial Scholarship
Conrad D. Engel	Joel Stebbins Fund Scholarship
Eric S. Green	U.S. Harkson Scholarship
Shilo J. Hilger	Physics & Astronomy Alumni Scholarship
Randy R. Porter	Henry H. Marvin Memorial Scholarship
Samuel P. Rankin	John E. Almy Scholarship
Jeremy C. Terry	Ed Hirsch Scholarship
Jeremy A. Vetter	Joel Stebbins Fund Scholarship

1994 Distinguished Teaching Assistant Awards

Mark A. Freeling **Martin J-C. Hu** **Bradley W. Ohlmann**

1993-94 Recognition Award for Contributions to Students

Brad Jacobsen **Gregory Snow** **Orhan Yenen**

1994 Sigma Xi Outstanding Graduate Student Award

Jiandi Zhang

George Holmes Distinguished Professor of Physics

John R. Hardy

1993-94 Society of Physics Students Officers

Oceana P. Francis, President
Scott A. Annin, Vice President
Samuel P. Rankin, Secretary
Daniel T. Hagrman, Treasurer

The Record

Physics Astronomy

Faculty Professional Activities

In addition to service on Departmental, College and University-wide committees, for 1994-95 a number of the faculty are active in local, national and international professional activities, as follows:

Clifford L. Bettis: Lincoln Children's Museum Science Committee; Physics Instructional Resource Association.

Paul D. Burrow: Gaseous Electronics Conference Executive Committee.

William B. Campbell: Rocky Mountain Consortium for High Energy Physics, Steering Committee.

Stephen Ducharme: NSF/SBIR Review Panel.

Robert G. Fuller: Interactive Physics CD-ROM (NSF/SBIR grant) (Consultant); Multinational Multimedia Bicycle Project (Co-director); Physics Academic Software Steering Committee.

Timothy J. Gay: Symposium on Two-Center Effects in Ion-Atom Collisions, Lincoln, NE (Chair).

John R. Hardy: Army Ballistics Research Lab, Aberdeen, MD (Consultant); U. S. Naval Research Laboratory (Consultant).

Duane H. Jaecks: 8th International Symposium on Polarization and Correlation in Electronic and Atomic Collisions (July 1994), Vancouver, BC, Organizing Committee; ICPEAC General Committee.

Sitaram S. Jaswal: Program Committee, International Conference on Magnets; Division of Condensed Matter Physics of American Physical Society (Teller).

Kam-Ching Leung: AAS Chrétien Research Grants Com-

mittee (Chairman); *Chinese Astronomy & Astrophysics* (Pergamon Press) Editorial Board; Scientific Organizing Committee (Chairman), The Third Pacific Rim Colloquium; Shaanxi Observatory, Academia Sinica, China (Distinguished Professor); United Nations Working Group, Astronomical Facility in the Pacific.

James A. R. Samson: Advanced Light Source, Berkeley, CA, Atomic Physics Beamline Committee; Argonne National Laboratory, Atomic Physics Review Committee; Fellowships Committee, Division of Atomic, Molecular, and Optical Physics; Program Committee, Oji International Seminar on Atomic and Molecular Photoionization, Tsukuba, Japan; NASA Planetary Atmospheres Review Panel; NASA UV, Visible, and Astrophysics Review Panel.

David J. Sellmyer: Magneto-Optical Recording Conference 1994, International Organizing and Program Committee; National Storage Industry Consortium Technical Council; Nebraska Experimental Program to Stimulate Competitive Research (EPSCoR) Committee; Nebraska Science and Technology Planning Task Force.

Gregory R. Snow: NSF Teacher Preparation and Enhancement Program Review Panel; SciTech Museum, Aurora, IL, Exhibit Development Committee; NSF Site Visit Team for 6 Scope, Sequence, and Coordination Projects.

Anthony F. Starace: APS Committee on Investments; APS Division of AMO Physics, Nominating Committee; Institute for Theoretical Atomic and Molecular Physics, Harvard-Smithsonian Center for Astrophysics (Advisory Board); *Physical Review A* (Editorial Board).

1994-95 Visiting Staff Members

Visiting Professors this year are **Sam Cipolla** (Ph.D. 1969, Purdue); **George Hadjipanayis** (Ph.D. 1979, Manitoba, Canada); and **Linxiang Zhou** (B.Sc. 1960, Xiamen University, China).

Visiting Associate Professor this year is **C. Martin Gaskell** (Ph.D. 1981, California-Santa Cruz) from the University of Oklahoma.

Visiting Assistant Professors this year are **Mark Clark** (Ph.D. 1988, North Carolina), working with Professor Fuller; condensed matter physicists **Diandra Lesley-Pelecky** (Ph.D. 1991, Michigan State), and **Charles B. Robbins** (Ph.D. 1969, Illinois), both working with Professor Sellmyer; and experimental condensed matter physicist **Chunxing Zhu** (M.S. 1988, Shanghai U. of Science and Technology), working with Professor Ducharme.

Research Assistant Professors this year are theoretical atomic physicist **Cheng Pan** (Ph.D. 1988, Virginia), working

with Professor Starace; and experimental condensed matter physicist **Zhengsheng Shan** (Ph.D. 1990, Nebraska), working with Professor Sellmyer.

In our Department as Postdoctoral Research Associates this year are theoretical condensed matter physicists **Huazhe Cao** (Ph.D. 1993, Nebraska) and **Qing Shen** (Ph.D. 1993, Northwestern, Evanston IL), both working with Professor J. Hardy; experimental condensed matter physicists **Jian Chen** (Ph.D. 1993, Texas-Austin), **Eric Singleton** (Ph.D. 1994, Delaware), and **Yuan Long He** (Ph.D. 1993, Rensselaer Polytechnic), all working with Professor Sellmyer; experimental atomic physicists **Jeffrey N. Cutler** (Ph.D. 1992, W. Ontario), **Zhong-Xiang He** (Ph.D. 1990, Hawaii), and **Wayne Stolte** (Ph.D. 1994, Nevada-Reno), all working with Professor Samson; condensed matter physicists **David N. McIlroy** (Ph.D. 1993, Rhode Island) and **Jiandi Zhang** (Ph.D. 1994), Syracuse, both working with Professor Dowben; theoretic-see 'Visiting Staff', next page

The Record

Physics Astronomy

1993 Fall Semester Colloquia

September 2: Professor Anthony F. Starace, University of Nebraska

“Fundamental Aspects of Some Few-Body Atomic Processes”

September 9: Dr. Chien-Tè Chen, AT&T Bell Laboratories

“Soft X-Ray Magnetic Circular Dichroism”

September 30: Professor John R. Hardy, University of Nebraska

“First Principles Studies of Ionic Molecular Solids: Computer Design of Novel Materials”

October 7: Professor Michael A. Morrison, University of Oklahoma

“Experimental and Theoretical Studies of Near-Threshold Electron-Molecule Scattering: The Agony and the Ecstasy”

October 21: Professor William J. Lewis, University of Nebraska

“Science and Mathematics Education Reforms in Nebraska”

November 4: *The Jerry E. Ruckman Lecture*: Professor Jack M. Wilson, Rensselaer Polytechnic Institute

“How Interactive Technology is Restructuring Physics Education”

November 11: Professor Linda S. Sparke, University of Wisconsin-Madison

“Warps in Galactic Discs”

November 18: Professor Jacob J. Leventhal University of Missouri-St. Louis

“Classical View of the Stark Effect in Atoms”

1994 Spring Semester Colloquia

January 27: Professor Keith B. MacAdam, University of Kentucky

“Orientational Effects in Collisions with Rydberg Atoms”

February 3: Professor Edward B. Hale, University of Missouri-Rolla

“Ion-Induced Electron Emission in Metals”

February 17: Professor Robert J. Hardy, University of Nebraska

“What’s New in the Theory of the Thermal Properties of Solids?”

March 3: Professor Myron Ya. Amusia, A. F. Ioffe Institute, Russia

“Many-Body Effects in Atomic Processes”

March 17: Professor Li-Zhi Fang, University of Arizona

“How Does One Show That the Universe is Big?”

April 7: Professor Philip L. Taylor, Case Western University

“Global Warming and the Greenhouse Effect—Are They Here Yet?”

April 14: Dr. Judith G. Cohen, California Institute of Technology

“Trends in Globular Cluster Research”

April 21: Professor E. Ward Plummer, University of Tennessee

“When are Thin Films of Metals Metallic?”

April 28: Professor Michael Kasha, Florida State University

“Art and Science of Musical String Instruments”

May 10: Professor Gregory R. Snow, University of Nebraska

“Search for the Top Quark at Fermilab”

Visiting Staff continued from previous page

cal atomic physicist **Qiaoling Wang** (Ph.D. 1991, Louisiana State), working with Professor Starace; experimental atomic physicist **Orhan Yenen** (Ph.D. 1986, Nebraska), working with Professor Jaeks; experimental atomic physicist **Martin Johnston** (Ph.D. 1993, California-Riverside) working with Professor Gay; condensed matter physicist **Renat Sabiryanov** (Ph.D. 1993, Institute of Chemistry of Solids, Ekaterinburg, Russia), working with Professor Jaswal; and experimental condensed matter physicist **Hassanayn Machlab** (MSEE 1991, Nebraska), working with

Professor Ducharme.

Research Associates this year are **Christopher J. Moore** (M.S. 1992, Nebraska) and **Vicki Plano Clark** (M.S. 1993, Michigan State), both working with Professor Fuller.

Research Assistants this year are **Thomas M. Ahlschwede** (B.S. 1993, Kansas), working with Professor Fuller; and experimental condensed matter physicist **Chunping Luo**, (M.S. 1990, Chinese Academy of Sciences), working with Professor Sellmyer.

1993 Faculty Publications

ASTRONOMY AND ASTROPHYSICS

- K.C. Leung**, "Cooperative Program On Close Binary Star Research Among The Pacific Countries," *Proceedings of United Nations/Indonesia Regional Conference on Space and Technology* (Jakarta: LAPAN 1993).
- E.G. Schmidt** and G.R. Carruthers, "Far Ultraviolet Stellar Photometry: A Field in Monoceros," *Astrophysical Journal* **408**, 484 (1993).
- T.J. Teays, J.T. Bonnell, **E.G. Schmidt**, E.F. Guinan and T.A. Barnes, "The Blazhko Effect in RR Lyrae," *Proceedings of the 27th ESLAB Symposium*.
- E.G. Schmidt**, and G.R. Carruthers, "Far Ultraviolet Stellar Photometry: A Field in Orion," *Astrophysical Journal Supplement* **89**, 259 (1993).
- E.G. Schmidt** and D. Reiswig, "The Behlen Observatory Variable Star Survey: Finding Charts and Light Curves for the First Ninety-Three Stars," *Astronomical Journal* **106**, 2429 (1993).
- N.R. Simon**, S.M. Kanbur, and D. Muihalas, "On Cepheids at Maximum and Minimum Light," *Astrophysical Journal* **414**, 310 (1993).
- C.M. Clement, S. Ferance, and **N.R. Simon**, "The RR Lyrae Variables in the Globular Cluster M68," *Astrophysical Journal*, **412**, 183 (1993).
- N.R. Simon** and C.M. Clement, "Are the Cepheids in IC 4182 Different From Population I Cepheids in the Galaxy?" *Astrophysical Journal (Letters)*, **419**, L21 (1993).
- N.R. Simon** and C.M. Clement, "The Masses and Luminosities of Globular Cluster RRc Stars," in *New Perspectives on Stellar Pulsation and Pulsating Variable Stars*, Edited by J.M. Nemeč and J.M. Matthews (Cambridge: Cambridge University Press 1993), p. 315.
- N.R. Simon** and C.M. Clement, "A Provisional RR Lyrae Distance Scale," *Astrophysical Journal* **410**, 526 (1993).

ATOMIC, MOLECULAR AND OPTICAL PHYSICS

- X. Shi, T.M. Stephen and **P.D. Burrow**, "Differential Cross Sections for Elastic Scattering of Electrons from N_2 at 0.55, 1.5 and 2.2 eV," *Journal of Physics B* **26**, 121 (1993).
- D.M. Pearl and **P.D. Burrow**, "Thermal Decomposition and the Apparent Dissociative Attachment Cross Sections of Heated Methyl-, Ethyl- and t-Butylchloride," *Chemical Physics Letters* **206**, 482 (1993).

- D.M. Pearl, **P.D. Burrow**, J.J. Nash, H. Morrison and K.D. Jordan, "Dissociative Attachment as a Probe of Intramolecular Electron Transfer," *Journal of the American Chemical Society* **115**, 9876 (1993).
- Adam P. Hitchcock, A.T. Wen, Sunwoo Lee, J.A. Glass, J.T. Spencer, and **P.A. Dowben**, "Inner Shell Excitation of Boranes and Carboranes," *Journal of Physical Chemistry* **97**, 8171 (1993).
- J.E. Furst, W.M.K.P. Wijayarathna, D.H. Madison, and **T.J. Gay**, "Investigation of Spin-Orbit Effects in the Excitation of Noble Gases by Spin-Polarized Electrons," *Physical Review A* **47**, 3775 (1993).
- T.J. Gay**, V.D. Irby, and S.P. Yallaly, "A High-Voltage Variable Resistor for Charge-Transfer Projective-Ion Energy Spectroscopy," *Review of Scientific Instruments* **64**, 1644 (1993).
- T.J. Gay**, J.E. Furst, and W.M.K.P. Wijayarathna, "Some New Developments in Polarized Electron Science and Technology," in *Invited Papers Presented at the Eighteenth International Conference on the Physics of Electronic and Atomic Collisions*, AIP Conference Proceedings Series, Number 295, pps. 276-285 (AIP, New York, 1993), pp. 276-285.
- J.F. Kirchoff, **T.J. Gay**, and E.B. Hale, "Has the True Ion-Induced Electron Yield from Copper and Other Metals Been Measured?" in *Ionization of Solids by Heavy Particles*, Edited by R.A. Baragiola (Proceedings of the NATO Advanced Research Workshop on Ionization of Solids by Heavy Particles, Giardini Naxos, Italy, 1992, NATO Advanced Research Series, Plenum, 1993).
- B.W. Moudry, O. Yenen, and **D.H. Jaecks**, "Collective Propensity of Orientation for Multielectron Ions in Collisions," *Physical Review Letters* **71**, 991 (1993).
- B.W. Moudry, O. Yenen, and **D.H. Jaecks**, "Alignment and Orientation Measurements of $(Ar^+)^*$ Formed in Transfer-Excitation Collisions with He^+ ," *Nuclear Instruments & Methods B* **79**, 75 (1993).
- O. Yenen, D. Calabrese and **D.H. Jaecks**, "Covalent-Ionic Problem: $H^+ - H^-$ Pairs from Doubly Excited $(H_2)^*$ Formed by Transfer-Excitation of H_2^+ During Collisions," *Nuclear Instruments & Methods B* **79**, 103 (1993).
- O. Yenen, L.M. Wiese, **D.H. Jaecks** and G.A. Gallup, " $H^+ - H^-$ Coincidences from the Three-Body Dissociation of H_3^+ ," *Physical Review A* **47**, 1059 (1993).
- D.H. Jaecks**, Invited Paper, "Alignment and Orientation of Ar^+ in $He^+ - Ar$ Collisions," 7th Symposium on Polarization and Correlation in Electronic and Atomic Collisions, Bielefeld, Germany, 29-31 July, 1993.

The Record

Physics Astronomy

- E.W. McDaniel, J.B.A. Mitchell, and **M.E. Rudd**, *Atomic Collisions: Heavy Particle Collisions* (John Wiley & Sons, New York, 1993).
- M.E. Rudd**, K.W. Hollman, J.K. Lewis, D.L. Johnson, R.R. Porter, and E.L. Fagerquist, "Doubly Differential Electron Production Cross Sections for 200–1500–eV $E^- + H_2$ Collisions," *Physical Review A* **47**, 1866 (1993).
- M.E. Rudd**, "Secondary Electron Spectra Resulting From Charged Particle Interactions," *ICRU News*, June 1993, p. 14–16. (Published by the International Commission on Radiation Units and Measurements in Aachen, Germany).
- Y.M. Chung, E.M. Lee, T. Masuoka, and **J.A.R. Samson**, "Dissociative Photoionization of H_2 From 18 to 124 eV," *Journal of Chemical Physics* **99**, 885 (1993).
- J.A.R. Samson**, C.H. Greene, and R.J. Bartlett, Comment on "Measurement of the Ratio of Double-to-single Photoionization of Helium at 2.8 keV Using Synchrotron Radiation," *Physical Review Letters* **71**, 201 (1993).
- J.A.R. Samson**, "Multiple Excitation Process in Photoionization," in *Many-Body Theory of Atomic Structure and Photoionization*, Edited by T.N. Chang (World Scientific Publ. Co. 1993), pp. 271–295.
- J.A.R. Samson**, E.-M. Lee, and Y. Chung, "Autoionization of Doubly Excited Ar Atoms into Ar^{2+} and Ar^+ Continuum States," *Journal of Electron Spectroscopy and Related Phenomena* **66**, 75 (1993).
- V.M. Borodin, **I.I. Fabrikant**, and A.K. Kazansky, "Collisional Broadening of Rydberg Atoms Perturbed by Ground-State Sodium Atoms," *Zeitschrift fuer Physik D* **27**, 45 (1993).
- I.I. Fabrikant**, "Resonant Theory of Dissociate Attachment," in *Dissociative Recombination: Theory, Experiment and Applications*, Edited by B.R. Rowe, J.B.A. Mitchell, and A. Canosa (NATO ASI Series B, vol. 313, Plenum Press, New York, 1993), p. 195.
- V.M. Borodin, A.K. Kazansky, D.B. Khrebtukov, and **I.I. Fabrikant**, "Adiabatic Complex-Plane Calculations of Rydberg States Broadening by Rb and K Perturbers," *Physical Review A* **48**, 479 (1993).
- I.I. Fabrikant**, "Theory of a Negative Ion Decay in an External Electric Field," *Journal of Physics B* **26**, 2533 (1993).
- I.I. Fabrikant**, "Electron Transfer in $Ca^*(4snl)-Ca(4s^2)$ Collisions," *Physical Review A* **48**, R3411 (1993).
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INTERDISCIPLINARY PHYSICS

•Archaeometry

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•Research in Physics Education

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•Track Physics

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The Record

Physics & Astronomy

New Research Grants and Contracts

during the period 1 November 1993 - 31 October 1994 the following new and renewal grants and contracts were received by our faculty

Principal Investigator	Title (Source of Funds)	Amount (\$ Thousands)
Burrow	Electron Scattering Studies of Temporary Anion Formation in Hydrocarbons (NSF)	94.0
Dowben	Drift Mobility Measurement/Thin Film Boron Carbide (AFOSR)	40.9
Dowben/ Woods	Photoassisted Chemical Vapor Deposition for Packaging & Fabrication of Wide-Band Gap Semiconducting Devices (AFOSR)	96.8
Dowben	Spin Polarized Inverse Photoemission Spectrometer (NSF)	80.7
Dowben	Metallicity of Surfaces/Metal Thin Film Overlayers (NSF)	75.0
Ducharme	Novel Photonic Materials (NSF)	89.3
Ducharme/Burrow/Duquette	Modern Optics & Lasers in Advanced Undergrad Lab (NSF)	24.5
Duquette	Laser Photoionization Studies of Excited Atomic States (NSF)	50.0
Fabrikant	Atomic Processes Involving Negative Ions (NSF)	49.5
Fuller	Multi-Media Mathematics: Across the Curriculum and Across the Nation (NSF)	50.0
Fuller	Research & Devel/Using Hypermedia (NSF)	112.5
Fuller	The Physics Infomall Guidebook (NSF)	168.0
Fuller	Teaching Physics Using Interactive Digitized Video (NSF)	81.3
Gay	Polarized Electron-Atom Collisions (NSF)	200.1
J.R. Hardy	First Principles Theoretical Studies of Ferroelectric Lattice Instabilities (ONR)	50.8
J.R. Hardy	Numerical Studies on Two Fluid Mixing (EG&G Idaho)	5.0
J.R. Hardy	Microwave Optics of Ionic Molecular Solids: Theory and Development (ARO)	80.0
Jaecks	Correlation Studies of Three Massive, Coulomb-Interacting Particles (NSF)	164.0
Katz	Theory of Biological Effectiveness (DOE)	45.0
Katz	Theoretical Evaluation of the Radiation Hazards from Cosmic Rays within Space Vehicles (NASA)	40.0
Samson	Interaction of Radiation with Planetary Gases (NASA)	50.0
Samson	Photoionization Studies of Atoms (NSF)	30.7
Samson	Ultraviolet and X-ray Bombardment of Planetary Atmospheres (NSF)	75.0
Sellmyer	Magnetism and Magneto-Optics of Artificially-Structured Materials (NSF)	51.1
Sellmyer	Fundamental Studies of Strongly Magnetic Rare Earth-Transition Metal Alloys (DOE)	72.7
Sellmyer	Ultra High Density Recording: Magnetic Disk Component (NSIC)	80.1
Sellmyer	Extra High Density Recording: Optical Recording Component (NSIC)	36.1
Sellmyer	Surface Studies of Metal Film Resistors (Dale)	5.0
Sellmyer	Materials Research on Nano-Structured and Complex Systems (EPSCOR)	1090.0
Simon	A Test of New Radiative Opacities and Their Incorporation into Improved Cepheid Pulsation Models (NASA)	46.0
Snow	Elementary Particles Physics (NSF)	28.1
Starace	Dynamics of Collision Processes (DOE)	64.0
Starace	Coherent Control of Continuum Quantum Processes (NSF)	75.0
Weymouth	Midwest Archaeological Center (DI)	1.9
Weymouth	Museum of the Rockies: Lower Portage Camp, Great Falls (MSU)	5.0
Weymouth	Museum of the Rockies: Merrell & Barton Gulch Sites (MSU)	1.1
Weymouth	Geophysical Surveys at Hopton Earthworks (DI)	4.0
Weymouth	Dixon Site Magnetometer Survey (UI)	2.5
Woods	Magnetization/Chemisorption on Ferromagnetic Surfaces (ACS)	10.0
TOTAL		\$3,325.4

ACS - American Chemical Society
 AFOSR - Air Force Office of Scientific Research
 ARO - Army Research Office
 Dale - Dale Electronics
 DI - United States Department of Interior

DOE - United States Department of Energy
 EPSCOR - Experimental Program to Stimulate Competitive Research
 MSU - Montana State University

NASA - National Aeronautics and Space Administration
 NSF - National Science Foundation
 NSIC - National Storage Industry Consortium
 ONR - Office of Naval Research
 UI - University of Iowa