SPECTRUM

A Newsletter for Alumni and Friends of the Department of Physics and Astronomy of the University of Nebraska–Lincoln

No. 14 Fall 1993 M. Eugene Rudd, Editor

Dowben, Gay, and Snow Join Department

Three new senior experimental faculty joined the Department this fall. These hires bring the number of experimental physics faculty in the Department to twelve, or about half the physics faculty. This increase from seven physics experimentalists only five years ago has required finding space for five new laboratories in the Department, as well as offices for laboratory-related students and postdoctoral researchers. Doing so has been an arduous and piecemeal effort entailing many separate building modification projects over a ten-year period. The result, however, is that we are becoming a more "normal" Department of Physics and Astronomy with a much wider range of experimental programs.

Peter A. Dowben

Associate Professor **Peter A. Dowben** is a condensed matter/materials physicist who holds a joint appointment in the Department and in the Center for Materials Research and Analysis. He received his B.A. in 1977 from Haverford College and his Ph.D. in 1981 from Cambridge University in the U.K. Following a three-year postdoctoral stint at the Fritz-Haber Institute in Berlin, Dowben was an Assistant and then an Associate Professor at Syracuse University before coming to Nebraska. He won a Sigma Xi Outstanding Faculty Research Award in 1989 and has authored over 140 research articles and submitted 3 patents. His research is supported by several sources of funding, including NSF, DOE, IBM, and AFOSR. Dowben's research interests include metallic and magnetic properties of thin films as well as novel cluster structures.

Timothy J. Gay

Professor **Timothy J. Gay** is an atomic physicist who was hired to fill the vacancy left when Professor M.Eugene Rudd retired this year. He received his B.S. in 1975 from California Institute of Technology and his Ph.D. in 1980 from the University of Chicago. Following a three-year appointment as a lecturer and postdoctoral researcher at Yale, in 1983 Gay joined the University of Missouri - Rolla, where he rose through the ranks to become a Professor in the Physics Department. At Rolla, Gay has won numerous outstanding teaching and outstanding faculty awards. His research interests lie in fundamental atomic collision processes, particularly regarding spin-dependent effects, as well as in the development of polarized electron technologies. Gay is chairing a conference in May 1994 to be held in honor of M. Eugene Rudd's contributions to atomic collision physics.

Gregory R. Snow

Associate Professor **Gregory R. Snow** is a high energy physicist hired to form an experimental group in this field at Nebraska. Snow received his A.B. degree from Princeton in 1976 and his Ph.D. in 1983 from The Rockefeller University. Following a postdoctoral appointment at Rockefeller, Snow joined the faculty at Michigan in 1987. He was awarded an NSF Presidential Young Investigator Award in 1988. Snow is a leading member of the D0 experiment at Fermilab. Among the goals of this experiment is the search for the top quark. Snow is a collaborator as well on the UA6 experiment at CERN studying products of proton - proton and proton-antiproton collisions. Snow has also been active in physics education projects at the SCITECH museum in Aurora, IL and at the Hands-On museum in Ann Arbor. An avid runner, he ran recently in the New York Marathon.

Hardy Named George Holmes Professor

John R. Hardy

Professor **John R. Hardy**, a native of Great Britain and a member of the Department faculty since 1967, was named George Holmes Professor of Physics in September. He was recommended for this honor by the Distinguished Professorships Committee upon nomination by Professors **David J. Sellmyer** and **Anthony F. Starace**. Hardy is a noted theoretical solid state researcher in the areas of lattice dynamics and statics of solids, the principle of latent symmetry, and the origin of high temperature superconductivity.

Hardy has an outstanding record of training graduate and postdoctoral students and collaborating with other scientists. His students have gone on to distinguished careers in theoretical condensed matter physics. He is also noted for his collaboration with experimentalists.

Hardy's demonstration that he could calculate such properties as effective Debye temperatures and moments of the lattice vibrational spectrum made him an international authority in the field of lattice dynamics, a field in which he has been active for many years. In 1979 he co-authored a book with A.M. Karo entitled, *The Lattice Dynamics of Alkali Halide Crystals.*

Five years ago, Hardy, in collaboration with one of his former students, UNO Regents Professor J.W. Flocken (Ph.D. 1969), went a long way toward developing a new theory of high temperature superconductivity, one of the outstanding problems in condensed matter physics. The standard theory places an upper limit on the transition temperature of superconductors which is very much lower than the temperatures achieved experimentally. Hardy and Flocken proposed a novel mechanism, a double-well potential, which leads to a radically higher predicted temperature for the superconducting phase transition. While it is too early to know the final outcome of the proposed theory, it has received support from Alex Muller, who won the 1987 Nobel Prize in physics for discovering this effect experimentally.

Physics Laboratory Manager Hired

Vicki L. Plano

Vicki L. Plano (M.S. Michigan State University, 1993) has been hired as the new physics laboratory manager. Vicki is a native of Kalamazoo, Michigan, and is a physics graduate of Kalamazoo College. She comes to UNL after a year as a research assistant in experimental atomic physics at Western Michigan University. Vicki has a strong interest in physics education and outreach programs. Her experiences with the Science Theatre group at MSU caused her to shift her career goals from research in atomic physics to physics instruction. Vicki said "The introductory physics labs at UNL are very similar to the ones I have experienced as a student and a teaching assistant. Those experiences combined with my work in experimental atomic physics have, I hope, prepared me to meet the challenges of this position."

She is looking forward to improving the introductory physics labs. Her plans include the introduction of a multimedia format.

Chairman's Letter

Anthony F. Starace

Graduates in most fields and professions are having a more difficult time now finding employment than in the recent past. The fields of physics and astronomy have not escaped this problem. In my own experience, the severity of the current job market is comparable to that of a generation ago. In 1957, as a young boy, I remember reading the *New York Times* on the day after the USSR launched Sputnik, the world's first man-made orbiting satellite. The newspaper was filled with stories about the strong science and mathematics preparation young Soviet students received in school. There was the implication that America needed more scientists to compete. I was already inclined toward science anyway, but this event determined the matter for me. By the time I entered college in the 1960's, the job market for scientists was booming. Universities, government labs, and industry were all hiring. However, by the time I received my doctorate in the early 1970's, the boom had turned to a bust. I felt very lucky to get a faculty position at Nebraska.

Causes of the Tight Job Market

The current job dearth appears to stem from an unfortunate clustering of a number of events, all of which have led to either fewer jobs or more competition for the available number of jobs. These events include the end of the Cold War, growing federal government budget deficits, the current world-wide recession, the end of mandatory retirement, and foreign political events. Let's consider each of these in turn.

We should, of course, all be grateful that the Cold War is over. It is, however, resulting in structural changes in the US economy. Specifically, the defense and aerospace industries are cutting back and government laboratories associated with them are also downsizing. These industries and labs have been major employers of science and engineering graduates.

The US government's budget deficit is focusing legislators' attention on that fraction of the US budget in which spending is discretionary, i.e., not part of an entitlement program such as Social Security, Medicare, Medicaid, etc. A major casualty so far is the scuttling of the Superconducting Super Collider and the jobs associated with it. More generally, there is talk of restructuring the government laboratories and the science agencies to ensure that society and, especially, the economy benefit more directly from the Nation's investments in science and technology. A new model for government support of science and technology is clearly needed. Pending the development of such a model, science funding and government laboratory employment are unlikely to help ameliorate the current job dearth.

The world-wide recession has dried up employment in industry. It used to be a safe bet to specialize in some field of science or engineering that was of use to industrial employers. Then, if one failed to locate a job in academe one could "always" get a job in industry. This truism, if it ever was true, does not apply now. Even companies which formerly regarded layoffs as unthinkable (e.g., IBM) are undergoing major restructurings.

In academia, over the next decade there is likely to be a massive turnover of staff as the many faculty hired in the 1960's retire. However, mandatory retirement ages will no longer be legal after January 1, 1994. Hence long-term planning for replacement hiring is more difficult than in the past. Of course, regardless of the effect on the employment market, we should all applaud the fact that improved medical care and healthier lifestyles are making ages of 65 and 70 not seem so old anymore since there are so many individuals beyond these ages who are still physically and intellectually vigorous and productive in their endeavors!

Finally, political events throughout the world have increasingly impacted the US job market in science and engineering. One could give many examples. Here are four. In Great Britain, government restructuring of support for science in universities coupled with recession has made science job prospects grim. In Germany, the high cost of reunificationin addition to recession has had a similar effect. In the former Soviet Union, the fall of Communism has given Soviet scientists the opportunity to travel abroad, and inflation has so decimated the currency that employment abroad has become a necessary means of personal survival. In China, the tragic events of Tiananmen Square have led many extremely capable students studying abroad to seek to remain for political reasons. Conditions such as these have resulted in increased numbers of applicants for every U.S. job opening in science and engineering.

Some Perspectives

What can one do about this situation? Every fall, I meet with our junior and senior majors to discuss graduate schools and careers and so I've thought carefully about this matter. If there were fields that were hot, one could advise students to go into those fields. However, I know of none. Hence, after describing the current job situation, I've emphasized two things. First, that the decade or more needed to prepare for a career in science is far longer than it may take for a change to occur in any of the cluster of events described above. (Cynics argue, with some justification, that such events have a 4 year time scale, the length of a Presidential term!) Hence it is really not possible to predict what the job situation will be 5-10 years hence when students currently embarking on a scientific career may be in the market for a permanent job.

Second, I emphasize the necessity of flexibility. Scientists have been trained to analyze complex sets of data and to make predictions (or decisions) based on the results. Such abilities are of great value in many non-traditional careers in addition to the usual scientific ones. Thus if it turns out that the job situation is adverse when one is looking for employment, training in science will aid in the search for a job as long as one remains willing to search widely.

Examples abound. A study by the AAPT in the early 1980's found that such analytical skills were highly desired by deans of business schools, who as a group expressed great interest in attracting more physics majors to their MBA programs. A recent issue of *The Economist* magazine reported that many physicists knowledgeable in nonlinear dynamics (chaos) are being hired by financial firms to analyze financial market data. Many of this Department's graduates, both theorists and experimentalists, have successfully carved out careers in the relatively new area of medical physics, and are teaching in medical schools or working in hospitals in both diagnostics and treatment of various medical conditions. Many, many more graduates of this Department have reported back to us that the laboratory skills they acquired here as undergraduates have been invaluable to them in their careers, even when these have been in fields far removed from physics.

Lastly, while the current employment situation looks grim, it should not blind us to the larger perspective. Namely, if one looks at the challenges society must confront in the future, such as environmental changes, development of alternative energy sources, and world-wide economic competition, it seems inconceivable that scientists and engineers will not have a major role to play.

Two of our alumni have addressed these issues recently. George Look (BS 1971) was this year's alumni speaker at our annual Recognition Luncheon for Department graduates. As reported elsewhere in this issue of *Spectrum*, Look advised graduates to be flexible in their pursuit of a career. He found his physics training extremely valuable in his career as an arms control negotiator.

Career Survey

Kevin Aylesworth (PhD 1989) has just been elected a General Councillor of the American Physical Society (see article inside). He ran for this position in order to get the APS more involved with the current job crisis than it has been. Already he has teamed up with science observer Sheila Tobias to survey physicists nationwide on their careers, both to find out more accurately how they are coping with the present job situation and to provide anecdotal evidence of the wide range of career options open to individuals with science backgrounds. A copy of the survey he's conducting is being mailed to all alumni with this newsletter. I hope you will give it your attention and send it in.

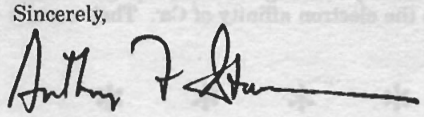
Department News

As this issue of *Spectrum* reports, this Department is doing its share to help with the employment crisis. Three new faculty and a Laboratory Manager have been hired in the past year. In addition, our external grants for research and education are at record levels, bringing the number of grant-related personnel in the Department also to record levels. These additional people and the offices and labs they require are squeezing us more than ever. We've completed the move of our Department offices to the first floor of Brace Lab so that the entire second floor of Behlen comprises research labs and offices for the faculty, students, and other researchers who use the labs. Just when I thought we could breathe easily, the Department received a large NSF EPSCoR grant that will bring in even more grant-related personnel. What to do? Well, I read in the *Chronicle of Higher Education* recently (10/6/93, p. A45) that new faculty at the Sorbonne in Paris when they inquire about

their offices, are told they could use the café across the street. Things are not yet that bad here, but such a solution does not seem so far-fetched now as it once might have. We continue, however, to draft plans for renovation projects and rearrangements of our facilities to meet our growing needs. If anyone would care to help us financially to add a wing or at least a few extra floors to our facilities, please call me collect!

As always, I want to thank you, our alumni and friends, for the financial support you continue to provide. Our growing research stature and high-quality teaching programs benefit enormously from the private financial resources we have available to us for equipment, for fellowships and scholarships, for colloquia and seminar series, and for other program support. I thank our recent graduates also for their strong rate of response to our recent survey of opinions on our programs. This survey is being carried out as part of an upcoming Academic Program Review, on which I will report next year. In the meantime, do keep in contact and let us know about 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

Books Published by Department Faculty

While most of the publications that come from the Department are articles in journals, occasionally someone publishes a book. Now within one year three books authored and one edited by Department professors have been published.

Professor **Leo Sartori's** book *Fundamentals of Relativity* will be published by the University of California Press in 1994. Based on a course which Prof. Sartori has given at UN-L over the past twenty years, the book is aimed at a non-specialist audience and focuses on the logical structure of special relativity. Some historical material is included. Another feature is a detailed analysis of relativistic paradoxes. The last two chapters contain an introduction to general relativity and to cosmology.

The book has received enthusiastic pre-publication reviews. One reviewer stated "I am unaware of any other text at this level that presents the ideas of relativity in such a complete and convincing manner, yet without the use of any but the most elementary mathematics... This work may lead to a new wave in the teaching of relativity at the undergraduate level."

Emeritus Professor **Theodore Jorgensen's** interest in golfing led to an article several years ago in the *American Journal of Physics* on the physics of golf. This attracted widespread interest and ultimately led to its expansion into the book *The Physics of Golf* which was published in October 1993 by the American Institute of Physics and advertised in the *Physics Today* issue of that month. In the book, Ted analyzes the golf swing using a mathematical analysis based on the equation of motion of the double pendulum. The results of his analysis are compared with data obtained from stroboscopic photographs of actual golf swings. Ted contends that minor adjustments in the swing can have substantial effects on the distance the ball travels. While he says that mastering the swing is the most important part of golf, his book also treats other aspects such as the aerodynamics of golf, the matching of clubs, the flexibility of shafts, and the handicap system.

In 1964 Professor Earl W. McDaniel of Georgia Institute of Technology wrote a highly successful graduate level textbook on atomic collisions. A few years ago he began updating it with a new two-volume version. The first volume, published in 1989 by John Wiley & Sons, was entitled *Atomic Collisions: Electron and Photon Collisions*. However, after beginning the second volume, McDaniel had some health problems and also realized that the rapid advance in the field made it difficult for one person to adequately cover it all. He thereupon enlisted the aid of Prof. J.B.A. Mitchell of the University of Western Ontario (one of our colloquium speakers last year) and Professor **M. Eugene Rudd** of the University of Nebraska. The three coauthored the book *Atomic Collisions: Heavy Particle Projectiles*, also published by Wiley, which came out in May 1993.

Rudd says the 681 page book is a bargain at only $125 (ouch!). Chapters of the book deal with elastic scattering, excitation, dissociation, chemical dynamics, ionization, charge transfer, negative ions, ion-molecule reactions, swarms, and recombination.

New Frontiers in Binary Star Research is the title of Vol. 38 of the Astronomical Society of the Pacific Conference Series published by the Pacific Rim Colloquium and edited by Professors **Kam-Ching Leung** and I.-S. Nha of Yonsei University in Seoul, Korea. This 471-page book contains the papers given at a colloquium at Seoul and Taejon, Korea in November 1990, including three papers by Leung and also two by Professor **Arcadio Poveda**, a former visiting professor at Nebraska, now at a university in Mexico.

IN MEMORIUM: JAMES C. COE (1900-1993)

Jessie B. and James C. Coe

James C. (Kositzky) Coe, one of the Department's major benefactors, died May 1st in Phoenix. A military burial ceremony was held in Yankton, South Dakota. He is survived by his wife, Jessie B. Coe.

Coe was born in 1900 in Niobrara, Nebraska to Gustav and Josephine Kositzky. His parents had emigrated to this country in 1871 from Europe. They encouraged each of their seven sons to attend the University of Nebraska. Four sons played varsity football. All retained a deep loyalty to their alma mater throughout their lives.

James Coe went to graduate school at M.I.T. and was struck by the out-of-date equipment in the teaching labs. In 1983, he and his wife Jessie took steps to ensure that Nebraska students had state-of-the-art equipment in their educational programs. They established the Kositzky Memorial Equipment Fund, in honor of his parents, to benefit students in the Department of Physics and Astronomy, in the College of Business Administration, and in the College of Engineering and Technology. The Kositzky Fund is an endowment, so the income will benefit students at this University in perpetuity.

Over the past 10 years this Department has received about $240,000 in equipment money from the Kositzky Fund. The money has been used to buy modern experimental laboratory equipment for our teaching and research labs, lecture demonstration equipment for our large enrollment courses, and computers and software for our Physics Learning Center. These funds have been used whenever possible to match additional funds from other sources, thereby leveraging the benefits even further. For example, Kositzky funds along with NSF and University grants were used to establish the James and Jessie Coe X-Ray Materials Characterization Facility. The funds from the Kositzky endowment have made a measurable improvement in the quality of our teaching and research programs in only the first 10 years they have benefitted us. The Coes' foresight in emphasizing the quality of the tools of learning looks certain to have a growing impact on our students and our programs in the future.

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 28 December 1992 issue of PRL, Associate Professor **Sy-Hwang Liou** and collaborators from the Materials Science Division at Brookhaven National Laboratory report on measurements which seek to solve a major problem standing in the way of practical uses of high-temperature superconducting materials. The problem is that magnetic fields generated by high superconducting currents tend to leak into the superconducting material, thereby quenching the superconducting current and returning the material to its non-superconducting state. A solution to this problem is to create defects in the superconducting material since these defects tend to pin down stray magnetic field lines and extend superconducting behavior to much higher temperature than in the normal material. Liou's work concerned thallium-cuprate high-T_c thin films. Defects were created in these films by heavy-ion irradiation. At the optimum defect density, the group measured a thousand-fold enhancement of the superconducting current at 77 K for magnetic fields of order 2.5 T.

In the 5 July 1993 issue of PRL, Professor **James A.R. Samson**, Professor (and alumnus) **Chris H. Greene** (B.S.1976) of the University of Colorado, and a Los Alamos collaborator report on an effect which has been overlooked in the currently hot research area of photo double ionization of the helium atom. For many years there have been theoretical predictions of a constant ratio of double to single photoionization of the helium atom at asymptically high photon energies. This ratio was predicted to be about 1.6%. Only recently, however, have experimental measurements become possible and these have generated much new theoretical interest and controversy. The present PRL Comment points out that if the experimental measurements detect ion production, then at high photon energies the Compton effect will become a significant competing process, producing singly and doubly charged helium ions plus a scattered photon. Therefore if the experiments do not perform an electron energy analysis, the photoionization measurements need to be corrected for the Compton effect. Even before this Comment appeared in print, this insight stimulated what has become the newest hot field, experimental and theoretical work on the high energy Compton effect!

In the 16 August 1993 issue of PRL, graduate student **Brian Moudry**, postdoctoral researcher **Orhan Yenen**, and Professor **Duane H. Jaecks** report studies of charge exchange collisions of He^+ ions with Ar atoms. They performed a coincidence measurement to determine the states of the Ar^+ and He particles in the final state. They found that the five outer p-electrons in the Ar^+ ion are collectively rotating in the same sense as the internuclear axis in the collision. In other words, the angular momentum of the colliding nuclear system tends to get transferred into the angular momentum of the circulating unpaired electrons in the Ar^+ ion. Such a propensity rule is well-known for atoms and ions in which there is only a single electron. This is the first experiment that provides experimental proof of a more general applicability of this propensity rule to multielectron ions.

In a Rapid Communication in the September 1993 issue of PR-A, postdoctoral research associate **Qiaoling Wang** and Professor **Anthony F Starace** demonstrated numerically how quantum interference effects occurring in atomic processes can be controlled using coherent, short laser pulses. The process studied was detachment of the outer electron of the H^- negative ion by a short laser pulse in the presence of an external, static uniform electric field. Normally the cross section for this process has ripples due to interference between the two pathways for the detached electron to escape: the direct path along the direction of decreasing electric field potential and the reflected path in which the electron initially travels in the direction of increasing electric field potential and is reflected. In their calculations with electronic wave packets, they found that if the laser pulse length is shorter than the classical reflection time for the reflected wave packet, then the cross section ripples disappear: there is no longer any direct amplitude for the reflected electrons to interfere with! This result led them to propose a new kind of experiment. Namely, if at the time the reflected electron wave packet returns to the origin a second, coherent laser pulse produces a new wave packet, then interference can re-occur. The relative phases of the two coherent laser pulses determine whether there is constructive or destructive interference, with corresponding effects on the magnitudes of the respective cross sections. Such control of quantum interference and the connection to classical dynamics is well known in studying highly excited (Rydberg) atoms. These calculations are the first to predict similar control in a continuum state atomic process.

In a Rapid Communication in the November 1993 issue of PR-A, Associate Professor **Ilya I. Fabrikant** reports a theoretical analysis for some startling new experimental results of graduate student **Kenneth W. McLaughlin** and Assistant Professor **David W. Duquette**. Fabrikant considers the charge exchange process $A^* + A \longrightarrow A^+ + A^-$, in which A^* is a highly-excited (Rydberg) atom. He shows theoretically that the cross section for this process is extremely sensitive to the energy mismatch between the Rydberg atom A^* and the negative ion (A^-) energy level. Therefore, in cases for which the electron affinity of the negative ion is extremely small , making it hard to either measure the electron affinity or calculate it accurately, the charge exchange process utilizing laser-produced Rydberg atoms (A^*) may be the most accurate experimental means of obtaining the electron affinity. The reason is that the smaller the electron affinity, the denser the number of Rydberg levels in the energy region that is significant for the charge exchange process, hence the more likely that a particular Rydberg level will stand out from all the others, permitting an accurate determinination of electron affinity. McLaughlin and Duquette utilized such an approach to obtain the electron affinity of Ca^-. Their results are awaiting publication.

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CMRA Receives Grant for Ultra-High-Density Recording

The Center for Materials Research and Analysis (CMRA) has received a 5-year grant of about $1.6 million from the National Storage Industry Consortium (NSIC) which is funded by the Advanced Research Projects Agency (ARPA) of the federal government. According to Professor **David J. Sellmyer**, director of CMRA, this is part of a joint research program on ultra-high density information storage by magnetic disk and magneto-optic recording. NSIC's goal is to achieve an areal density of 10^{10} bits per square inch by the year 2005. Other Nebraska professors involved in the project are **Roger Kirby, Sy-Hwang Liou, Brian Robertson,** and **Zhengsheng Shan**.

The specific topics being researched include the study and development of a magnetic film media consisting of exchange decoupled grains having dimensions of only about 200 Å and a coercivity of 3000 Oe. In the magneto-optics project, they will be seeking a film with a large Kerr rotation (1-2 degrees) at a 400 nm wavelength, and also having a grain size of about 200 Å to produce a low media noise film.

An areal density of 10^{10} bits per square inch corresponds to storing on a 1.8 inch diameter disk the information in a stack of single spaced typewritten pages 120 feet high.

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Department Supplies Books and Journals to Needy Countries

While we often grumble about the level of support for our teaching and research activities, our situation is far better than that in many countries. In recent months we have received and responded to pleas for donations of books and journals from three less fortunate institutions.

Piotr Krzyszton of the Kaclowa School in Poland wrote asking for American physics textbooks in physics, astronomy, and astrophysics. The members of our Department responded and some 50 books were sent to him in December.

Mumtaz Zaidi, a member of our faculty about 30 years ago, wrote in May from the Centro de Investigacion y de Estudios Avanzados del IPN Unidad Merida in Mexico asking for past issues of *Physical Review, Reviews of Modern Physics, American Journal of Physics, Astrophysical Journal* and *Journal of Chemical Physics* to supplement their poorly equipped library in support of a new masters and Ph.D. program. More than 30 boxes of journals, weighing over 2000 pounds, were gathered from the faculty and shipped to Mexico.

In addition, books on physics and astronomy and some equipment were sent to Professor Ivan Lalov, Dean of the Faculty of Physics at St. Kliment Ohridski University of Sofia in Bulgaria.

Department Shares $3.9 Million EPSCoR Grant

In August the state of Nebraska was awarded a three-year $3.9 million grant for scientific research. The grant, which is to be matched by state and University funds, was awarded by the National Science Foundation under its Experimental Program to Stimulate Competitive Research (EPSCoR). The program was initiated in 1980 to assist states with low levels of R&D support to strengthen their science and engineering research capabilities, to improve the quality of education in those areas, and to foster university/industry interaction. Two years ago the program was expanded, making Nebraska eligible. The grant to Nebraska will be divided among three projects, one of which will be partly carried out in this Department:

• **Materials Research on Nanostructured and Complex Systems.** This is to advance our understanding and application of advanced materials with novel properties and unusually complex atomic structures. Emphasis will be on nanostructured magnetic films, ferroelectrics and high temperature superconductors, synthesis of nanophases, and molecular layers and thin-film structures. This project, headed by Professor **David Sellmyer**, director of the Center for Materials Research and Analysis, will involve scientists from UNL, UNO, several Nebraska industries, and the IBM and 3M companies. Among the other UNL participants are Department Professors **J.A. Woolam, R.D. Kirby, S.S. Jaswal, S.H. Liou, J.P. Woods**, and **C.J. Eckhardt.** State-of-the-art facilities to be used in the research include instruments for x-ray diffraction, crystallography, electron microscopy, materials preparation, mechanical characterization and optical and magnetic resonance spectroscopy. The program also has a strong emphasis on education and will fund approximately 6 postdoctoral positions, 20 graduate research assistants, and 12 undergraduate assistants.

• **Function of Metals in Natural Processes.** This project, headed by UNL biochemistry Professor John Golbeck, involves research into the role of metal ions in plant biology. Other participants are from UNL, Creighton University, Hastings College, and Eastman Chemical Co.

• **Adaptation/Mechanism Interface in Behavioral Biology.** Improved livestock management techniques, improvements in methods of saving endangered species, and public education about animal behavior are some of the goals of this research directed by Alan Kamil of UNL with participation by UNO and Creighton University.

New Laser Course Instituted

Although lasers have been studied by students in various courses in the Department, the rapid growth of their technology and the increasing demand for workers trained in their use in research and in industry justifies a separate course in the subject. As noted in the 1989 report "Lasers and Modern Optics in Undergraduate Physics," nearly one-third of today's experimental papers in physics and chemistry report on research involving the use of lasers. Professor **Stephen Ducharme** has designed such a course. It has now been approved to be offered in the spring semester.

With the prerequisites of Physics 142 or 212 plus a laboratory course in science or engineering, students will be able to register for Physics 398, *Physics of Lasers and Modern Optics.* The course, comprising one hour of lecture and three hours of laboratory per week, will deal with such topics as detector physics, geometrical optics, reflection and refraction, polarization, Gaussian beams, coherence, diode lasers, interferometry, holography and phase conjugation, atomic spectroscopy, fiber optics, and nonlinear optics. Students in the advanced laboratory courses Physics 442 and 443 may also elect to do some of the laser experiments developed for this course.

According to Ducharme, the course has the two-fold purpose of teaching concepts of physics using fascinating visual phenomena and of exposing students to optical techniques and phenomena which a majority of them will encounter in their careers.

Ducharme, along with Professors **Paul Burrow** and **David Duquette** are resubmitting a proposal to the National Science Foundation for funds to modernize the laser and optical equipment used in the upper-level laboratories.

Fuller Receives Most Prestigious Teaching Award

Robert G. Fuller with his videodisc "Physics: Cinema Classics."

For many years the various campuses of the University of Nebraska have awarded several Distinguished Teaching Awards to professors whose teaching was judged to be superior. This year the University established a sort of "super-recognition" award honoring one or two individuals from the entire multi-campus University system. This is the Outstanding Teaching and Instructional Creativity Award (OTICA). The Department is proud that one of its members, Professor **Robert G. Fuller**, was one of two people selected for the first of these prestigious awards, which were presented on June 19.

No stranger to teaching honors, Fuller received Distinguished Teaching Awards from the University in 1973 and in 1986. The American Association of Physics Teachers awarded him its Distinguished Service Citation in 1986 and the Robert A. Millikan Medal in 1992. He was named one of the 10 best college professors in America by *Insight* magazine in 1987, and in the same year the Nebraska Legislature passed a commendatory resolution to honor him.

Fuller is a pioneer in the application of learning theory, especially the work of Swiss psychologist Jean Piaget, to the teaching of science. He developed the innovative program ADAPT (Accent on Development of Advanced Processes of Thinking) which has flourished on the UNL campus for 15 years and has attracted national attention. In addition, he has been active in utilizing new technologies in teaching such as computer-assisted instruction, videodiscs, and film loops.

To carry out his projects in science education he currently has external grants from the National Science Foundation, the Department of Education, and other sources which total in excess of $800,000 annually.

Jaswal Awarded Distinguished Teaching Award

Sitaram S. Jaswal

Professor **Sitaram S. Jaswal** received a College of Arts and Sciences Award for Distinguished Teaching in April 1993. He came to UNL in 1966 after two years of postdoctoral work at the University of Pennsylvania. Jaswal was born in India and received his B.Sc. and M.Sc. degrees from Punjab University and in 1964 his Ph.D. from Michigan State University. He is active in Departmental affairs and is a productive researcher with more than 80 publications in refereed journals. His research field is the theory of the electronic structure of magnetic and magneto-optic materials.

Perhaps the most outstanding characteristic of his teaching method is the level of personal concern he has for his students. As one student said, he is not a "slick" lecturer, but his concern for the students promotes an excellent learning atmosphere. He has the knack of getting students to relate what they are learning in physics to their other studies. Professor Jaswal is a versatile teacher who does well teaching advanced courses for majors as well as elementary courses for nonmajors. He is involved in teaching activities beyond the classroom and is the faculty advisor for the campus chapter of the Society for Physics Students.

Staff Activities

Among the recipients of the UNL Parents Association "Recognition Award for Contributions to Students" in January were Professors **Clifford L. Bettis, Robert G. Fuller, Evelyn Tuska Patterson, Norman Simon, and Donald J. Taylor.**

Patty Christen, the Accounting Clerk for the Department, received the Sigma Xi Support of Research Award for her outstanding work in managing the internal purchasing and accounting systems which service all of the research grants as well as the Departmental expenditures. Especially cited was her ability to solve the difficult problems encountered in tracking several million dollars of expenditures each year. In 1991 she received the Regent's KUDOS award in recognition of the superior way in which she handles her job.

A $14,000 Partners In Science grant from the Research Corporation supported work done last summer in Professor **Stephen Ducharme's** laboratory by Beatrice High School physics teacher Robert McClelland (MS 1969). The collaboration will continue through the 1994-95 academic year. This program provides high school physics teachers with opportunities to work at the cutting edge of science by collaborating with university research scientists. It enables them to bring first-hand experience of research and careers to their students. McClelland is making a study of the anisotropy of the electro-optic response of photorefractive polymers and will examine the effects of polymer preparation and temperature. He was also able to build a diode laser which he will use in his classroom teaching.

Jack Loos, a machinist in our Instrument Shop for many years and Acting Manager of the shop since the death of Don Fuehring in July 1992, was appointed Manager of the Shop on December 1, 1992.

Electronics Technician **Donald Miller** retired in April after 15 years in the Electronics Shop. A luncheon was held at Valentino's and Don was presented with a certificate of appreciation from the University and gifts from the Department. He is now living in Alliance, Nebraska with his son. Don has been replaced by **Brian Farleigh**, who for several years had been employed by the Polar Ice Core Project but had done his work in our Electronics Shop.

Professor **Duane H. Jaecks** has been appointed to a National Science Foundation review panel for their Instrumentation and Laboratory Improvement Program.

Don Miller and Department Chairman Anthony Starace

Professor **M. Eugene Rudd,** along with two other alumni of the College of Arts and Sciences, was given a 1993 Alumni Achievement Award at a ceremony held in the Wick Alumni Center on April 8, 1993. Rudd received his Ph.D. degree from the University of Nebraska in 1962.

Department Business Manager **Allen Specht** has taken on business duties for the Center for Materials Research and Analysis in addition to his work for the Department. While he was previously a half-time employee, his position is now a full-time one.

Professor **John Weymouth** supervised geophysical surveys this summer in western Greece as part of the Nikopolis Project of the Archaeology Department of Boston University. Involving 50 staff and students, the project used magnetic, conductivity, and probe resistivity studies on sites from the classical Greek through the Roman and Byzantine periods. Magnetic and other anomalies identified some square structures, possibly foundations, and others probably caused by pottery kilns or metal smelting facilities. He also conducted surveys near Bozeman, Montana at the site of Fort Ellis, a fort occupied by the US Army beginning in the 1860s. This project was sponsored by the Museum of the Rockies of Montana State University.

* * * * * *

Gallup and Rudd Retire

Professor **Gordon A. Gallup**, who has been in the Department of Chemistry since 1955, was given a courtesy appointment in the Department of Physics and Astronomy in December 1992 in recognition of his collaboration with members of this Department including Professors Sellmyer, R. Hardy, Macek, Jaecks, Fabrikant and Burrow. He has been the "outside member" of the graduate committees of numerous Ph.D. candidates in physics. Gallup's A.B. degree was from Washington University in St. Louis and his Ph.D. from the University of Kansas. He has done extensive theoretical research in quantum chemistry, the theory of electron scattering, and in atomic structure, and has been a frequent attendee at atomic physics seminars and physics colloquia. In May he officially retired from his university position but has moved his office to the subbasement of Behlen Laboratory to continue his active collaboration with members of the Department. In May 1993 a symposium in his honor was sponsored by the Chemistry Department. At that symposium four of his 21 Ph.D. graduates were speakers.

Retiring at the end of August, Professor **M. Eugene Rudd** has also continued to be active in research. He received his B.A. degree in 1950 at Concordia College in Moorhead, Minnesota, his M.A. in 1955 at the University of Buffalo. During his eleven years on the faculty at Concordia College, he had a two-year leave of absence in which he finished his Ph.D. at Nebraska in 1962. He returned to Nebraska to join the faculty as an Associate Professor in 1965. Since then he has had a major role in bringing the atomic physics group at UNL to its current internationally-prominent position. His work on secondary electrons ejected in collisions of ions and electrons with atoms and molecules has been supported by one of the longest-running grants of the National Science Foundation. He became a Professor in 1968 and served as Acting Chairman of the Physics Department from 1970 to 1972 following Henry Valk's move to Georgia Tech. He is a fellow of the American Physical Society and served in 1980 as Chairman of his national professional society, the American Physical Society Division of Electron and Atomic Physics.

Seven students have received their Ph.D. degrees with Rudd and two more are currently finishing their research. A small amount of residual grant money will keep an undergraduate working on an electron impact project until next May. He also chairs an international committee charged with writing a comprehensive report on secondary electron spectra. After he and his associates publish their research results, he plans to divide his time between possible future research collaborations and his hobby of collecting antique scientific instruments and rare books in science. A symposium in honor of his retirement is planned for May 13-14, 1994.

Indiana Kam & the Magic Staff of Lake Toba

Kam-Ching Leung, professor of physics and astronomy at UNL, was in Indonesia in the summer of 1992 collecting wood carvings and other native art pieces. Some of the islands of Indonesia are world renowned for tribal wood carvings produced by their native populations.

Siberut is an island of low hills, swamps, rivers and dense rain forests 70 miles off Sumatra. There are few visitors at most, and those who make the journey from Sumatra disembark from Padang in a harbor some distance from the reef-bound and dangerous side of the island where Leung was headed. He had to hire a guide with a small canoe to take him halfway around the 80 miles long by 30 miles wide island.

The inhabitants of Siberut watched him inquisitively as he approached their village. They weren't hostile or openly aggressive like the reformed headhunters of Ecuador were, Leung was relieved to observe. [He was in Ecuador on a 1991 trip.]

"All of the places are inhabited by retired headhunters and cannibals," he thought. "But these people look like they retired longer ago than the natives in Ecuador."

Most of the year Leung has his head turned toward the heavens. He is a student of close binary stars--paired stars that constitute up to 80 percent of the stars in the universe--and his studies of their behavior have resulted in a number of significant discoveries. It is only during brief periods, generally during the summer, that he looks away from the universe to examine his own planet.

Leung slotted his visit to Siberut into a summer of professional visits and consultations with astronomers in southeast Asia, Korea, China and Tibet. In Tibet, he spent several days on a 14,000 foot mountain plateau about a two-hour ride from Lhasa, evaluating the site for a medium to large-sized telescope planned by the Chinese government. In Southeast Asia, he visited both Indonesia and Thailand, working with astronomers and government officials to find a way to obtain funds to build an observatory somewhere in the region.

Leung enjoyed a reputation as a seasoned world traveler well before last summer. Last year, some of his graduate students taped a sign over the door of his office in Ferguson Hall, proclaiming that the sanctum was that of "Indiana Kam."

Leung moved easily among the Siberut natives. He made friends and watched them at work and play, sometimes participating in both activities with them. He recalled, a month or two later in his office that despite having few of the trappings of modern civilization, the people on this primitive but tranquil island quickly adapted to one modern innovation--mosquito nets. "We (Leung and his guide) didn't take any nets along with us," Leung said. "We found it to be a serious oversight when we bedded down in the outdoors that night."

His hosts, however, were generally gracious. And though wood carving wasn't a highly developed skill among the Siberut natives, Leung left the island with some souvenirs--a tobacco pouch carved from a coconut, and a loin cloth made for him from the bark of a tree.

Most of the latest additions to his collection are in his living room, and they include an intricately carved staff as dark as ebony but not ebony. Leung said the magic staff is from an island in the volcanic Lake Toba in northern Sumatra. It had been blackened by many years of use as a ceremonial object housed in a poorly ventilated, smoke filled domicile on Nias.

The fact that his avocation occasionally puts him in harm's way he dismissed with a shrug. "Once you come out, you don't worry," he said. But, he recalled, there were some moments. Like that time in Ecuador.

His 14-year-old son, Kienan, was with him during a tense moment in the summer of 1991, far up a crocodile and piranha infested tributary of the Amazon River with a motorized dugout canoe. Leung, his son and their guides stopped at a native village deep in the rain forest, and were treated civilly enough until it came time to depart.

"They wanted our gasoline, and we couldn't convince them that we needed it for our long homeward trip," Leung said. "It was my son, our two boatmen and I with only hunting knives against 50 or more natives, most of them armed with wooden spears, arrows and blowguns with poison darts. It didn't take us long to figure out who would come out ahead in that confrontation, so we filled up as many of their containers as we could and then got out of there."

"I don't like to call any people uncivilized," he said. "What does that mean, anyhow? That they don't wear a suit and tie? No. That's not it. They have different cultures, and from that come differences in communications. But sometimes, one thing leads to another, and you wind up in real physical danger."

Kam-Ching Leung and his guide make the treacherous journey from Padang to Siberut via dugout canoe.

On Siberut, while the natives were friendly, the environment itself posed certain hazards, Leung said. "Sometimes I worry more about catching malaria or something or suffering an injury when there's nowhere to go for help."

He isn't sure when he will return to Indonesia, but he has a standing offer from an attorney on one of the Indonesian Islands to explore Egganno, a tiny, isolated, seldom visited island.

(This is an abridged version of an article written by Robert Sheldon which appeared in the Nebraska Alumnus Magazine for Spring 1993.)

Professors Make Scientific Pilgrimages

A trip to Denmark in July to attend the International Conference on the Physics of Electron and Atomic Collisions gave Professors **Duane H. Jaecks** and **M. Eugene Rudd** an excuse to stop in England to make a pilgrimage to a few of the "holy places" in the history of science. First on the agenda was a trip to Woolsthorpe Manor, the birthplace and family home of Isaac Newton, which is north of London near the city of Grantham. What is probably the original apple tree of the famous legend still grows in the yard. A church in the nearby village of Colsterworth contains a stone sundial made by Newton and the school in Grantham attended by Newton still has the window sill where he carved his initials. Rudd also visited the Trinity College Library in Cambridge, a splendid building designed by Sir Christopher Wren, where he was able to examine some of the books from Isaac Newton's personal library. Newton is said to have made a practice of folding over a corner of a page in a book to mark references to his own work. Sure enough, in Newton's copy of William Molyneux's *Dioptrica Nova* the sentence "as is noted by the admirably learned Mr. Newton in his incomparable treatise..." was so marked!

In Bath, England, the two visited William Herschel's home where they saw the workshop where he made the best reflecting telescopes of the late 18th century and stood in the garden where he used one of his telescopes to discover the planet Uranus. Near Bath they found Lacock Abbey where William Henry Fox Talbot invented the negative-positive photographic process. The two pilgrims found the famous latticed bay window pictured in the earliest dated negative photograph, now at a museum at the University of Texas. On their way back to London they stopped to see a house once occupied by Joseph Priestley, the scientist who discovered oxygen.

In a later trip Rudd went to a museum at the site of Ole Roemer's 17th century observatory near Copenhagen. This is where the Danish astronomer made his observations of the moons of Jupiter that first proved that light had a finite velocity. In Florence, Italy, Rudd found one of the villas where Galileo had lived. In the Museum of the History of Science in Florence he not only saw two telescopes made by Galileo, but also the bones of one of Galileo's fingers preserved for all to see!

Kelty and Farleigh Do Electronics in Greenland

Brian Farleigh holding the Nebraska flag at the GRIP camp

While most of us were enjoying warm weather this summer, two members of the Electronics Shop ventured again onto the Greenland icecap in support of polar research. This year found both Electronics Technician Brian Farleigh and Electronics Shop Manager Bob Kelty at the European GRIP (Greenland Ice Core Project) camp at Summit, Greenland and later at Dye 3, Greenland. Kelty and Farleigh are members of the Snow and Ice Research Group (SIRG) along with Research Associates B. Lyle Hansen, Karl Kuivinen, and Technician Bill Boller, members of the former UNL Polar Ice Coring Office (PICO). A grant from NASA with logistics assistance from the GRIP European community supported the construction and deployment of the SIRG Thermal Probe that was to melt its way through the 3 kilometers of ice at Summit. A breakdown in the heaters caused this year's attempt to be abandoned, but most of the equipment was saved and a new probe is being assembled for another try in 1994.

A camera system like one used in Kelty's model trains was used to hook and recover a reamer stuck in a bore hole at Dye 3, but that hole still remains plugged with ice. High correlation in δO^{18} (the change of the oxygen-18 isotope concentration, which indicates climate changes) between the 1989 and 1992 surveys at Camp Century in North Greenland has sparked renewed interest in the continued logging of bore holes, particularly the Dye 3 hole, which was last logged in 1987 during the "Search for the Fifth Force" gravity experiments performed there. A coring drill may be used to clear the hole so that future surveys might give a better indication of the earth's past climate record.

Ducharme Visits Former Soviet Union

The present sad predicament of scientists in the Former Soviet Union (FSU) has been the subject of numerous recent news reports and articles. But in August Professor **Stephen Ducharme** witnessed the situation firsthand when he attended the International Meeting on Photorefractive Materials, Effects and Devices in Kiev, and when he and his wife were guests of Moscow physicist Professor Vladimir M. Fridkin for three weeks.

Fridkin, who is Head of the Electronic Materials Laboratory at the A. Shubnikov Institute of Crystallography of the Russian Academy of Sciences, is the discoverer of the bulk photovoltaic effect and other phenomena and is the author of seven books. Fridkin and his wife were in Lincoln from May to July pursuing collaborative research with Ducharme concerning nonlinear optical and ferroelectric materials.

Ducharme says that while the political and economic situation in Russia is undergoing a great upheaval and the situation is compounded by unemployment and crime, people still have hope. Scientists are in an especially critical situation because of the lack of adequate government funding. In many cases, they can work only by developing international cooperation and finding support outside the FSU. One of Fridkin's associates makes paint for a living and comes to the laboratory only in his spare time, spending his personal funds to subsidize the meager laboratory budget. A typical Ph.D. researcher in Fridkin's group earns only $25 a month, which is not a living wage in Moscow.

Ducharme and Fridkin have submitted a proposal for joint funding to the NSF International Opportunities for Scientists and Engineers Program. If funded, one of Fridkin's colleagues will spend two years in Ducharme's laboratory and reciprocal visits will be made on a regular basis.

Vladimar M. Fridkin and Stephen Ducharme.

Look Speaks at 1993 Recognition Luncheon

George W. Look

George W. Look (B.S. 1971) was the invited alumnus to speak at the May 6th Recognition Luncheon which the Department holds annually to recognize Department graduates of the past year and to honor students and faculty who have received awards or honors. Look is the Deputy Representative of the Special Verification Commission in the International Security Policy Division of the Defense Department. He spoke on "Physicists, Nuclear Arms Control and the Washington Bureaucracy — A Personal View."

Prior to his talk, Look reminisced about his days at Nebraska. The late 1960's and early 1970's were politically turbulent because of the Vietnam War. He remembered especially the draft lottery, student antiwar demonstrations, football Saturdays and some of his interactions with our faculty. He recalled Ted Jorgensen's remarks on building his house and on his studies of the golf swing. He remembered advice Duane Jaecks gave him never to throw away any experimental results since, if the experiment is reliable, the points that don't fit one's expectations are the most interesting ones. He learned that there's a lot of grunt work in science when Kam Leung employed him to do numerical analyses using card sorters, work related to Leung's efforts to establish the Behlen Observatory. He was grateful to be hired by the Department after graduation as a lab assistant to set up experiments in our teaching laboratories.

Look did graduate work at Virginia Polytechnic Institute and Purdue University, where he received a PhD in high energy physics in 1977. He then joined the staff of Sandia National Laboratory in Albuquerque, where for nine years he led studies of nuclear force exchanges, nuclear weapons safety, and nuclear weapons security. After a year at a consulting firm working on arms control verification technology, he joined the Defense Department in 1987 as Deputy Director of Verification Policy.

From 1988 to the present Look has been working as a representative to the Special Verification Commission of the INF (Intermediate Nuclear Forces) Treaty. He negotiated procedures for implementing the INF Treaty's inspections and missile system eliminations. This work entailed three trips to the former Soviet Union, which he led, to resolve major treaty implementation issues. Details of what equipment could be used to carry out inspections had to be negotiated after the treaty was signed. He told many interesting stories of these negotiations. For example, Ever-ready flashlights were not allowed, but another brand was acceptable.

Look stated that arms control is a part of national security policy and hence follows the ups and downs of political events. He emphasized to our graduates that his background as a physicist was invaluable in his career in arms control. This background gave him the ability to structure arguments and to serve as a mediator between technical and political people. He told students that if they enjoy problem-solving, then there are many job opportunities for physicists in addition to the traditional ones.

Look was accompanied by his wife, Karin, who is a lawyer and is also engaged in arms control. She is a division leader at the Arms Control and Disarmament Agency.

We Heard From

Boeckman, James M. (B.A. 1976) 2821 S 2nd Street, Omaha, NE 68108–1703. Is employed as a System Programmer with Computing Services/Telecommunications at the University of Nebraska Medical Center.

Bolorizadeh, M.A., (M.S. 1979, Ph.D. 1984) University of Kerman, Kerman, Iran. "Greetings. I was glad to be able to visit my honorable teachers and colleagues from Nebraska at the ICPEAC meeting in Aarhus. I presented a paper on the cross sections for multiple ionization of copper by electrons. At this time I have a permanent position at the Shahid Bahonar University of Kerman. From October 1992, I was on leave to spend my sabbatical at the Queen's University and collaborated with Dr. Shah and Professor Gilbody."

Bryan, Blaine D. (B.S. 1960) 2625 Bobcat Trail, Titusville, FL 32780. Employed as a Senior Quality Engineer/Auditor at the EG&G Florida/ Kennedy Space Center.

Byrne, Eric J. (B.S. 1983) 4809 Dunckel Drive, Lansing, MI 48910. Is an instructor at Michigan State University. "I graduated from UNL with a B.S. in both Physics and Computer Science. Every year I enjoy hearing from you and learning how the Department is doing. This year I plan to finish my Ph.D. in Computer Science, at long last!"

DuBois, Robert D. (B.S. 1970, M.S. 1972, Ph.D. 1975) 7721 W 13th Street, Kennewick, WA 00337. Employed as a senior scientist at Battelle Pacific National Laboratory. "I always enjoy reading the *Spectrum* and hearing what's new. Also I thoroughly enjoyed visiting in May. Many changes since I graduated and obviously many more in progress. Best regards to everyone."

Eddy, Stephan E. (B.S. 1978) 2780 Forest Point, League City, TX 77573. Employed as an ISO Management Representative with Schlumberger Well Services. "I'm interested in hearing from members of the old S.L.O.P. (Student Learning Opportunities in Physics) Club. It's nice to see familar faces in *Spectrum.*"

Furtak, Thomas E. (B.S. 1971) 15927 W. Ellsworth Lane, Golden, CO 80401. Is a Professor of Physics at the Colorado School of Mines.

Hofmann, Werner, R. (Former Staff) Institute für Physik und Biophysik, Universität Salzburg, Hellbrunner Str. 34, A–6020 Salzburg, Austria. Is an Associate Professor.

Hollman, Kyle W. (B.S. 1988) 6032 McPherson, St. Louis, MO 63112. Is a Graduate Teaching Assistant in the Department of Physics at Washington University.

Johnston, Alan R. (M.S. 1978, Ph.D. 1983) 15 Wynnewood Drive, Cranbury, NJ 98512–2811.

Lannan, William J. (M.A. 1956) 924 N Park, Helena, MT 59601. Is Director of the Montana Guaranteed Student Loan Program.

Liu, Chih–Ray (M.S. 1985, Ph.D. 1988) is an Assistant Professor in the Department of Radiation Oncology, U.F. Shands Cancer Center, University of Florida, P.O. Box 100385, Gainesville, FL 32610–0385.

May, Arthur D. (B.S. 1954 Geology/Physics) RR#1, Box 92C, Avoca, IA 51521. Retired Computer Programmer.

Potter, James G. (Former Postdoc) Department of Physics and Space Sciences, Florida Institute of Technology, Melbourne, FL 32901. "I am a Professor Emeritus. I do not know why I am favored to receive the *Spectrum*, but I certainly enjoy reading about all the good things connected with your department."

Richards-Kortum, Rebecca (B.S. 1985) 718 Shade Tree Drive, Austin, TX 78712. Is an Assistant Professor in the Department of Electrical and Computer Engineering at the University of Texas–Austin, Biomedical Engineering Program, Engineering–Science Building 610, Austin, TX 78712–1084. "I was named a Presidential Faculty Fellow by NSF this year. We got to travel to Washington and attend the National Medal of Science/National Medal of Technology Awards in the Rose Garden. Alex is now walking – he keeps us on our toes!"

Schmidt, James J. (B.S. 1956, M.S. 1957) 187 Eastside Road, Deer Lodge, MT 59722. Retired.

St. Lucas, J. (M.S. 1976) 13033 Earlgate Ct., Poway, CA 92064–5833. Is a Senior Engineer with General Dynamics S.S., PO Box 85990, San Diego, CA 92186–5990. "I just noticed that you folks have email, and a site that's ftp'able by anonymous means. Oh, I graduated from there back in, what, 1976? Every now and then I receive something from the UNL Physics Department giving the current news, and status of former alumni, etc. How about giving an email address next time, so people who are too lazy to write what we're doing, where we are, etc., can email an update to some physics–department address? Or maybe also receive the UNL updates via email? That way people from around the world could keep in closer touch with what's going on back in Lincoln–land, or whether my sundial in 301 Brace is still working? Just some thoughts. . . ." [*Editor's note: e–mail messages can be sent to* ASTARACE@UNLINFO.UNL.EDU].

Stricklett, Kenneth L. (M.S. 1981, Ph.D. 1987) National Institute of Standards and Technology, Gaithersburg, MD 21701.

Synowicki, Ronald A. (B.S. 1990) 3717 S. 117th Street, Omaha, NE 68144. Is a Graduate Teaching Assistant in the UNL–Center for Microelectronic and Optical Materials Research.

Tonder, Steven 221 Satellite Lane, NE #3, Fridley, MN 55432. Is a Freelance Technical Writer on the Expert Biography Update Project at Teltech.

Xing, Lei (M.S. 1987) Department of Physics, University of Illinois, Urbana, IL 61801. "Glad to hear from you. I moved to Illinois last summer to pursue my postdoctoral research. All the best to you."

Yilk, Todd A. (B.A. 1991) Department of Physics, Yale University, New Haven, CT 06520.

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Michael Day Uses National Guard Artillery to Teach Physics

The complications of projectile motion have been illustrated in dramatic fashion to students at Lebanon Valley College in Annville, Pennsylvania. Their physics teacher, **Michael A. Day** (Ph.D. 1983), recently wrote an article with Martin H. Walker on the experiments in the March 1993 issue of *The Physics Teacher*. Walker, a major in the Pennsylvania Army National Guard, is the logistics officer for the 28th Division Artillery. With data on such things as muzzle velocities supplied by the Guard, Day and his class worked out the expected ranges of shells for different projection angles. Then, in a field trip, their predictions were tested at the National Guard firing range at Fort Indiantown Gap using nine firings of a 155-mm M198 howitzer shooting a 95-pound shell.

The students quickly learned that the elementary textbook equation for projectile motion requires numerous corrections to yield accurate predictions. In addition to atmospheric drag, wind, and the curvature of the earth, they also needed to take account of such effects as the dependence of the drag coefficient on temperature and elevation, the angle of yaw of the shell in its trajectory, the Coriolis force, and the direction of spin of the shell. The range, which was between 4000 and 7000 m, was measured by tracking radar and the muzzle velocity by Doppler radar. The ranges predicted by the class were typically within 2.5% of the measured values, almost as good as the ranges predicted using the Army's published firing tables. The class also calculated such effects as the average force on the shell, the pressure in the gun, and the recoil momentum.

Aylesworth Elected to APS Governing Board

Last year's *Spectrum* reported on the organization of the Young Scientists' Network (YSN), an informal confederation of young physicists concerned about the job market for new Ph.D.s. A Nebraska graduate, **Kevin Aylesworth** (Ph.D. 1989) started the YSN and has continued his efforts to draw attention to the plight of many young scientists seeking employment by his letters to *Physics Today* and his updates on the electronic mail network used by YSN members for communication. One of Aylesworth's goals was to form the YSN into a political force. He has recently succeeded in that plan by initiating a petition drive in which he and YSN member Zachary Levine of Ohio State University sought positions on the governing board of the American Physical Society. Their campaign, carried out through their electronic bulletin board, was successful and, as reported in the October 1 issue of *Science*, the two were able to defeat the candidates nominated by the APS.

Aylesworth contends that the physics establishment is partly to blame for the scarcity of jobs because it continues to train large numbers of Ph.D.s at a time when the job market for them is shrinking. More emphasis on the employment situation in APS actions might be expected now that Aylesworth and Levine will be sitting on the Council. "This election certainly sends a message to the Council," notes APS president-elect Burton Richter. "It's an indication that a big part of the membership wants more emphasis on the employment problem." However, others on the Council, while admitting there is a problem, are not convinced that the APS is in a position to do anything about it. Still others, such as Council member Michael Turner, are not convinced that there is an overproduction of physics Ph.D.s. "We tend to overreact in this Country," he says, "and try to turn off the spigot as soon as there is a problem. We need more Ph.D.s in the physical sciences, not fewer, because it's technological prowess that's going to keep this country afloat." The transactions of the APS Council will surely be watched with interest after the two newcomers take office at the end of the year.

Meanwhile, Aylesworth is now turning to the practical matter of helping physicists find jobs. He is collaborating with well-known science observer Sheila Tobias on a Research Corporation survey "that looks beyond in-class education to the experiences and prospects of careers for science majors." In order to gather data for a book on nontraditional employment for scientists, surveys are being sent to alumni of various science departments in order to reach not only those who have remained in science but also those who have entered other fields. All are being asked to give anecdotal evidence of how their science education has been used in their careers.

Each alumnus of this Department is receiving a copy of this survey with this newsletter. You are urged to fill it out and return it to Sheila Tobias at the address indicated on the survey. Results of this survey will provide raw data for the planned book.

* * * * * *

Acknowledgments

The Department is very grateful to the following individuals and corporations for their new and continuing financial contributions during the period 1 November 1992 – 31 October 1993. 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!

Richard C. Altrock (B.S. 1962)
Amoco Foundation
William A. Barrett, Jr. (B.S. 1952, M.S. 1953)
Blaine D. Bryan (B.S. 1960)
Thomas E. Bullock (M.S. 1979)
Louis J. Caplan (M.S. 1964, Ph.D. 1975)
Jessie Coe
FMC Foundation
David M. Gray (B.S. 1977)
Andrew T. Groebner (B.S. 1989)
Bert H. Hartzell (A.B. 1939 Math/Physics)
Ping He (M.S. 1989, Ph.D. 1993)
Alan J. Heeger (B.S. 1957)
Howard L. Heinisch (M.S. 1968, Ph.D. 1972)
Louise C. Hewell
Kyle W. Hollman (B.S. 1988)
Gary M. Hoover (B.S. 1961 Math/Physics)
IBM Corp.
Sitaram S. Jaswal
David W. Keifer (B.S. 1968)
William J. Lannan (M.A. 1956)
Richard D. MacMillan (M.S. 1970)
Robert L. McKenzie (B.A. 1948)
Charles B. Minnich (B.Sc.E.E. 1937)
Burton E. Moore
Joseph L. Parker (Ph.D. 1940 Chemistry/Physics)
Phillips Petroleum Foundation
Kevin D. Reilly (M.S. 1962 Physics/Math)
Rockwell International
Jerry E. Ruckman (B.S. 1962)
M. Eugene Rudd (Ph.D. 1962)
James J. Schmidt (B.S. 1956, M.S. 1957)
Donald P. Schneider (B.S. 1976)
Theodore J. Schuldt (B.S. 1959, M.A. 1961)
David J. Sellmyer
Michael R. Stamm (M.S. 1966, Ph.D. 1976)
Anthony F. Starace
Alan B. Tveten (M.A. 1959)
Maurice H. Witten (M.A. 1960)

THE RECORD

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No. 9 Fall 1993

Anthony F. Starace, Editor

1992–93 DEGREE RECIPIENTS

Bachelor of Arts

Michael B. Beza (December 1992). Is an Ensign in the United States Navy

Jeffrey J. McNeil (August 1992). Is a Second Lieutenant in the United States Marine Corps.

Bachelor of Science

Stanley J. Allen (December 1992). Is working for Kawasaki in Lincoln.

Nathan P. Borchers (May 1993). Is an Ensign in the United States Navy.

Joseph S. Centenni (December 1992). Is working in a computer company in Westbury, New York.

Richard E. Ervin (August 1992). Is working for MicroImages Inc. in Lincoln.

Stephen T. Gunther (December 1992). Is working in industry in Houston, Texas.

William T. Heller (With High Distinction, May 1993). Is enrolled in the graduate physics program at Rice University

Peixen Li (August 1992). Is enrolled in the graduate physics program at the University of Michigan.

Daniel A. Meyer (August 1992). Is enrolled in the graduate physics program at Florida State University.

Paul J. White (May 1993). Is a project assistant specializing in keywording for the Physics Teacher's CD–Rom Toolkit Project under the direction of Professor Robert G. Fuller.

Master of Science

Min–Qi Bao (December 1992). Is engaged in doctoral research with Professor Anthony F. Starace.

Ralph E. Cofield (May 1993). Is in Texas job hunting.

Martin M. Liphardt (December 1992). Is engaged in doctoral research with Professor Stephen Ducharme.

Sudhir S. Malhotra (December 1992). Is engaged in doctoral research with Professor Sy–Hwang Liou.

Jing Meng (May 1993). Is engaged in doctoral research with Professor Ram Narayanan in the Electrical Engineering Department at UNL.

Christopher J. Moore (December 1992). Is a research associate in physics education with Professor Robert G. Fuller.

Michael R. Schetterer (May 1993). Professor of Physics at the United States Air Force Academy in Colorado Springs.

Stephen P. Tonder (December 1992). Is a Technical Writer on the Expert Biography Update Project at Teltech in Minneapolis.

Lisa M. Wiese (May 1993) Is engaged in doctoral research with Professor Duane H. Jaecks.

Jing Yang (May 1993). Has returned to Kunming, China.

Ying Bo Zhang (August 1992). Is engaged in doctoral research with Professor John A. Woollam.

Doctor of Philosophy

Ping He (May 1993). Is working for the John A. Woollam Company.

Apostolos Sarris (August 1992). Has returned to Athens, Greece and is currently fulfilling his military service obligation. He's using his knowledge of remote sensing in the Greek Army's meteorology service.

Sueying Shi (August 1992). Is working part–time in Canton, Ohio.

Dexin Wang (May 1993). Is a postdoctoral research associate in the Center for Materials for Information Technology at the University of Alabama in Tuscaloosa.

Yi Ming Xiong (May 1993). Is working for the John A. Woollam Company.

HONORS

1992-93 Fellows

Kenneth W. McLaughlin	Bukey Memorial Fellowship; Henry F. & Jean D. Holtzclaw Fellowship; Donald Walters Miller Fellowship
Alan P. Runge	CMRA Summer Fellowship
Efren Serra	Richard H. Larson Fellowship
Jian-Xiang Shen	Bukey Memorial Fellowship
Rui Qi	Maud Hammond Fling Fellowship
Dexin Wang	Presidential Fellowship (Elmer C. Rhoden Fund)
Weijia Zhang	Avery Fellowship

1992-93 Scholarships

Steven J. Buda	Joel Stebbins Fund Scholarship
Conrad D. Engel	Henry H. Marvin Memorial Scholarship
Joan R. DeButts	U. S. Harkson Scholarship
Eric S. Green	U. S. Harkson Scholarship
Clifford D. Miles	Joel Stebbins Fund Scholarship
Brent A. Peterson	Henry H. Marvin Memorial Scholarship
Randy R. Porter	Physics & Astronomy Alumni Scholarship
Matthew E. Ramspott	John E. Almy Scholarship
Samuel P. Rankin	Henry H. Marvin Memorial Scholarship
Donald C. Stafford	U. S. Harkson Scholarship

1993 Sigma Xi Support of Research Award

Patricia J. Christen

1993 Distinguished Teaching Assistant Awards

Kayvan Aflatooni **Brian E. Jones**

1993 Alumni Achievement Award of the College of Arts and Sciences Alumni Association

M. Eugene Rudd

1993 College of Arts and Sciences Distinguished Teaching Award

Sitaram S. Jaswal

1993 Recognition Award for Contributions to Students

Clifford L. Bettis **Evelyn T. Patterson**
Robert G. Fuller **Norman Simon** **Donald J. Taylor**

1993 Outstanding Teaching and Instructional Creativity Award

Robert G. Fuller

Robert A. Millikan Medal of the American Association of Physics Teachers

Robert G. Fuller

1992-93 Society of Physics Students Officers

Eric Green, President **Mary Krasovec, Vice President**
Joan DeButts, Secretary **Michael Anderson, Treasurer**

Faculty Professional Activities

In addition to service on Departmental, College and University-wide committees, in 1993-4 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: *AAPT Announcer,* "Ask the Medium" column (Author); *AAPT Instructional Materials Center* (Editor); AAPT Publications Committee; Physics Academic Software Steering Committee; Science Supplement of Nebraska Statewide Systemic Initiative (Co-Principal Investigator).

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: Edgerton Museum Project, Plainsman Museum, Aurora, NE (Consultant); 8th International Symposium on Polarization and Correlation in Electronic and Atomic Collisions (July 1994), Vancouver, BC, Organizing Committee; ICPEAC General Committee; National Academy of Sciences, NSF Graduate Fellowship Committee (Chairman); NSF Instructional Equipment Program Evaluation Committee.

Kam-Ching Leung: AAS Chrétien Research Grants Committee (Chairman); *Chinese Astronomy & Astrophysics* (Pergamon Press) Editorial Board; Shaanxi Observatory, Academia Sinica, China (Distinguished Professor); United Nations Working Group, Astronomical Facility in the Pacific.

Sy-Hwang Liou: *Applied Physics Communications* (Editor).

James A. R. Samson: Advanced Light Source, Berkeley, CA, Atomic Physics Beamline Committee; Argonne National Laboratory, Atomic Physics Review Committee; Optical Society of America, X-Ray and Ultraviolet Techniques Committee.

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.

Gregory R. Snow: NSF Teacher Preparation and Enhancement Program Review Panel; SciTech Museum, Aurora, IL, Exhibit Development Committee.

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

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1993-94 Visiting Staff Members

Visiting Professors this year are **Sam Cipolla** (Ph.D. 1996, Purdue) and **George Hadjipanayis** (Ph.D. 1979, Manitoba, Canada).

Visiting Associate Professors are **C. Martin Gaskell** (Ph.D. 1981, California-Santa Cruz) from the University of Oklahoma; **Jang Hae Jeong** (Ph.D. 1988, Yonsei, China); and **Soon-Young Jeong** (Ph.D., Korea U.).

Visiting Assistant Professors this year are physics education researcher **Charles R. Lang** (Ph.D. 1975, Kansas State); **Charles B. Robbins** (Ph.D. 1969, Illinois); and experimental condensed matter physicist **Chunxing Zhu** (M.S. 1988, Shanghai U. of Science and Technology).

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 experimental high energy physicist **Giuseppe Ballochi** (Ph.D. 1989, Rochester), working with Professor Snow; experimental condensed matter physicists **Jian Chen** (Ph.D. 1993, Texas-Austin) and **Yuan Long He** (Ph.D. 1993, Renssalaer Polytechnic), both working with Professor Sellmyer; experimental atomic physicists **Jeffrey N. Cutler** (Ph.D. 1992, W. Ontario) and **Zhong-Xiang He** (Ph.D. 1990, Hawaii), both working with Professor Samson; condensed matter physicist **David N. McIlroy** (Ph.D. 1993, Rhode Island), working with Professor Dowben; theoretical atomic physicist **Qiaoling Wang** (Ph.D. 1991, Louisiana State), working with Professor Starace; and experimental atomic physicist **Orhan Yenen** (Ph.D. 1986, Nebraska), working with Professor Jaecks.

Research Associates this year are **Dongjin Byun** (M.S. 1993, Syracuse); **Seong-Don Hwang** (M.S. 1991, Syracuse), and **Jiandi Zhang** (M.S. 1992, Syracuse), all working with Professor Dowben; **Christopher J. Moore** (M.S. 1992, Nebraska) and **Laurie Gottsche Rapkin** (M.A. 1988, Nebraska), both working with Professor Fuller.

Research Assistants this year are **Thomas M. Ahlschwede** (B.S. 1973, Kansas); **Dominic Calabrese** (Ph.D. 1993, Nebraska), and **Brad Jacobsen** (M.A. 1993, California), all working with Professor Fuller.

1992 Fall Semester Colloquia

September 3: Professor Robert G. Fuller, University of Nebraska–Lincoln
"Hypermedia and the Knowing of Physics: Standing Upon the Shoulders of Giants"

September 10: Professor Patricia A. Thiel, Iowa State University
"Thin Film Structure at Low Deposition Temperatures"

September 24: Professor Laird A. Thompson, University of Illinois
"Adaptive Optics: A Revolution in Ground-Based Astronomy"

October 1: Professor Robin Shakeshaft, University of Southern California
"Multiphoton Ionization of Atoms"

October 22: Dr. Eric P. Rudd, Intellimetrics, Hopkins, MN
"Don't Slam the SLAM: Scanning Laser Acoustic Microscopy"

October 29: *The Jerry E. Ruckman Lecture:* Professor Arnold B. Arons, University of Washington
"Understanding vs Coverage—Resisting the Undertow"

November 9: Murray Gell-Mann, Robert Millikan Professor of Theoretical Physics, California Institute of Technology
"Simplicity, Complexity, and Complex Adaptive Systems"

November 12: Professor J. Brian Mitchell, University of Western Ontario
"New Experiments on H_3^+ Recombination"

November 19: Professor Chris H. Greene, JILA and University of Colorado
"Novel Physics of Doubly-Excited Atoms"

December 10: Professor Craig J. Eckhardt, University of Nebraska–Lincoln
"Crystal Engineering in Two Dimensions: A Calculative and Experimental Excursion into Flatland"

1993 Spring Semester Colloquia

January 21: Professor Mark W. Meisel, University of Florida
"One-Dimensional, Integer-Spin Antiferromagnets: To Order or Not to Order"

January 26: Dr. Francisco Lamelas, AT&T Bell Labs
"X-Ray Studies of Crystal Surfaces During Vapor-Phase Growth"

February 2: Dr. Daniel L. Abraham, University of Nijmegen, The Netherlands
"Nanomagnetism in the 1990s"

February 4: Professor Peter Dowben, Syracuse University
"Are the Surfaces of Metals Metallic?"

February 9: Professor Jon M. Slaughter, University of Arizona
"Theory of Exchange Coupling in Magnetic Multilayers"

February 18: Professor Timothy Gay, University of Missouri-Rolla
"Testing Physical Theories With Polarized Electrons: From Relativistic Atomic Collisions to the Standard Model"

February 25: Professor C. Martin Gaskell, University of Nebraska–Lincoln
"Quasars—Into the Black Hole"

April 8: Professor E. Dan Dahlberg, University of Minnesota
"Ubiquitous Non-Exponential Decay—Disorder, Interaction, or What?"

April 15: Professor Robert N. Compton, Oak Ridge National Laboratory and University of Tennessee
"Negative Ions"

April 26: Professor Daniel M. Kaplan, Northern Illinois University
"High-Rate Heavy-Quark Experiments at Fermilab"

April 29: Professor Gregory R. Snow, University of Michigan
"The Production of 'Direct Photons' From CERN Experiment UA6, Fermilab Experiment D0, and the SSC"

May 6: Professor Vladimir Fridkin, Russian Academy of Sciences
"Ferroelectric Polymers"

1992 Faculty Publications

ASTRONOMY AND ASTROPHYSICS

K.C. Leung, "Binary Stars, Contact," in *Reference Encyclopedia of Astronomy and Astrophysics*, (New York: Van Nostrand Reinhold 1992), pp. 63–65.

D.Q. Zhou and **K.C. Leung**, "Circulation in Contact Binary Systems," in *Evolutionary Processes in Interacting Binary Stars*, Edited by Y. Kondo, R.F. Sistero and R.S. Poliden (Kluwer, Dordrecht 1992), p. 391.

E.G. Schmidt, J.R. Chab, and D.E. Reiswig, "Stars Classified as Constant in the General Catalogue of Variable Stars," Astronomical Society of the Pacfic **104**, 906 (1992).

E.G. Schmidt, "Automated CCD Photometry at Behlen Observatory," in *Robotic Telescopes in the 1990's*, Edited by A.V. Filippenko (Astronomical Society of the Pacific, San Francisco, 1992) p. 73.

N.R. Simon, "Evolution Versus Pulsation Along the Horizontal Branch of M15," Astrophysical Journal **387**, 162 (1992).

N.R. Simon and S.M. Kanbur, "Radiative Opacities and Stellar Pulsations," Revisto Mexicana Astronomia Astrofisica **23**, 253 (1992).

C.M. Clement, M. Jankulak, and **N.R. Simon**, "An RR Lyrae Period Shift in Terms of the Fourier Parameter f_{31}," Astrophysical Journal **395**, 192 (1992).

D.J. Taylor and E.G. Schmidt, "A Bok Globule in the Orion Nebula," Monthly Notices of the Royal Astronomical Society, **258**, 147 (1992).

ATOMIC, MOLECULAR AND OPTICAL PHYSICS

X. Shi, T.M. Stephen, and **P.D. Burrow**, "Temporary Negative Ions and Vibrational Excitation in CH_3Cl and CD_3Cl," Journal of Chemical Physics **96**, 4037 (1992).

X. Shi and **P.D. Burrow**, "Differential Scattering Cross Sections of Neon at Low Electron Energies," Journal of Physics B **25**, 4273 (1992).

P.D. Burrow, A.E. Howard, A.R. Johnston, and K.D. Jordan, "Temporary Anion States of HCN, CH_3CN, $CH_2(CN)_2$, Selected Cyanoethylenes, Benzonitrile, and Tetracyanoquinodimethane," Journal of Physical Chemistry **96**, 7570 (1992).

K.W. McLaughlin and **D.W. Duquette**, "Absolute Photoionization Cross section of Excited Titanium," Journal of the Optical Society of America B **9**, 1953 (1992).

I.I. Fabrikant, S.A. Kalin, and A.K. Kazansky, "Resonant R–Matrix Theory of Inelastic Processes in Collisions of Electrons with HF Molecules," Journal of Physics B **25**, 2885 (1992).

I.I. Fabrikant, "Impulse–Approximation Analysis of Collisions Between Rydberg and Ground–State Rubidium Atoms at Thermal Energies," Physical Review A **45**, 6404 (1992).

I.I. Fabrikant, "Electron Drift in Alkali–Metal Vapours," Journal of Physics B **25**, 4865 (1992).

J.A. Brand, J.E. Furst, **T.J. Gay**, and L.D. Schearer, "Production of a High–Density State–Selected Metastable Neon Beam," Review of Scientific Instruments **63**, 163 (1992).

T.J. Gay, J.A. Brand, J.E. Furst, M.A. Khakoo, W.V. Meyer, W.M.K.P. Wijayaratna, and F.B. Dunning, "Extrapolation Procedures in Mott Electron Polarimetry," Review of Scientific Instruments **63**, 114 (1992).

J.E. Furst, **T.J. Gay**, W.M.K.P. Wijayaratna, K. Bartschat, H. Geesman, M.A. Khakoo, and D.H. Madison, "An Attempt to Observe Mott Scattering Optically," Journal of Physics B **25**, 1089 (1992).

D.G. Seely, S.W. Bross, A.D. Gaus, J. Wm. Edwards, D.R. Schulz, **T.J. Gay**, J.T. Park, and J.L. Peacher, "Angular Differential Cross Sections for H(2p) Formation in Intermediate Energy Proton–Helium Collisions," Physical Review A **45**, R1287 (1992).

M. Schulz, D.M. Blankenship, S.W. Bross, A.D. Gaus, **T.J. Gay**, W. Htwe, J.T. Park, and J.L. Peacher, "State–Selective Capture in Collisions of Protons with Noble Gases," Physical Review A **46**, 3870 (1992).

T.J. Gay, J.E. Furst, H. Geesmann, M.A. Khakoo, D.H. Madison, and W.M.K.P. Wijayaratna, "Optical Studies of Polarized Electron–Noble Gas Collisions," in *Correlations and Polarization in Electronic and Atomic Collisions and (e,2e) Reactions*, Edited by P.J.O. Teubner and E. Weigold (IOP Conference Series #122, IOP, Bristol, 1992).

M.E. Rudd, Y.–K. Kim, D.H. Madison, and **T.J. Gay**, "Electron Production in Proton Collisions with Atoms and Molecules: Energy Distributions," Reviews of Modern Physics **64**, 441 (1992).

M.E. Rudd, M.W. Gealy, G.W. Kerby III, and Ying–Yuan Hsu, "Backward Peak in the Electron Spectrum from Collisions of 70–keV Protons with a Target from a Hydrogen–Atom Source," Physical Review Letters **68**, 1504 (1992).

J.A.R. Samson, Y. Chung, and E.M. Lee, "Autoionization of Doubly Excited Ne Atoms into Excited Ionic States," Physical Review A **45**, 259 (1992).

R.J. Bartlett, P.J. Walsh, Z–X. He, Y. Chung, E–M. Lee, and **J.A.R. Samson**, "Single Photon Double Ionization of He and Ne," Physical Review A **46**, 5574 (1992).

J.A.R. Samson, R.J. Bartlett, and Z–X. He, "Probability for Double Photoionization of He and Ne," Physical Review **46**, 7277 (1992).

C. Pan and **A.F. Starace**, "Angular Distributions for Near Threshold (e,2e) Processes for H, He, and Other Rare Gas Targets," Physical Review A **45**, 4588 (1992).

A.F. Starace, "Hyperspherical Coordinate Description of Single– and Multiphoton Processes in Two–Electron Systems," in *Many–Body Theory of Atomic Structure and Photoionization*, Edited by Tu–Nan Chang (World Scientific, Singapore, 1992).

C.R. Liu, B. Gao, and **A.F. Starace**, "Variationally Stable–Treatment of Two– and Three–Photon Detachment of H^- Including Electron–Correlation Effects," Physical Review A **46**, 5985 (1992).

CONDENSED MATTER PHYSICS

W. Li, J. Lin, M. Karimi, **P.A. Dowben**, and G. Vidali, "The Three Dimensional Structure of the Ordered Phases of Mercury on Cu(001)," Physical Review B **45**, 3708 (1992).

D. Li, J. Zhang, **P.A. Dowben**, R.–T. Wu, and M. Onellion, "The Temperature Dependence of the Gadolinium Bulk Band Structure," Journal of Physical Condensed Matter **4**, 3929 (1992).

Y.J. Kime, J. Zhang, and **P.A. Dowben**, "Lateral Interactions and Structural Phase Transitions in Ultra Thin Hg Films," Surface Science **268**, 98 (1992).

F.K. Perkins, M. Onellion, S. Lee, D. Li, J. Mazurowski, and **P.A. Dowben**, "Synchrotron–Radiation Induced Deposition of Boron and Boron Carbide Films from Boranes and Carboranes II: Nido–2,3–diethyl–2,3–dicarbahexaborane," Applied Physics A **54**, 442 (1992).

D. Li, J. Zhang, **P.A. Dowben**, and M. Onellion, "Temperature Dependent Electronic Structure in a Localized Magnetic Moment System: Gadolinium," Physical Review B **45**, 7272 (1992).

D. Li, J. Zhang, S. Lee, and **P.A. Dowben**, "Evidence for the Formation of Metallic Mercury Overlayers on Si(111)," Physical Review B **45**, 11876 (1992).

S. Lee, **P.A. Dowben**, A.T. Wen, A.P. Hitchcock, J.A. Glass,Jr., and J.T. Spencer, "The Structures of Selected Boranes and Carboranes," Journal of Vacuum Science and Technology A **10**, 881 (1992).

S. Lee, D. Li, S. M. Cendrowski–Guillaume, **P.A. Dowben**, F. Keith Perkins, S.P. Frigo, and R.A. Rosenberg, "The Electronic Structure of Adsorbed Borane Cage Molecules Adsorbed on Si(111)," Journal of Vaccum Science and Technology A **10**, 2299 (1992).

R.A. Rosenberg, S.P. Frigo, Sunwoo Lee, and **P.A. Dowben**, "Selective Area, Synchrotron Radiation Induced, Delta–doping of Silicon," Journal of Applied Physics **71**, 4795 (1992).

F. K. Perkins, M. Onellion, Sunwoo Lee, and **P.A. Dowben**, "Demonstrating the Utility of Boron Based Precursor Molecules for Selective Deposition in a Scanning Tunnelling Microscope," in *Photons and Low Energy Particles in Surface Processing*, Edited by C.I.H. Ashby, J.H. Brannon, and S.W. Pang, Materials Research Society Symposium Proceedings **236**, 153 (1992).

J. Mazurowski, Sunwoo Lee, G. Ramseyer, and **P.A. Dowben**, "Characterization of Boron Carbide Films Formed by PECVD," in *Wide Bandgap Semiconductors*, Edited by T.D. Moustakas, J.I. Pankove, and Y. Hamakawa, Materials Research Society Symposium Proceedings **242**, 637 (1992).

P.A. Dowben, D. Li, and M. Onellion, "Comment on the Band Effects in the 5p Levels of Ho(0001)," Journal of Physics Condensed Matter **4**, 7021 (1992).

S. Lee, J. Mazurowski, G. Ramseyer, and **P.A. Dowben**, "Characterization of Boron Carbide Thin Films Fabricated by PECVD from Boranes," Journal of Applied Physics **72**, 4925 (1992).

Q. Chen, M. Onellion, A. Wall, and **P.A. Dowben**, "The Influence of Interfaces on Magnetism," Journal of Physics Condensed Matter **4**, 7985 (1992).

S. Datta, J.A. Glass, Jr., S. Kher, Y.–G. Kim, **P.A. Dowben**, and J.T. Spencer, "Palladium and Aluminum Thin Film Deposition on Thermally Sensitive Substrates from Organometallic Complexes," in *Metallized Plastics 3: Fundamental and Applied Aspects*, Edited by K.L. Mittal (Plenum Press, New York, 1992), pp. 65–72.

D. Li, **P.A. Dowben**, and M. Onellion, "Multiplet Fine Structure of the Gd and Tb 5p Levels," in *Magnetic Thin Films, Surfaces and Multilayers*, Edited by SSP Parkin, H. Hopster, I.–P. Renard, T. Shinjo, and W. Zinn, Materials Research Society Symposium Proceedings **232**, 107 (1992).

D. Liu, F.G. Ullman, and **J.R. Hardy**, "Raman Scattering and Lattice–Dynamical Calculations of Crystalline KNO_3," Physical Review B **45**, 2142 (1992).

J.R. Hardy and H.M. Lu, "Ferroelectric Transitions, Molecular Dynamics and Intrinsic Surface Problems," Ferroelectrics **136**, 167 (1992).

V. Katkanant, H.M. Lu, and **J.R. Hardy**, "Lattice and Molecular Dynamics Studies of $CsLiSO_4$," Physical Review B **46**, 5982 (1992).

H.M. Lu and **J.R. Hardy**, "Simulations of Phase Transitions in Rb_2ZnCl_4," Physical Review B **46**, 8585 (1992).

J.W. Flocken, R.A. Guenther, and **J.R. Hardy**, "Millimeter–Wave Dielectric Response of SbSI," Ferroelectrics **135**, 309 (1992).

H.M. Lu and **J.R. Hardy**, "Phase Transitions in K_2ZnCl_4," Physical Review B **46**, 8582 (1992).

J.W. Flocken, Z. Mo, **J.R. Hardy**, and H.M. Lu, "Diffuse Phase Transitions in Mixed Halide Ferroelectrics," Ferroelectrics **136**, 125 (1992).

H.Z. Cao, **J.R. Hardy**, R.W. Douglass, P.T. Dawkins, and S.R. Dunbar, "Fractal Character of Two–Dimensional Fluid Mixing at Both Continuum and Atomic Levels," Physical Review A **45**, 3841 (1992).

S.S. Jaswal and A.A. Kusov, "Magnetic Anisotropy in $R_2Fe_{14}B$ Compounds," Journal of Magnetism and Magnetic Materials **109**, L151 (1992).

S.S. Jaswal, "Generic Source of Perpendicular Anisotropy in Amorphous Rare–Earth–Transition–Metal Films," Physical Review Letters **69**, 1440 (1992).

S.S. Jaswal and X.–G. He, "Electronic Structure and Magnetism for a Supercell Model of AlMn Quasicrystals," Physical Review B **46**, 495 (1992).

S.S. Jaswal, "Electronic Structure and Magnetic Properties of $R_2Fe_{17}N_X$," IEEE Transactions on Magnetics **28**, 2322 (1992).

A.A. Kusov, **S.S. Jaswal**, and Z.S. Shan, "Shape Anisotropy of Magnetic Multilayers," Physical Review B **46**, 3123 (1992).

D.J. Sellmyer and **S.S. Jaswal**, "Phase Transitions," in *McGraw–Hill Encyclopedia of Science and Technology*, Seventh Edition, Edited by S. Parker (McGraw–Hill, New York, 1992), Vol. 13, p. 349.

C.P. Reed, R.J. DeAngelis, **S.H. Liou**, S. Nafis, J.A. Woollam, K.W. Lee, and R.J. Jacob, "Substructure–Magnetic Property Correlation in Co/Ag Composite Thin Films," Materials Research Society Symposium Proceedings **231**, 329 (1992).

V.K. Chan and **S.H. Liou**, "Magnetic Relaxation and Irreversibility in a Superconducting $Tl_2Ba_2Ca_2Cu_3O_{10}$ Thin Film," Physical Review B **45**, 5547 (1992).

S.H. Liou and C.Y. Wu, "Crystalline Orientations of $Tl_2Ba_2Ca_2Cu_3O_x$ Grains on MgO, $SrTiO_3$ and $LaAiO_3$ Substrates," Applied Physics Letters **60**, 2803 (1992).

J.C. Ho, C.Y. Wu, Y.X. Tian, Y.J. Tang, X.L. Cheng, X.W. Cao and **S.H. Liou**, "Pr–substitution Effect on Superconducting Transition Temperature of $YbBa_2Cu_3O_{7-d}$," Solid State Communications **82**, 385 (1992).

C.P. Reed, S.C. Axtell, R.J. DeAngelis, B.W. Robertson, V.V. Munteanu, and **S.H. Liou**, "Magnetic Properties of Mechanically Alloyed Nano–crystalline Cu/Fe Composites," Materials Research Society Symposium Proceedings **274**, 177 (1992).

K.C. Goretta, C.T. Wu, M.T. Lanagan, M.A. Boling, Donglu Shi, D.J. Miller, Nan Chen, W.G.Hanewald, S. Sengupta, Z. Wang, R.B. Poeppel, F. Foong, and **S.H. Liou**, "Processing and Properties of Silver–clad Tl–Ba–Ca–Cu–O Wires and Tapes," Materials Research Society Symposium Proceedings **275**, 813 (1992).

B. Jayaram and **S.H. Liou**, "Magnetic and Transport Properties of Nd–Ce–Cu–M–O (M=Fe, Ni and Zr) in the Normal States," Physica C **201**, 189 (1992).

R.C. Budhani, M. Suenaga and **S.H. Liou**, "Giant Suppression of Flux–flow Resistivity in Heavy–ion Irradiated $Tl_2Ba_2Ca_2Cu_3O_{10}$ Films: Influence of Linear Defects on Vortex Transport," Physical Review Letters **69**, 3816 (1992).

D.J. Sellmyer, "Magnetism of Nanostructured Rare–Earth Multilayers and Films," Journal of Alloys and Compounds **181**, 397 (1992).

Z.S. Shan and **D.J. Sellmyer**, "Behavior of the Uniaxial Anisotropy of Ferrimagnets near the Compensation Point," Journal of Magnetism and Magnetic Materials **109**, 353 (1992).

Y.Z. Wang, G.C. Hadjipanayis, A. Kim, **D.J. Sellmyer**, and W.B. Yelon, "Structure and Magnetic Properties of $RFe_{10}V_2N_X$ Compounds," Journal of Magnetism and Magnetic Materials **104–107**, 1132 (1992).

D. Wang, G.C. Hadjipanayis, and **D.J. Sellmyer**, "Magnetization of Sm–Fe–N Thin Films with In–Plane Anisotropy," IEEE Transactions on Magnetism **28**, 2590 (1992).

D.J. Sellmyer, "Magneto–Optic Data Storage Alloys," in *Rare Earths: Science, Technology and Applications*, Editors R.G. Bautista and N. Jackson (TMS, Warrandale, PA, 1992), p. 195.

D.J. Sellmyer, and M.J. O'Shea, "Random Anisotropy and Phase Transitions in Magnetic Glasses," in *Recent Progress in Random Magnets*, Edited by D. Ryan, (World Scientific Publishing, Singapore, 1992), pp.72–121.

HIGH ENERGY PHYSICS

G.R. Snow (for the DØ collaboration), "The DØ Detector at the Fermilab Tevatron Collider," Proceedings of VII International Symposium on Very High Energy Cosmic Ray Interactions, Ann Arbor, MI, 22–27 June 1992.

G.R. Snow (for the DØ collaboration), "Direct Photon Production from DØ," Proceedings of 1992 Annual Meeting of the Division of Particles and Fields, American Physical Society, Fermilab, Batavia, IL, 10–14 Nov. 1992.

HISTORY OF SCIENCE

M.E. Rudd, "An Early Micrometer Microscope," Bulletin of the Scientific Instrument Society **32**, 14 (1992).

M.E. Rudd, "Science on the Great Plains: The History of Physics and Astronomy at the University of Nebraska–Lincoln," University of Nebraska Studies, New Series **71** (1992).

PHYSICS EDUCATION

R.G. Fuller and C.R. Lang, "Physics: Cinema Classics," Three Double-Sided Videodiscs: Mechanics (I); Mechanics (II) and Heat; Waves (I); Waves (II) and Electricity; Conservation Laws; and Angular Momentum and Modern Physics. Final Version, May, 1992.

R.G. Fuller and C.R. Lang, "Physics Single–Concept Film Collection 1: Motion, Unit I; Motion in the Heavens and Modern Physics, Unit II; Momentum and Energy and Waves, Unit III; and Collisions, Unit IV. (Four videotapes) August, 1992.

TRACK PHYSICS

F.A. Cucinotta, J.W. Wilson, L.W. Townsend, J.L. Shinn, and **R. Katz**, "Track Structure Model for Damage to Mammalian Cell Cultures During Solar Proton Events," Nuclear Tracks and Radiation Measurements **20**, 177 (1992).

F.A. Cucinotta, J.W. Wilson, **R. Katz**, and G.D. Badhwar, "Katz Model Prediction of Caenorhabditis Elegans Mutagenesis on STS–42," NASA Technical Memorandum 4383, November 1992.

R. Katz, F.A. Cucinotta, J.W. Wilson, and Duc M. Ngo. "Track Structure Model of Cell Damage in Space Flight," NASA Technical Paper 3235, October 1992.

New Research Grants and Contracts

During the period 1 November 1992–31 October 1993 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)	60.6
Burrow/ Ducharme	Scanning Tunneling Microscope for Advanced Undergraduate Laboratories (UNF)	14.5
Campbell	Rocky Mountain High Energy Physics Research Laboratory (TNRLC)	49.6
Dowben	Boron Carbide, Boron Phosphide and Boron Device Fabrication by Photo AssistedChemical Vapor Deposition (RIST)	50.0
Ducharme	Real Time Space Materials Degradation Monitor Using Ellipsometers (WC)	72.8
Ducharme	Experimental Studies of Photorefractive Polymers (NSF)	100.0
Ducharme	Helping High School Students Experience Modern Scientific Research Through the Eyes of Their Teachers (RC)	14.0
Ducharme	Real Time Space Materials Degradation Using a Small Modulation (WC)	134.8
Duquette	Laser Photoionization Studies of Excited Atomic States (NSF)	53.7
Fabrikant	Atomic Processes Involving Negative Ions (NSF)	45.6
Fuller	Bridges, Bicycles, and Traffic: Thematic Physical Science Lessons (NSF)	41.6
Fuller	Every Physics Teacher's CD-ROM Toolkit (NSF)	468.5
Fuller	Using New Technologies to Teach Physics (NSF)	99.0
Fuller	Transforming Physics Laboratories Using New Technology (IU)	29.9
Fuller	Undergraduate Education Initiative (HH)	15.0
Fuller	Teaching Physics Using Interactive Digitized Video (NSF)	89.0
Fuller	Instructional Enhancement Award (KELLY)	19.5
Gaskell	CCD Photometry of Supernovae and Seyfert Galaxies (AAS)	4.5
Gaskell/ Taylor	Undergraduate Teaching Observatory Telescope (NSF)	9.3
J.R. Hardy	Studies of Ionic Molecular Solids (ARO)	60.0
J.R. Hardy	First Principles Theoretical Studies of Ferroelectric Lattice Instabilities (ONR)	94.4
J.R. Hardy	Structural Instabilities in Complex Ionic Solids (EPSCOR)	149.8
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)	40.0
Jaecks	Correlation Studies of Three Massive, Coulomb-Interacting Particles (NSF)	182.0
Jaswal	Electronic and Magnetic Properties of Quasi-crystalline and Amorphous Alloys (NSF)	15.0
Katz	Theory of Biological Effectiveness (DOE)	48.0
Katz	Theoretical Evaluation of the Radiation Hazards from Cosmic Rays within Space Vehicles (NASA)	30.0
Liou	Superconductivity (NASA)	22.8
Rudd	Ionization Processes in Atomic Collisions (NSF)	96.2
Samson	Interaction of Radiation with Planetary Gases (NASA)	53.5
Samson	Photoionization Studies of Atoms (NSF)	85.0
Samson	Ultraviolet and X-ray Bombardment of Planetary Atmospheres (NSF)	85.0
Samson	A Rare Gas Optics-Free Absolute Photon Flux and Energy Analyzer (USC)	57.0
Schmidt	Survey of Poorly Studied Variable Stars (NSF)	54.5
Sellmyer	Magnetism and Magneto-Optics of Artificially-Structured Materials (NSF)	50.9
Sellmyer	Fundamental Studies of Strongly Magnetic Rare Earth–Transition Metal Alloys (DOE)	75.0
Sellmyer	Development of New Permanent–Magnet Materials for Energy–Related Applications (NEO)	124.2
Sellmyer	Ultra High Density Recording: Magnetic Disk Component (NSIC)	80.8
Sellmyer	Ultra High Density Recording: Optical Recording Component (NSIC)	48.9
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)	109.5
Starace	Dynamics of Photon-Atom Interactions (NSF)	56.0
Starace	Dynamics of Collision Processes (DOE)	72.0
Starace	Conference on Two-Center Effects in Ion-Atom Collisions (EPSCOR)	5.0
Weymouth	Magnetic Survey–L&C Lower Portage Camp Site (WHR)	7.0
Weymouth	St. Catherine's Island Survey (AMNH)	5.0
Weymouth	Kennard House Magnetic Survey (NSHS)	1.0
Weymouth	Fort Ellis Magnetic Survey (MSU)	1.4
Weymouth	North Central Kansas Survey (DI)	3.5
Weymouth	Magnetic Survey of Ulysses S. Grant National Historic Site, Missouri (NPS)	4.4
Weymouth	Magnetic Survey of the Cuyahoga Valley National Recreation Area, Ohio (NPS)	1.0
	TOTAL	**$4,191**

AAS – American Astronomical Society
AMNH – American Museum of Natural History
Dale – Dale Electronics
DI – United States Department of Interior
DOE – U.S. Department of Energy
EPSCOR – Experimental Program to Stimulate Competitive Research
HH – Howard Hughes Medical Institute
IU – Indiana University
Kelly – Kelly Funds
MSU – Montana State University
NASA – National Aeronautics and Space Administration
NEO – Nebraska Energy Office
NPS – National Park Service
NSF – National Science Foundation
NSHS – Nebraska State Historical Society
NSIC – National Storage Industry Consortium
RC – Research Corporation
RIST – Research Institute of Industrial Science and Technology
TNRLC – Texas National Research Laboratory Commission
UNF – UN Foundation
USC – Subcontract from the University of Southern California
WC – Woollam Company
WHR – Western History Research