Spectrum

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

No. 20 Winter 2000 Anthony F. Starace, Editor

Newly Discovered Asteroid Named for D.B. Brace

Robert Linderholm, an amateur astronomer in Cambridge, NE (about 25 miles East of McCook), tracks asteroids from Lime Creek Observatory, the name he gave his backyard telescope and sensitive electronic camera. He earned the distinction in 1996 of being the first Nebraskan to discover a celestial body, Asteroid 10195, which he named "Nebraska." Since 1997 he has been tracking another asteroid, which in 1999 was officially named for Dewitt Bristol Brace, a former Chair of our Department, under whose leadership during 1887-1905 the Department grew rapidly and developed a world-wide reputation for its research. Linderholm's description of this latest discovery follows.

Asteroid Brace is a "main-belt" asteroid orbiting the sun in a path between Mars and Jupiter. It was located in 1974 but was then "lost" to observation for several years. In September of 1997, during a routine search with a CCD camera for comets and asteroids near the Pleiades in the constellation Taurus, I noted an object showing relative motion against the stellar background. Such relative motion can be observed by using "blinking" software which is the rapid replacement on a computer monitor of two or more sequential images covering the same physical location. The object was measured for position and magnitude, subsequent observations on following nights were made, and the accumulated data was then submitted to the Harvard/Smithsonian Minor Planet Center (MPC) in Cambridge MA. The MPC assigned a temporary designation, 1997 RP7, to the object. Further review by the MPC resulted in identifying 1997 RP7 with data obtained in previous years. Subsequent observations of this asteroid resulted in determining that Lime Creek Observatory had furnished the "principal" observations, and after data from over 40 observations and 5 oppositions had been obtained, the discovery was credited to Lime Creek and a permanent number (10392) was assigned. Such assignment allows the discoverer to name the asteroid.

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Gay Teaches Football Physics

At each Nebraska home game this past fall, Professor Tim Gay has been convening physics classes with an attendance of 77,000. Appearing in his trademark bow tie, larger than life on the two 17-foot high, 23-foot-wide Huskervision television screens at Memorial Stadium, Gay has been using football fundamentals to illustrate physics principles.

Sketch of Tim Gay
by Dan Claes

In response to an open forum on UNL's dedication to research versus teaching, and academics versus athletics, that played out last summer in the *Lincoln Journal Star* letters page, HuskerVision producer Jeff Schmahl conceived a series of 45-second spots on Football Physics. Michaela Dowd, the broadcasting student intern who produced the videos explained, "We thought of this as a way to bring academics and athletics together and turn a positive light on teachers." When Dowd approached the Department seeking a professor who "loves football," she was immediately steered to Gay. Gay, a former CalTech tackle and current Nebraska football season ticket holder, embraced the opportunity to combine two of his passions. "I love physics, and of course, I love football!"

Each mini-lesson uses videotaped football action to highlight a particular physics principle. "Like all football fundamentals," Gay explains in one segment, "it has good physics reasons behind it." In this way, momentum is introduced to explain the effectiveness of a block or tackle and to estimate the force of the collision. We learn that "in the first second of play both teams combined expend enough energy to lift a pickup truck

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Letter from the Chair


Roger D. Kirby

Every Department on campus undergoes an Academic Program Review (APR) every six years, during which it reviews what has been accomplished in the past decade and makes fairly detailed plans for the next decade. Our Department has just completed the first phase of this process - preparing a report for College and University administrators and a Review Panel to study and evaluate. The next phase occurs in early April when the Review Panel, consisting of distinguished physicists from other universities and local representatives from the A&S College Academic Planning Committee and another science department, visits the Department for two and one-half days. They will meet with faculty, administrators, staff, graduate students and undergraduate students to assess all aspects of our program, including budget, facilities, and our research, teaching and service accomplishments. They will also comment on and make recommendations about our plans for the future. Past Review Panels have given us good advice, most of which we have taken, or would have taken, if necessary resources had been granted.

Thus, this Spring semester has been very busy preparing the substantial report. While the Department has routinely reviewed its broad plans for the future since the last Academic Program Review, it is still interesting to think more seriously about "what might have been" and "what could be", and to put it on paper. It is also interesting to note the diversity of opinions that faculty and others have regarding such things as the administration of the university, where Department resources could be most wisely used, and where its primary efforts should be directed.

While physics is a mature discipline, there remains a seemingly inexhaustible supply of new areas to study and new discoveries to be made. Advances in instrumentation, theory, and preparation of new materials continue to lead us to new and striking results and to send our discipline in new directions. Rapid changes in technology dictate that neither an individual scientist nor a Department can remain static and also remain successful. Consequently, the Department has extended its research activities into several new directions over the past five to ten years, including the investigation of the electronic structure of solids and surfaces (**Peter Dowben**), the study of chirality in molecules (**Timothy Gay**), experimental high-energy physics and participation in the discovery of the Top Quark (**Gregory Snow, Dan Claes**), novel methods of producing nanoscale magnetic materials (**Diandra Leslie-Pelecky**), electronic properties of nanometer-size junctions (**Bernard Doudin**), modern laser atomic physics and matter optics (**Herman Batelaan**), interactions of high-intensity laser light with atoms (**Anthony Starace**), high-resolution polarized-light studies of atomic structure at the Advanced Light Source (**Duane Jaecks**), development and study of novel magnetic materials (**David Sellmyer, Sitaram Jaswal**), ferroelectricity in ultrathin films (**Stephen Ducharme**), ultra-high resolution magnetic force microscopy (**Sy Hwang Liou**), and the first theoretical predictions of phase transition temperatures in molecular solids (**John Hardy**). Redirections such as the above are essential if the Department's research activities are to remain vital.

Similarly, the Department is, over time, adopting new modes of teaching. **Robert Fuller** and **Vicki Plano Clark** have substantially revised the laboratories associated with our introductory courses to help the students better understand physics concepts. A number of faculty, including **Diandra Leslie Pelecky, Stephen Ducharme, C. Edward Jones, Robert Hardy, Herman Batelaan, Daniel Claes, Anthony Starace, Edward Schmidt**, and **Paul Finkler** are employing active-engagement/peer-instruction techniques in introductory and (sometimes) upper-division/graduate courses. These various teaching techniques are designed to help the students confront and better understand the concepts of physics. Finally, the Department is moving towards the integration of web-based components and on-line homework/quizzes into its courses. **C. Edward Jones, Kevin Lee** and **Robert Fuller** have been leaders in this effort, and we will soon be able to institutionalize some aspects of their work. It is clear that various distance learning approaches will be important in the delivery of instruction in future years, especially in our introductory courses. A major benefit of these methods is that students remain consistently engaged in the course – they cannot ignore the on-line assignments and simply cram for the exams.

Higher education, particularly in the physical sciences, is facing many challenges associated with redirections of research

funding, increased emphasis on instruction and assessment of instruction, and with making education accessible to our constituents throughout their lives. Our Department is also facing a special challenge that was fully discussed in the Academic Program Review report. In a Department our size (27 faculty), it is expected that there will be approximately one retirement or resignation per year, and this has been the case for the past 15 years: Since the 1985/86 academic year, fifteen Department faculty have retired or resigned. During this same period, the Department has hired thirteen new faculty members (the observant reader will note that this represents a loss of two faculty members). The next several years will bring much more dramatic changes. The age demographics of our Department are such that we expect an average of two retirements per year over the next five to seven years. The Department will lose the experience and knowledge of many wise and accomplished faculty members, but it will (hopefully) replace them with young faculty members who bring new ideas and new energy to our programs. But even in the best of circumstances, the Department will have to work hard to maintain coherence and productivity in its teaching and research efforts given the large and rapid turnover that is undoubtedly going to occur. It will not be easy to compensate for the loss of an internationally recognized researcher or of a leader in the Department's teaching programs. It will not be easy to manage the large costs associated with bringing in many new faculty (particularly experimentalists) in a short period of time.

On the other hand, turnover in faculty is positive in the sense that the Department has the opportunity to either re-emphasize existing areas of research, or redirect its research efforts into new fields. Over the next several years, the Department hopes to strengthen its efforts in experimental high-energy physics and astronomy/astrophysics, to continue to extend our atomic physics research efforts into frontier areas of the subdiscipline, and to continue our significant efforts in condensed matter/materials physics, particularly at the nanoscale. If events unfold as outlined in our plans, we will be a stronger and more balanced department and have a greater national and international impact on our discipline.

The impacts on our undergraduate and graduate students will be significant. Many of our undergraduates participate in research, and there will be new opportunities for them to do so. We have found that undergraduate research participation is particularly valuable for finding employment after the Bachelor's degree and provides excellent preparation for further education in graduate school. With the continued development of the University Honors Program, more and more of our undergraduates will write Honors Theses. Similarly, our graduate students will benefit from the availability of more "frontier" areas of research. Keeping research programs current is essential if we are to serve our students and our discipline effectively.

I wish to thank those of you who responded to the recent survey of graduates for your helpful remarks. Your comments were summarized (and often quoted, without attribution) in the Academic Program Review report. I particularly enjoyed getting career updates from many of you. It is gratifying to see that so many alumni have found satisfying and rewarding careers. Thus, if you haven't done so recently, please send me a letter or e-mail (rkirby1@unl.edu) with an update.

Sincerely,

Roger D. Kirby

Professor and Chair

Brace Asteroid (continued from page 1)

The submission of a name of a person must contain a brief biography and the International Astronomical Union (IAU) Names Committee reviews submitted names for validity and suitability. Many asteroids are named for deceased persons who have contributed to science, and I selected this category. The reason I chose Dewitt B. Brace is that I have had the great pleasure of being acquainted with several of the staff in the Physics & Astronomy Dept, along with some UNL staff members of other departments related to science, and I wanted to name someone associated with the foundation of science at UNL. Professor Brace was instrumental in developing the Physics Department at the University of Nebraska, making outstanding contributions in the field of physics, and his work was well known to many noted physicists of that era.

Lime Creek Observatory (LCO) is a private observatory, assigned #721 by the IAU. LCO is located about 15 miles northwest of Cambridge, Nebraska. Equipment at LCO includes a permanent polar mounted Meade LX200 10" Schmidt Cassegrain telescope equipped with an ST7 CCD camera, remotely operated from a computer. The equipment is capable of locating objects as faint as magnitude 19. More importantly, through the use of images obtained with the CCD camera, such faint objects can be accurately measured using astrometric software. And of course, the advantage of a dark sky location such as enjoyed here cannot be over-estimated.

Initial 1997 observations of Asteroid Brace indicated a magnitude of 18.4 at a distance of 170 million miles from Earth. In September 1999 this asteroid was about 320 million miles from Earth near the constellation Virgo and was difficult to observe because it "set" at about 0100 GMT. The size of this object can be estimated based on reflected light and based on data obtained to date. The object is probably less than 10 kilometers in diameter. Such an estimate depends on the shape and the rotation about its axis at the time of observation, and of course, on the reflectivity of the object's elemental makeup, i.e., metal or rock or some combination.

The permanent number assignment (10392) was published in IAU Circular 34158, 1999 Apr 2. The permanent name "Brace" was published in IAU Circular 35495, 1999 Jul 28. IAU Circulars are published on behalf of Commission 20 of the International Astronomical Union by the Minor Planet Center, Smithsonian Astrophysical Observatory, Cambridge MA 02138, USA. Circulars are published on the date of each full moon; copies may be obtained by requesting them from the MPC at the above address.

Robert Linderholm
Cambridge NE

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Football Physics (continued from page 1)

10 yards in the air - enough for a vertical first down."

"I worried no one would really be interested," Gay admits, "but Nebraska football fans are the best in the world. If convinced it has something to do with football, they want more. They have really made it a success!" Enough so that the American Physical Society's Media Relations began following the story (follow links from the APS homepage, http://www.aps.org, through Media Relations to Football Physics). And ABC News correspondent Bob Jamieson was on campus November 4-6 with an ABC World News team to film a segment on Football Physics. It aired November 15 on ABC News World Tonight. In the segment, one UNL football player says that the team generally does not pay much attention to the TV screens. But when Dr. Gay's segments are broadcast, all the players watch, as do the fans.

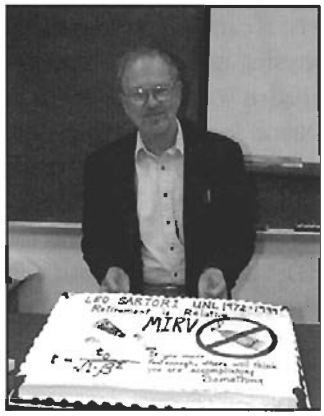
It's Gay himself who deserves the lion's share of the credit for Football Physics' success, according to HuskerVision's Schmahl. "It took the right type of person to make this work," he acknowledges. "Someone who not only understands physics but can present it in a clear, concise and entertaining way." Gay scripts all the spots himself, careful not to cross the fine line between being truly entertaining to an audience of fans and simple cheerleading. Editing his ideas down to 45 seconds has proved to be a particularly interesting challenge. "My first script ran something like 4 minutes," Gay says. The resulting messages have been not only entertaining and informative, but immensely popular. When asked if we can look forward to new segments

next season, Schmahl doesn't hesitate in responding, "Oh, yeah!"

QuickTime videos of all six segments are available through the UNL Physics and Astronomy Departmental website at http://www.physics.unl.edu/football.html or follow the link to Football Physics! under the News and Events banner on the Department's home page http://www.physics.unl.edu. The QuickTime video player program is downloadable for free from http://www.apple.com/quicktime. The mini-lessons are also being collected on VHS to accommodate the over 60 requests already received from high school and college teachers across both Nebraska and the country. Senior Vice Chancellor for Academic Affairs Richard Edwards and Arts & Sciences Dean Brian Foster have joined the Department of Physics and Astronomy in producing and distributing the tapes. For more information contact Professor Timothy Gay at tgay1@unl.edu.

Leo Sartori Retires

On April 28th, 1999 the Department held a going-away/ retirement party for Leo and Eva Sartori, who have lived and worked in Lincoln for 27 years. As both of them have been involved with two departments on campus (Leo with Physics and with Political Science, and Eva with Modern Languages and with the Libraries), many people attended. Leo brought plans and photos of the house he and Eva were having built near Amherst, MA, which is where they are now living.



Leo Sartori in front of his retirement cake.

Leo obtained his Ph.D. in theoretical nuclear physics from M.I.T. in 1956. After a postdoctoral position at Brookhaven National Lab, he took an Instructor position at Princeton during 1956-59, and then an Assistant Professor position at Rutgers during 1959-63. In 1963 he moved back to M. I. T., where he worked in the Science Teaching Center for three years. In 1967 he was appointed an Associate Professor in the Physics Department at M.I.T. as well as in the Center for Space Research, where he did research in astrophysics with Phillip Morrison. Then in 1972 he joined UNL as Professor and Chair of the Department. Before arriving in Lincoln, Sartori kept in touch with Interim Chair M. Eugene Rudd about various department matters, including the making of a job offer to Professor Anthony Starace. During his 6 year tenure as Chair, Professors Paul Burrow, C. Edward Jones, and Edward Schmidt were hired. These were the last faculty hires until the late 1980's.

In 1978, Sartori took a three-year leave of absence to serve with the U.S. Arms Control and Disarmament Agency, where he worked in the Strategic Affairs Division of the Bureau of International Security Programs. In Spring 1979 he served as a senior advisor to the U.S. delegation charged with negotiating the terms of the Strategic Arms Limitation Treaty (SALT). Also during this leave of absence, Leo served on the Executive Committee of the American Physical Society's (APS) Forum on Physics and Society (1979-81).

Upon returning to UNL in 1981, Leo continued his involvement with arms control issues. In 1983 he was given a joint appointment in the Political Science Department and he began to teach courses in both Physics and in Political Science. During 1983-84 he served as Vice Chair and then Chair of the APS Forum on Physics and Society. And during the 1988-89 academic year he took another leave of absence, to serve in the Office of Arms Control of the U.S. Department of Energy. In 1988 he co-authored a book on *Compliance and the Future of Arms Control*.

In recent years, Leo's interest turned to relativity. He developed a new course entitled "Fundamentals of Relativity" (Physics 374) aimed at a broad audience of students and focused on the special theory and its implications for the nature of space and time. Stemming from the teaching of that course, Sartori wrote a book, *Understanding Relativity*, which was published by the University of California Press in 1995 and which obtained positive reviews in the physics press.

The Sartori's lived in a rented condominium during Fall 1999 and moved into their new home on January 4th, 2000. Their address is 144 Porter St, Granby MA 01033. Leo writes that he does not know how they could have managed to have the house built if they were not retired and could devote lots of attention to it. This year Leo is teaching his relativity course to 80 students at Amherst and Eva is auditing courses there and also working on translating a French book.

Farleigh Wins Sigma Xi Support of Research Award

At the annual meeting of the UNL Chapter of the Sigma Xi, the Scientific Research Society on 14 April 1999, Electronics Shop staff member **Brian S. Farleigh** was presented with the Support of Research Award. Farleigh joined the Department in 1983. He holds an Electronics Engineering A.S. degree from Southeast Community College - Milford. Electronics Shop manager John R. Kelty nominated him for the award. (Kelty received the 1987 Sigma Xi Support of Research Award.)

Kelty emphasized that "His daily efforts in computer setup, interfacing, and repair, as well as the design and construction of specialized electronics equipment for education and research have been essential to the success of many researchers in this Department and around the campus." Most recently, Brian was instrumental in the installation of the new student observatory 16" telescope that is atop the parking garage just west of the football stadium. Additionally for our astronomers, Brian provides maintenance of the 30" telescope at Behlen Observatory in Mead, Nebraska.

Brian is also the key person responsible for the Snow and Ice Research (SIRG) Polar Ice Coring Office (PICO) satellite and radio communications in Greenland and annually assists in setting up field research camps. Last year Brian assisted in the installation of a wind generator system on the Greenland icecap and was the primary designer of the electrical power systems for the winter-over Greenland atmospheric research station at Summit, Greenland. Brian's recent work for PICO stems from over a dozen years of polar-related electronics and field support that have also taken him to Antarctica. His efforts have led to the success of borehole logging and thermal probing research at the University of Nebraska.

Brian Farleigh (r.) receives award plague from Sigma Xi Chapter President James E. Specht (l.).

As noted by Kelty at the awards ceremony, "Those who work with Brian know he is a good man to have in the field as well as in the lab because of his competence in dealing with anything electrical or involving electronics."

Sigma Xi Honors Duli, Liu, and Thaden

At its annual meeting on 14 April 1999, the UNL Chapter of Sigma Xi, the Scientific Research Society, honored three graduate students in the Department. **Hani Duli**, a graduate student from the University of Tennessee carrying out his research at UNL under the direction of Professor Peter Dowben, won the Sigma Xi Graduate Student Paper Competition for his work on a novel surface phase transition in the manganese perovskites, which are an important class of giant magnetoresistance materials. Duli and Dowben attributed this new surface phase transition to the surface enthalpy and the surface stoichiometry. The surface transition and surface electronic structure may have a profound impact on the interpretation of the various electron spectroscopy studies of these materials.

Two other Department graduate students were elected to membership in Sigma Xi based on the research they have accomplished and published. Elected to full membership was **Chien-Nan Liu** (M.S. 1995, Ph.D. 1999), who carried out his research in theoretical atomic physics under the direction of Professor Anthony F. Starace. Liu's thesis work involved detailed analyses of photodetachment spectra of negative alkali ions including identification and characterization of many previously unknown two-electron resonance states. He also developed a theory for mirroring behavior of resonance profiles in alternative photodetachment partial cross sections. Such mirroring behavior is often observed experimentally in studies of highly excited resonance states.

Elected to associate membership was **Brandon Thaden**, who is carrying out his graduate research in experimental atomic physics under the direction of Professor Duane H. Jaecks. Thaden was a collaborator with Lisa Weise, Orhan Yenen, and Duane Jaecks on studies of collisional dissociation of 4 keV H_3^+ into p + p +H^-, where the fragments are measured in triple coincidence. Thaden, Yenen and Jaecks are currently carrying out similar measurements for different isotopic species, such as HD_2^+ and H_2D^+, whose centers of mass and charge are not identical.

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Salford/UNL Exchange Program Off to Good Start

The exchange program between Salford University (Manchester, England) and the University of Nebraska-Lincoln had a successful first year. UNL students **Tina Lund** (Physics) and **Yen Nguyen** (Chemistry/Biochemistry) went to Salford University while Salford students **Rebecca Grove** (Astronomy) and **Ellen Day** (Physics) spent a year at UNL. Both **Rebecca Grove** and **Ellen Day** undertook undergraduate research work while at UNL, in addition to course work, and both are expected to be coauthors on papers that will be submitted shortly from UNL. **Ellen Day** extended her stay at UNL by remaining as an REU student in the groups of Brian Robertson and **Shireen Adenwalla**. She also made the Dean's List of the College of Arts and Sciences while here.

Tina Lund is very positive about her Spring 1999 semester at Salford, where she took a full load of one chemistry and three physics courses. She says that it took awhile to get used to the fact that at Salford the courses have no homework, quizzes, or hour exams. One's entire grade in each course depends on one's performance on the final exam. But she managed to adjust. The best part of the experience was meeting many friends from all parts of Europe, who were also exchange students and lived in the same dorm. The only negative was the weather, which was cloudy and rainy much of the time, until the weeks just before final exams, when it turned sunny and nice.

The University of Salford went through an academic assessment exercise and was recently awarded a teaching quality score of 23/24. This is an excellent result (the same as Cambridge University). (See: http://www.salford.ac.uk/physics/ for more details). The North American links (our exchange program with Salford University) came up on a number of occasions during the assessment exercise at Salford and the panel specifically mentioned the North American links as a strength of the Salford program of courses.

In this second year, UNL has three chemical engineering students at Salford University. We anticipate hosting more Salford students in Physics and Astronomy in the third year.

This exchange program strengthens the already close ties with Salford University. **Michael Bonder** (M.S. 1997), is close to graduating with a Ph.D. from Salford University, having won the prestigious Joule Fellowship there. **Neil Boag**, a senior lecturer at Salford University, is an Adjunct Professor of Physics at UNL, where he carries out a part of his research program.

Brief Notes

• Emeritus Professor **Theodore P. Jorgensen's** book, *The Physics of Golf*, was published in a Korean edition in June 1999, according to publishers Springer-Verlag in Heidelberg. (Springer took over the publishing division of the American Institute of Physics (AIP), which published the original English edition of Jorgensen's book. The first English edition quickly leaped to the top of AIP's "best seller" list.) Springer has now published in 1999 a new (second) edition of the English version. It is available in paperback and can be ordered from the Springer web site at: http://www.springer-ny.com/physics/aip/0-88318-955-0.html. The book exists also in a Japanese edition.

• Emeritus Professor **Robert Katz**'s track model for describing the response of a biological system to gamma rays and charged particles has been used successfully for over 30 years. This work and its subsequent extensions have been reviewed recently by F. A. Cucinotta et al.. The article is entitled "Applications of Amorphous Track Models in Radiation Biology" and appears in the journal *Radiation and Environmental Biophysics* **38**, 81 (1999).

• Emeritus **Professor M. Eugene Rudd** continues as President of the Antique Telescope Society. He is also restoring many beautiful antique scientific instruments that have been in the Department for a long time, some from the Dewitt Bristol Brace era. Rudd and Professor David Cahan (Department of History, UNL) have recently completed a biography of Dewitt Bristol Brace entitled: *Science at the American Frontier: A Biography of Dewitt Bristol Brace*. The book received rave pre-publication reviews, and it will be available from the University of Nebraska Press in May, 2000. For those who are interested, we have enclosed an order form for this book.

• Emeritus **Professor John W. Weymouth** was reappointed as an Affiliate Research Associate of Historical Archaeology within the Research and Collection Division of the Museum of the Rockies at Montana State University in Bozeman. He has also been reappointed as a Research Archaeologist in the Glenn A. Black Laboratory of Archaeology at Indiana University in Bloomington. Weymouth continues to serve as an Associate Editor of the journal *Archaeological Prospection*. He is also the Vice President during 1998-2000 of the Nebraska Association of Professional Archaeologists.

UNL Awards Heeger an Honorary Degree

Alan J. Heeger (B.S. 1957) was awarded a Doctor of Science degree at the August 1999 UNL graduation ceremonies. Heeger is a professor in the physics department at the University of California - Santa Barbara, where he serves as the Director of the Institute for Polymers and Organic Solids. Heeger has a distinguished record of accomplishments and awards for his research in condensed matter physics. His most recent work has focused on understanding the nature of polymers.


Alan J. Heeger

Following his graduation from UNL in 1957 with a B.S. in physics with High Distinction, Heeger earned a Ph.D. from the University of California - Berkeley. He is a former Alfred P. Sloan Foundation Fellow and John Simon Guggenheim Fellow. He has authored or co-authored over 500 publications. In 1983 he won the Oliver Buckley Prize of the American Physical Society, the highest award granted in condensed matter physics. In 1995 he received the prestigious Balzan Prize, granted by the International Balzan Foundation, a Swiss foundation that awards prizes for outstanding contributions to the arts and the sciences as well as a humanitarian prize every three years. Heeger is also the founder, chief scientist, and CEO of UNIAX Corp., which is dedicated to bringing new display technology involving electroluminescent polymers to market.

Reed, Swift Present Campus-Wide Lectures

During the 1999-2000 academic year, two Department alumni, **Kennedy Reed** (Ph.D. 1978) and **Gregg Swift** (B.S. 1974 with High Distinction), were invited back to campus to present campus-wide lectures. Both work at national laboratories. Reed is a theoretical atomic physicist working in the High Temperature Physics Division at Lawrence Livermore National Laboratory. Swift is an experimental condensed matter physicist working in the area of thermoacoustics at Los Alamos National Laboratory.

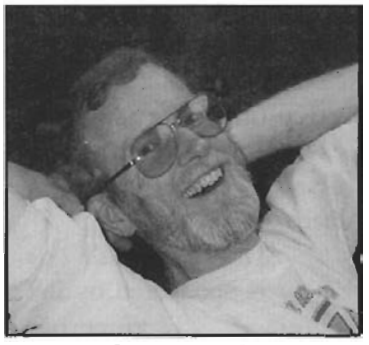
Reed was invited back to campus on January 27, 2000 to speak at the Inaugural Symposium for the Centennial Celebration, which is celebrating over 100 years of graduate education, research, and creative activity at UNL. (Graduate degree programs at UNL began in 1886 and the graduate school was founded in 1896.) Besides Reed, other symposium speakers included Robert Knoll, Varner Professor of English at UNL and author of *Prairie University: A History of the University of Nebraska*; Karen Kunc, Professor of Art at UNL and an internationally renowned printmaker; James C. Olson, 16th President of the University of Missouri (1976-84) and former Chair of the UNL History Department; and Clayton Yeutter, former U.S. Secretary of Agriculture and a former president and CEO of the Chicago Mercantile Exchange. All of the speakers did their graduate research at UNL and spoke of their experiences both at UNL and afterwards.


Kennedy Reed

Reed described how throughout his life he was continually drawn to research. He started his career teaching physics in the Chicago high schools, but then decided to get a graduate degree in physics. However, following his Ph.D. from UNL the job market for researchers was grim, and so he took a teaching position at Morehouse College in Atlanta. However, after three years he took a leave of absence to join a group at Lawrence Livermore National Lab (LLNL) developing an x-ray laser. He began doing calculations for the experimentalists and discovered that his UNL Ph.D. supervisor, Joseph Macek, was very highly regarded among specialists in this area. He never left LLNL, but joined the staff. He now has over 100 publications concerning research in atomic collisions in high temperature plasmas. Recently he has stimulated several efforts (1) to encourage minority students to study physics and (2) to involve African physicists in forefront research projects.

Greg Swift was invited back to UNL by the Office of Graduate Studies, which has inaugurated a distinguished speaker series entitled *Scholarship IN Society*. The aim of this series of talks is to model for current graduate students "the myriad of career possibilities available upon receipt of a graduate education." Swift spoke on "Thermoacoustic Engines...A Long Way from Superfluidity." Following his UNL B.S. degree in

Physics and Mathematics with High Distinction, Swift earned his Ph.D. at the University of California - Berkeley under the direction of Richard Packard. His research concerned superfluidity in helium, a very fundamental topic. Upon receipt of the Ph.D. in 1981, he joined Los Alamos National Lab (LANL) as a postdoctoral researcher and, beginning in 1986, as a member of the staff. He described how he made the transition from pure research as a graduate student to increasingly applied research at LANL. He outlined how thermoacoustic engines and refrigerators have many practical applications, including perhaps the saving of natural gas emitted by oil wells. He noted that currently the oil industry simply burns 30 million tons of natural gas annually. With a thermoacoustic refrigerator technique, this gas might be liquified and saved for energy use. (In a thermoacoustic engine, heat is converted to acoustic power, which then may be used to provide refrigeration or to generate electricity.) The work on the Acoustic Stirling Heat Engine was selected for a 1999 R&D 100 Award. The awards, now in their 37th year, are designed to honor significant commercial promise in products, materials, or processes developed by the international research and development community. **Scott Backhaus** (B.S. 1990 Eng. Physics) is a postdoctoral fellow in the group and has been honored for his role in this work (see "We Heard That...." elsewhere in this issue).



Greg Swift

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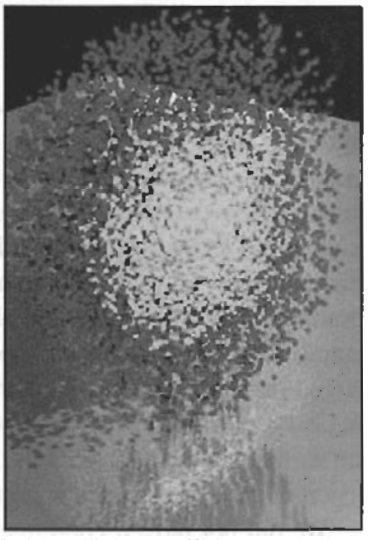
Physical Review Focus Article Highlights Gao's Research

***Bo Gao** (Ph.D. 1989)'s article on "Breakdown of Bohr's Correspondence Principle" in the 22 November 1999 issue of* Physical Review Letters *was featured in a* Physical Review Focus *article on 19 November 1999 (*http://focus.aps.org*). We reprint the* Focus *article here.*

Apply Quantum Principle with Caution

In the early 20th century physicists realized that classical physics fails to explain atoms, even though it works well for baseballs and planets. Part of the early atomic theory relied on Niels Bohr's correspondence principle, which states that the quantum theory must agree with the classical theory in situations where the classical theory is accurate. For atoms, the classical limit has always meant highly excited energy states, in which the energy spacing between quantum states is so small as to resemble the continuum of states predicted by Newtonian physics. While this idea works well for some special cases like the hydrogen atom, a paper in the 22 November PRL shows that high-energy states are not necessarily classical, so Bohr's commonly-used formulation of the principle is not correct in general.



Cold collisions. This simulation shows atoms in a two-component Bose-Einstein condensate at a temperature near 1 nK, where Bohr's formulation of the correspondence principle fails most dramatically.

Bohr's original 1913 model of the hydrogen atom was based in part on his correspondence principle: When the electron is far from the proton—say, a meter away—it should act like a classical charge, emitting light with the same frequency that it orbits the proton. It worked famously for Bohr, and the principle was formalized and extended over the years. Today textbooks

state that classical and quantum theories must agree for large quantum numbers, and many researchers expect all atomic calculations at large quantum numbers to agree with Bohr-like "semiclassical" predictions.


Bo Gao

Bo Gao of the University of Toledo in Ohio was studying the rotational-vibrational states of diatomic molecules close to breaking apart and was surprised that the semiclassical predictions became less accurate at higher quantum numbers. The problem, Gao eventually realized, is that a state with a large quantum number is not necessarily "more classical"—the correct classical limit is a state where the quantum mechanical wave associated with the particles has a short wavelength. Ultracold atoms can have extremely long wavelengths, so even if a pair of them attract one another at a great distance—equivalent to a molecule in a highly excited vibrational state—the semiclassical theory might still not apply. Neutral atoms do not attract one another as strongly as oppositely charged particles, which follow the Coulomb inverse-square law. Gao found that most commonly studied atomic force laws—such as the van der Waals interaction—fail to follow Bohr's version of the correspondence principle.

"We did not have a good quantum theory for those very highly excited states of molecules," says Gao, so most researchers use complex computer codes to calculate their properties. He explains that without a more direct theory, the semiclassical approach has remained popular "because it's a very simple result." Gao maintains that both physics teachers and researchers need to clarify their understanding of the correspondence principle.

"Fortunately, Bohr picked the Coulomb potential for his first study," notes **Chris Greene** (B.S. 1976) of the University of Colorado at Boulder, because it's one of the few cases where Bohr's formulation of the correspondence principle works. He says that others studying cold atoms in the past several years have noticed the problem in different guises. As physicists learn more, Greene adds, "the more remarkable it seems that the line of research Bohr initiated led ultimately to the correct quantum mechanical theory."

Stuart O. Nelson

The Georgia Engineering Foundation, Inc., named Dr. Stuart O. Nelson (M.A. 1954) as the "1999 Medal of Honor" recipient at its annual meeting in Atlanta on December 2nd. Nelson is a Research Agricultural Engineer with the U.S. Department of Agriculture, Agricultural Research Service, at the Russell Research Center in Athens.


Stuart O. Nelson

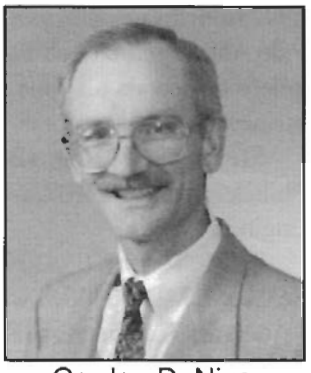
The "Medal of Honor" is sponsored by the Georgia Engineering Foundation, which is composed of all engineering organizations in the State of Georgia, to recognize outstanding and distinguished Georgia Engineers who have attained eminence in the engineering profession, inspired excellence, and have contributed a major portion of their lives to the fulfillment and betterment of their communities and their profession.

Dr. Nelson is recognized internationally for his pioneering research on the dielectric properties of grain, seed, fruits, vegetables, insects and other materials, and for his research on agricultural applications of radio-frequency and microwave energy. His work has been vital to the development of grain moisture measurement technology that is important in protecting grain from spoilage and in maintaining quality in stored grain and in processed grain products.

Holding professorial appointments at the University of Nebraska and The University of Georgia, Nelson has contributed to the graduate programs of both institutions through supervision of masters and doctoral candidates. He is a Fellow of the American Society of Agricultural Engineers, the Institute of Electrical and Electronics Engineers, and the International Microwave Power Institute. He received an Honorary Doctor of Science from the University of Nebraska in 1989 and was elected to the National Academy of Engineering in 1990.

Niva Presents Recognition Luncheon Address to Graduates

Gordon D. Niva (Ph.D. 1979) presented the Recognition Luncheon speech to graduating students on May 6th, 1999. Niva is currently the Program Manager for Cruise Missile Defense in Boeing Corp.'s Division of Electronic Systems and Missile Defense. Niva did his graduate work in astronomy working with Professor Edward J. Schmidt. Since graduation, however, he has worked as a systems engineer.


Gordon D. Niva

Niva entered the Department's graduate program in 1973 along with Bill Burmester (B.S. 1973, M.S. 1975, Ph.D. 1982), Virgil Dilly (M.S. 1976), Don Galliardt (M.S. 1975, Ph.D. 1983), Dale Montgomery (M.S. 1975, Ph.D. 1982), and Gary Webster (Ph.D. 1981). He reminisced about graduate student life in the 1970's with these fellow students, who got together often for dinner. He remembered the difficulties he had with electromagnetic theory and with quantum theory and is grateful for the help he received from Professors Jones and Campbell in these subjects. He found teaching to be very helpful in learning how to present a logical argument. He remarked that "in astronomy you stay up all night, sleep all day, and work with excellent people. It just doesn't get any better."

Upon graduation in 1979 he joined Rockwell International, where his job involved thinking about what may be required for defense in the next 15 years and what new science and engineering would be necessary. He was hired then as a systems engineer, which was the topic of his talk to graduates: "Physics as Preparation for a Career as a Systems Engineer." He defined systems engineering as a multidisciplinary approach to understand the various components of a system (i.e., a group of related items or processes that together satisfy a customer need or objective). While specialists work on the various components, it is the systems engineer who sees that it all hangs together. Key tasks are to characterize the problem, analyze the various functions and their requirements, synthesize and integrate the various functions and their inputs and outputs, and develop measures of performance for both the components and the entire system. Systems engineering comes naturally to a physics student, Niva says. Required skills are the ability to handle multidisciplinary tasks involving knowledge of the relevant technologies, the ability to think logically and to focus on the relevant aspects of the problem, the ability to extrapolate and integrate the available data, and the ability to communicate one's analysis to various audiences. His first task at Rockwell involved work on the Peacekeeper ICBM, and by 1983 he became the manager of a senior systems engineering and analysis group. Over the next 13 years he took on many other projects and became the manager of the systems engineering department of the Tactical Systems Division in 1991. In 1996 he joined Boeing, where he is leading a major corporate initiative on cruise missile defense. He noted that there is at present no good defense against cruise missiles and that the technology for building cruise missiles is available to so-called "rogue countries."

We Heard That...

Aylesworth, Kevin (PhD 1989), 3906 Red Leaf Ct., Point of Rocks, MD 21777-9600, has taken a new job as Senior Program Manager in the Center for Science, Mathematics, and Engineering Education at the National Research Council in Washington, DC.

Backhaus, Scott (BS 1990 Eng. Physics), 4627 Ridgeway, Los Alamos, NM 87544, has been awarded Los Alamos National Laboratory's Postdoctoral Publication Prize in Experimental Sciences for his paper on "A Thermoacoustic Stirling Heat Engine." Backhaus is a postdoctoral fellow at Los Alamos in the condensed matter and thermal physics group working with Greg Swift (BS 1974). (See article on Swift elsewhere in this issue.)

Beaver, John P. (PhD 1974), RR1, Donalda, AB TOB 1HO, Canada, has retired from teaching physics & math at Augustana College in Camrose, Alberta, Canada. He is now self-employed in a new career as a figurative sculptor in arc-welded steel.

Berggren, Matt (BS 1997), 1501 Springgate Dr., Apt. 904, Panama City, FL 32404-5719, is training as a pilot in the U.S. Air Force and is currently involved in studies of High G and/or Supersonic Flight in AT-38B aircraft.

Beza, Michael (BA 1992), 1416 W. "C" Street, North Platte, NE 69101-5021, is a Lieutenant in the U.S. Navy.

Dau, Donald E. (MA 1950 Physics/Math), 1450 18th Avenue, Apt. B17, Rock Island, IL 61201-4326, retired in 1995

(after 44 years) from the U.S. Department of Defense, where he was involved with quality control. Donald is still enjoying the sights and sounds in and around Illinois.

Egbert, Gary T. (PhD 1974), 2110 185th Street E, Jordan, MN 55352-9433, works for Seagate Technology as Director, Head/Media Technology.

Feng, Yu (MS 1999), Louisville, Kentucky, is an actuarial assistant with the Aegon USA Insurance Company where he is developing insurance products by using mathematics and statistics.

Hartzell, Bert H. (BA 1939 Physics/Math), 2366 Harrison St., Santa Clara, CA 95050-4417, is the oldest Air Force navigator who was trained at Pan American Airlines in Miami from 1940-41. He trained also in B-25 bombers for Lt. Col. James H. Doolittle's raid on April 18, 1942 of Tokyo as well as the Battle of Midway in May and June 1942. He later became an optometrist and retired in 1978. He cruised the Amazon river in 1999 and took Elderhostel classes along the way.

Hawthorne, Maurice (BS 1964), RR2, Box 181, Wilburton, OK 74578-9633, is employed by Eastern Oklahoma State College.

Homan, Dean M. (BS 1991), 16503 Ember Hollow Ln, Sugar Land, TX 77478-7132, is working at Schlumberger Oilfield Services in Sugar Land, TX. He writes that he has a great research position in which he aims to change the way one looks for oil. He already has made one patent application, has a 300 sq. ft. lab, and a reasonable lab budget. Says the company was founded by physicists and is partial to physicists. His interview lasted 10 hours plus he gave a one-hour talk, which was attended by one of the VP's, who flew in from Paris. Says he feels he has an ideal job.

Jatzen, Eric (BS 1988), 3101 Franciscan Way, Aston, PA 19014-1234, is still enjoying life in Konigswinter, Germany, where he is employed by Gedys Software Consulting Gmbh as a Software Consultant.

Marcy LaBelle, Wilma Carol (BS 1955), 2201 N. Cambridge Ave. #415, Milwaukee, WI 53202, resides in Michigan but remains active with Omega Research Corp. in Milwaukee, WI.

Mitchell, Doug (BS 1968 Physics/Math), 1649 Hunting Creek Drive, Alexandria, VA 22314-6219, is a partner in Bassman, Mitchell & Alfano in Washington, D.C.

Moore, Donald C. (BA 1942), P.O. Box 458, Brookings, SD 57006-0458, is retired.

Nafis, Suraiya (MS 1984, PhD 1987), 6325 Windrow Ct., San Jose, CA 95135, is working for Celeritek.

Niva, Gordon (MS 1975, PhD 1979), 32 High Bluff, Laguna Niguel, CA 92677-4257, is working at Boeing as a Program Manager. Gordon and his wife, Susan Lahr, were both selected for promotion in the Army National Guard this year. Gordon was promoted to full Colonel in October, 1999 and Susan was promoted to Major.

Porter, Randy (BS 1993), 4626 N. 81st Street, Omaha, NE 68134, is the owner of The Niobrara Group.

Schmidt, James "Jim" J. - (BS 1956, MS 1957), 187 Eastside Road, Deer Lodge, MT 59722, retired in November, 1992 from his position as a Senior Staff Scientist at Lockheed's Palo Alto Research Laboratories. He then moved to Montana, where he spends his time model railroading and landscaping his new home.

Stevenson II, R.D. (BS 1998), 1324 Locust Street #1416, Philadelphia, PA 19107, works for Chemalloy Co. as a Project Engineer.

Teays, Terry J. (PhD 1986), 8811 Magnolia Drive, Lanham-Seabrook, MD 20706, is working for Computer Sciences Corp.

Wade, Jr., Theodore E. (MA 1962, PhD 1970), 11560 Red Bud Trail, Berrien Springs, MI 49103, owns his own small publishing firm.

Wiese, Lisa (PhD 1998), 913 Northland Drive, Madison, WI 53704-1344, is currently a postdoctoral researcher at the University of Wisconsin in Madison. In December 1999 she presented a Joint Atomic Physics Colloquium, sponsored by the Institute for Theoretical Atomic and Molecular Physics at Harvard. She spoke on her thesis research, "Experimentally Determined Dynamics of the Coulomb-Interacting Three-Body System $p + p + H^-$."

Winder, Dale (MA 1954), 1430 W. Oak St., Fort Collins, CO 80521-2348, is retired from the Physics Department at Colorado State University. He says he has enjoyed being a Graduate Gemologist and Jeweler as well as a traveler.

Acknowledgments

The Department is very grateful to the following individuals and corporations for their new and continuing financial contributions during the period 1 November 1998—31 October 1999. 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!

Akhter U. Ahmed (MS 1983)
Terry L .Anderson (MS 1971; PhD 1975)
Kevin D. Aylesworth (MS 1986; PhD 1989)
William A. Barrett, Jr. (BS 1952; MS 1953)
Roger D. Bengtson (BS 1962)
Billie A. Bengtson (BS 1964)
David R. Blinde
Beverly J. Blinde
Thomas E. Bullock (MS 1979)
William L Burmester (BS 1973; MS 1975; PhD 1982)
Louis J. Caplan (MS 1964; PhD 1975)
Paul O. Davey (PhD 1964)
John W. Flocken (MS 1964; PhD 1969)
Patricia E. Flocken
David M. Gray (BS 1977)
Andrew T. Groebner (BS 1989)
Bert H. Hartzell (BA 1939 Physics/Math)
Shirley Hartzell
Alan J. Heeger (BS 1957; HDS 1999)
Ruthann Heeger
Itt Industries, Inc.
David W. Keifer (BS 1968 Physics/Math)
Rebecca R. Richards Kortum (BS 1985)
Philip T. Kortum
Byron L Krauter (BS 1976 Physics/Math; MS 1978)
John E. Lahiff (BS 1964 Physics/Math)
Michele E. Lahiff
William J. Lannan (MA 1956)
Peter J. Martin (MS 1970; PhD 1975)
Claudia M. Martin
Donald C. Moore (BA 1942)
Suraiya Nafis (MS 1984; PhD 1987)
Jerry E. Ruckman (BS 1962)
Frances Ruckman
M. Eugene Rudd (PhD 1962)
Eileen L. Rudd
James J. Schmidt (BS 1956; MS 1957)
Anthony F. Starace
Terry J. Teays (PhD 1986)
The Boeing Company
Theodore E. Wade, Jr. (MA 1962; PhD 1970)

Jaswal, Sellmyer Initiate New NU Foundation Funds

Two of the Department's faculty members recently started new NU Foundation endowment funds with substantial initial donations. Professor **Sitaram Jaswal** started the Banti and Mela Ram Jaswal Scholarship Fund in honor of his parents. Income from the Jaswal Fund will initially provide one undergraduate scholarship annually. Professor **David J. Sellmyer** started the David J. and Catherine J. Sellmyer Endowment Fund. Income from this fund will be used to benefit the Department's efforts in condensed matter/materials physics. The Department greatly appreciates the generosity of these two faculty members, both of whom continue to contribute significantly to the welfare of our Department and University in many ways. Alumni or friends who wish to contribute to either of these funds may do so using the enclosed card and return envelope.

The Record

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

No. 20 Winter 2000 Roger D. Kirby, Editor

1998-1999 Degree Recipients

Bachelor of Science

Roger Dean Stevenson (Aug. 1998) Is on the technical staff at Chemalloy Co., in Philadelphia.

Chauncy Adam Barney (Dec. 1998) Has been admitted to the M.S. program in the UNL Teachers College.

Elizabeth Klimek (Dec. 1998) Is in the M.S. program in physics & astronomy at UNL.

Jared Males (Dec. 1998) Is in the United States Navy.

Mary Hiller (Dec. 1998) Has been admitted to the graduate physics program at Central Michigan University at Mt. Pleasant.

Patrick Harvey (May 1999) Is applying to graduate physics programs.

Master of Science

Cyrus Hall (Aug. 1998) Is in the astronomy PhD program at the University of Hawaii.

Rebecca Lindell (Aug. 1998) Is a PhD student at UNL working under the supervision of Professor Robert Fuller.

Sa Huang (Aug. 1998) Is in the graduate electrical & computer engineering program at Georgia Tech.

Mengjun Bai (Dec. 1998) Is a PhD student at UNL under the supervision of Professor Brian Robertson.

Thomas C. Koch (May 1999) Is a PhD student at UNL under the supervision of Professor Robert Fuller

Jian Zhou (May 1999) Is a PhD student at UNL under the supervision of Professor David J. Sellmyer

Doctor of Philosophy

Arosha Goonesekera (Aug. 1998) Is a postdoctoral research associate at Stanford University.

Maciej Ossowski (Aug. 1998) Is a postdoctoral research associate at UNL working with Professor J. R. Hardy.

Martin Hu (Aug. 1998) Is a postdoctoral research associate in the Beams Division at Fermi National Accelerator Lab.

Todd Young (Aug. 1998) Is an Assistant Professor at Wayne State College in Wayne, NE.

John Krane (Dec 1998) Is a postdoctoral research associate at Iowa State University stationed at Fermi National Accelerator Lab.

Jaewu Choi (Dec. 1998) Is a staff member at the Center for Advanced Micro Devices at Louisiana State University.

Kayvan Aflatooui (Dec. 1998) Is a postdoctoral research associate at UNL working with Professor H. Batelaan.

Hanqing Li (Dec. 1998) Is on the Research Staff at MIT, Dept. of Aeronautics & Astronautics.

Zhenhua Sun (May 1999) Is a postdoctoral research associate in the Dept. of Food Science at the University of Arkansas in Fayetteville.

Honors

1998-99 Fellowships

Hao Zeng	IBM Graduate Fellowship
Rong Feng	Avery Fellowship
Rebecca Lindell -Adrian	Graduate Research Traineeship
Thomas Koch	Graduate Research Traineeship

1998-99 Scholarships

Jared B. Luttich	Joel Stebbins Fund Scholarship
Brigitte Gregg	Physics and Astronomy Scholarship
Michael P. Roth	John E. Almy Scholarship
	Henry H. Marvin Memorial Scholarship
Jared R. Males	Henry H. Marvin Memorial Scholarship
Christina M. Lund	Henry H. Marvin Memorial Scholarship
Amber L. Reinker	U.S. Harkson Scholarship
	Henry H. Marvin Memorial Scholarship
Adam R. McConnell	U.S. Harkson Scholarship
Seth Root	U.S. Harkson Scholarship
Lucas A. Sabalka	Joel Stebbins Fund Scholarship

Sigma Xi, University of Nebraska Chapter, Support of Research Award
Brian Farleigh

UNL Parents Teaching Award
Gregory Snow Martin Gaskell

1999 Distinguished Teaching Assistant Award
Christopher D. Lindseth

1999 Distinguished Undergraduate Teaching Assistant Award
Howard A. Camp

1998-99 Society of Physics Students Officers
Jennifer Webster, President
Michael P. Roth, Vice President
Sarah Woehrer, Secretary/Treasurer

Faculty Professional Activities

In addition to service on Department, College and University-wide committees, for 1998-99 a number of the faculty are active in local, national and international professional activities, as follows:

Clifford L. Bettis: Secretary, Physics Instructional Resource Association

Peter A. Dowben: Advisory Board, Center for Advanced Microstructure and Devices, LSU

Robert G. Fuller: Centenary Speaker, American Physical Society

Timothy J. Gay: Executive Committee, DAMOP Division of APS; Secretary, DAMOP Division of APS; Centenary Speaker, American Physical Society; GEC Executive Committee/ Program Committee

John R. Hardy: Consultant, Army Research Laboratory; Consultant, Naval Research Laboratory

Duane H. Jaecks: Users Executive Committee, Advanced Light Source

Kam-Ching Leung: Chrétian International Research Award Committee of the American Astronomical Society; United Nations Working Group on Astronomical Facilities in the Pacific Rim; International Astronomical Union, Information Bulletin on Variable Stars (Editorial Board); Editorial Board, Chinese Astronomy and Astrophysics (Pergamon Press)

M. Eugene Rudd: Associate Editor of *Rittenhouse: Journal of the American Scientific Instrument Enterprise*

Edward G. Schmidt: Coordinator of the Archives of Unpublished Observations of Variable Stars of the International Astronomical Union

David J. Sellmyer: International Organizing Committee, MORIS 99 Conference; Executive Committee, APS Group on Magnetism and its Applications; Advisory Council, MMM-Intermag Conference; Technical Council, National Storage Industry Consortium; Member, Nebraska State EPSCoR Committee; Member, Governor's Science and Technology Planning Committee; Honorary Member of the Academic Committee, State Key Laboratory of Magnetism, Institute of Physics, Chinese Academy of Sciences

Gregory R. Snow: Chair, Users Executive Committee – Fermilab

Anthony F. Starace: UNL Faculty Representative, Federal Demonstration Partnership, National Research Council; Associate Editor, *Reviews of Modern Physics;* Member, Editorial Board, *Physical Review A;* Member, APS Div. AMO Physics Nominations Committee

1999-2000 Visiting Staff Members

Visiting Professors this year are **Sam Cipolla** (Ph.D. 1969, Purdue), **Robert C. Hilborn** (Ph.D. 1971, Harvard), **Nikolai L. Manakov** (D.Sc. 1979, Leningrad State U., Russia) working with Anthony Starace, and **Qinlun Xu** (M.S. 1987, Purdue) working with Sy-Hwang Liou.

Visiting Associate Professors **Mikhail Chibisov** (Ph.D. 1967, Kurchatou Inst, Russia) working with Ilya Fabrikant, and **Jianjun Liu** (Ph.D. 1994, Jilin U., China) working with John Hardy.

Visiting Assistant Professors **Rochelle Ondracek** (Ph.D. 1994, Johns Hopkins) working with David Sellmyer, and **Ralph Skomski** (Ph.D. 1991, Dresden) working with David Sellmyer.

Adjunct Professor **Ronald H. Ono** (Ph.D. 1983, SUNY) working with Sy-Hwang Liou.

Research Assistant Professors **Shireen Adenwalla** (Ph.D. 1989, Northwestern), **J. Ping Liu** (Ph.D. 1995, U. of Amsterdam) working with David Sellmyer, **Renat Sabiryanov** (Ph.D. 1993, Institute of Chemistry of Solids, Ekaterinburg, Russia) working with Sitaram Jaswal, and **Orhan Yenen** (Ph.D. 1986, UNL) working with Duane Jaecks.

Postdoctoral Research Associates **Kayvan Aflatooni** (Ph.D. 1998, UNL) working with Paul Burrow, **Mircea Chirpara** (Ph.D. 1987, Inst. Atomic Physics) working with Shireen Adenwalla, **Gérard Lagmago-Kamta** (Ph.D. 1999, National University of Benin, West Africa) working with Anthony Starace, **Ming-Te Liu** (Ph.D. 1998, Tufts U.) working with Sy-Hwang Liou, **Mauro Masili** (Ph.D. 1998, Sao Paolo U., Brazil) working with Anthony Starace, **Maciej Ossowski** (Ph.D. 1998, UNL) working with John Hardy, **You Qiang** (Ph.D. 1997, U. Freiburg, Germany) working with David Sellmyer, **Mark Rosenberry** (Ph.D. 2000, U. Michigan) working with Timothy Gay, **Andrei Sokolov** (Ph.D. 1996, Moscow State U) working with Bernard Doudin, **Alexander Sorokin** (Ph.D. 1997, Institute of Crystallography, Russian Academy of Sciences) working with Stephen Ducharme, **Hong Tang** (Ph.D. 1996, Inst. Of Metal Res., Academia Sinica) working with David Sellmyer, **Minglang Yan** (Ph.D. 1992, Lanzhou U, China) working with David Sellmyer, **Lanping Yue** (Ph.D. 1995, Chinese Academy Science) working with Diandra Leslie-Pelecky, and **Min Zheng** (Ph.D. 1997, Institute of Physics, CAS, China) working with Roger Kirby and David Sellmyer.

Lecturers **Hurol Aslan** (Ph.D. 1994, Purdue) and **Kevin M. Lee** (Ph.D. 1988, UNL).

1998 Fall Semester Colloquia

September 3
Dr. Steven L. Guberman, Institute for Scientific Research, Lexington, MA
"What Happens When a Molecule Captures an Electron"

September 10
Professor Leo Sartori, University of Nebraska-Lincoln
"Physics of Nuclear Weapons"

September 17
Professor Andrew D. Kent, New York University
"Magnetoresistance in Microfabricated Ferromagnets"

September 24
Professor Bo Gao, University of Toledo
"Cold Atom Collisions"

October 1
Professor Kenneth Heller, University of Minnesota, *The Jerry E. Ruckman Lecture:*
"Teaching Problem Solving Using Cooperative Group Techniques"

October 8
Dr. Richard Green, Kitt Peak National Observatory
"A Tale of Two Surveys: Evolving Populations of Quasars and Galaxies"

October 15
Professor Ami E. Berkowitz, University of California–San Diego
"The Effect of Disorder on the Magnetic Properties of Ferrimagnets and Antiferromagnets"

October 22
Dr. Charles W. Clark, National Institute of Standards and Technology–Gaithersburg
"Structure and Spectra of Bose Einstein Condensates"

October 29
Dr. Paul Mantsch, Fermi National Accelerator Laboratory
"The Pierre Auger Project: The World's Largest Cosmic Ray Experiment"

November 19
Dr. Anuradha Koratkar, Space Telescope Science Institute
"The Status of Quasar Accretion Disks"

December 3
Professor David J. Sellmyer, University of Nebraska-Lincoln
"New Directions in Nanoscale Magnetism"

1999 Spring Semester Colloquia

January 21
Professor Stephen Ducharme, University of Nebraska-Lincoln
"Two Dimensional Ferroelectric Polymers"

January 28
Dr. Karen Leighly, Columbia University
"Narrow-Line Seyfert 1 Galaxies: A Laboratory for Quasar Astrophysics"

February 11
Professor Jean-Philippe Ansermet, Ecole Polytechnique Fédérale de Lausanne
"Spin Transport Effects in Ferromagnetic Nanowires"

February 18
Professor Sun Kwok, University of Calgary (Canada)
"The Origin and Evolution of Planetary Nebulae"

February 25
Professor Henri J.F. Jansen, Oregon State University
"Magnetic Anisotropy in Transition Metals"

March 4
Professor William G. Matthews, University of California at Santa Cruz
"The Physics of Music"

March 11
Professor Franz J. Himpsel, University of Wisconsin-Madison
"Self-Assembly of Magnetic Nanostructures"

April 1
Professor Theodore Jorgensen, University of Nebraska-Lincoln
"Relativity and the Quantum"

April 8
Professor Thomas F. Gallagher, University of Virginia
"Frozen Rydberg Gases"

April 22
Professor Evelyn T. Patterson, U.S. Air Force Academy
"Teaching and Learning Using the World Wide Web"

April 29
Professor Kit H. Bowen, Johns Hopkins University
"Photoelectron Spectroscopy of Cluster Anions"

1998 FACULTY PUBLICATIONS

ASTRONOMY AND ASTROPHYSICS

M. Dietrich,... O.P. Francis,... **C.M. Gaskell**,... S.P. Pebley,... S.A. Snedden, *et al.*, "Steps Toward Determination of the Size and Structure of the Broad-line Region in Active Galactic Nuclei. XII. Ground-based Monitoring of 3C 390.3," Astrophysics Journal Supplement **115**, 185 (1998).

S.J. Collier,... **C.M. Gaskell**,... S.A. Snedden, *et al.*, "Steps Toward Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei. XIV. Intensive Optical Spectrophotometric Observations of NGC 7469," Astrophysics Journal **500**, 162 (1998).

P.T. O'Brien,... **C.M. Gaskell**,... *et al.*, "Steps Toward Determination of the Size and Structure of the Broad-Line Region in Active Galactic Nuclei: XIII. Ultraviolet Observations of the Broad-Line Radio Galaxy 3C 390.3," Astrophysics Journal Supplement **509**, 1630 (1998).

S.A. Snedden, **C.M. Gaskell**, W.N. Brandt, and C. Otani, "ASCA Observations of the Extreme Narrow-Line Seyfert 1 Galaxies Mrk 42 and Mrk 957," (abstract), Bulletin American Astronomers Society **30**, 1383 (1998).

C.M. Gaskell and S.A. Snedden, "The Effect of High Metal Abundances on Estimates of the Densities of Broad Line Region Clouds," (abstract), Bulletin American Astronomers Society **30**, 1414 (1998).

S.N. Goderya, **K.C. Leung**, and **E.G. Schmidt**, "Photometric Investigation of the Eclipsing Binary Star KN Per," Astronomy and Space Science **254**, 295 (1998)

E.G. Schmidt, "Light Curve Changes in the Eclipsing Binary V719 Her," IAU Information Bulletin on Variable Stars #4552 (1998).

ATOMIC, MOLECULAR AND OPTICAL PHYSICS

H. Batelaan, **T. J. Gay**, and J. J. Schwendiman, "The Stern-Gerlach Effect for Electron Beams," Physical Review Letters **79**, 4517 (1997); **H. Batelaan** and **T.J. Gay**, Response to Comment by G.H. Rutherford and R. Grobe, Physical Review Letters. **81**, 968 (1998).

P.D. Burrow, J.A. Michejda, D.R. Lun, J.P. Sullivan, R.P. McEachran, D.S. Newman, and S.J. Buchman, "The '5.2 eV Resonance' in Electron Scattering from Hg," Journal of Physics B **31**, L1009 (1998).

K. Aflatooni, **G.A. Gallup**, and **P.D. Burrow**, "Dissociative Electron Attachment in Chloroalkanes and the Correlation with Vertical Attachment Energies," Chemical Physics Letters **282**, 398 (1998).

K. Aflatooni, **G.A. Gallup**, and **P.D. Burrow**, "Electron Attachment Energies of the DNA Bases," Journal of Physical Chemistry A **102**, 6205 (1998).

C.W. Hutchings, A.P. Hitchcock, A.T. Wen, S.-D. Hwang, J.A. Glass, J.T. Spencer, Y.-F. Hu, G.M. Bancroft, and **P.A. Dowben**, "The Valence Band Photoemission and Near Edge Core Excitation Spectroscopy of Di-*t*-butylchlorophosphine," Journal of Electron Spectroscopy and Related Phenomena **94**, 187-194 (1998).

C.W. Hutchings, S.-D. Hwang, **P.A. Dowben**, J.A. Glass, J.T. Spencer, Y.-F. Hu , and G.M. Bancroft, "The Electronic Structure of Di-*t*-butylchlorophosphine," Physics of Low Dimensional Structures **1/2**, 65-70 (1998).

C.M. Teodorescu, D. Gravel, E. Rühl, T.J. McAvoy, Jaewu Choi, D. Pugmire, P. Pribil, J. Loos, and **P.A. Dowben**, "Retractable Miniature Double Pass Cylindrical Mirror Analyzers," Review of Scientific Instruments **69**, 3805 (1998).

I.I. Fabrikant, "Formation of Ca^- Ions by Charge Transfer from Rydberg Atoms," Journal of Physics B **31**, 2921 (1998).

G.A. Gallup, Y. Xu, and **I.I. Fabrikant**, "Nonlocal Theory of Dissociative Electron Attachment to H_2 and HF Molecules, Physical Review A **57**, 2596 (1998).

M.-Q. Bao, **I.I. Fabrikant**, and **A.F. Starace**, "Final-State-Interaction Effects on One-and Two-Photon Detachment of H^- in the Presence of a Static Electric Field," Physical Review A **58**, 411 (1998).

K.W. McLaughlin, O.Yenen, and **D. H. Jaecks**, "Production of Purely Spin-Aligned Autoionizing States Which Decay to Orbital Aligned Ionic States, Physical Review Letters **81**, 289 (1998).

K. W. McLaughlin, O. Yenen, and **D.H.Jaecks**, "Production of Purely Spin-Aligned Autoionizing States Which Decay to Orbital-Aligned Ionic States," *1997-98 ALS Highlights* (March 1999).

M.A. Ali, Y.-K. Kim, W. Hwang, and **M.E. Rudd**, "Electron-Impact Ionization Cross Sections of Environmentally Sensitive Molecules," Journal of the Korean Physical Society **32**, 499-504 (1998).

L.C. Tribedi, P. Richard, W.D.L. Gulyas, M.W. Gealy, and **M.E.**

Rudd, "Double Differential Distributions of Electron Emission in a Pure Three Body Collision: Ionization of Atomic Hydrogen by Highly Charged Ions," Journal of Physics B **31**, L369-78 (1998).

L.C. Tribedi, P. Richard, Y.D. Wang, C.D. Liu, L. Gulyas, and **M.E. Rudd**, "Ionization Dynamics in Fast Ion-Atom Collisions. I. Energy and Angular Distributions of Low-Energy Electrons Emitted in Ionization of He by Bare Carbon Ions," Physical Review A **58**, 3619-25 (1998).

N.L. Manakov, A.V. Meremianin, and **A.F. Starace**, "Invariant Representations of Finite Rotation Matrices and Some Applications," Physical Review A **57**, 3233 (1998).

A.F. Starace, "Novel Doubly Excited States Produced in Negative Ion Photodetachment," in *The Physics of Electronic and Atomic Collisions: XX International Conference*, Ed. F. Aumayr and H.P. Winter (World Scientific, Singapore, 1998).

J. Röder, H. Ehrhardt, C. Pan, **A.F. Starace**, I. Bray, and D.V. Fursa, "Absolute Triply Differential (e,2e) Cross Sections for He in the Intermediate Energy Region with Comparison to Theory," Journal of Physics B **31**, L525 (1998).

C.N. Liu and **A.F. Starace**, "Analysis of Doubly-Excited State Resonances Below the Li(5p) Threshold in Li^- Photodetachment," Physical Review A **58**, 4997 (1998).

D.B. Miloevi and **A.F. Starace**, "Static-Electric-Field-Induced, High-Energy Plateau for Scattered X-ray Photons in Laser-Assisted, X-Ray-Atom Scattering," Physical Review Letters **81**, 5097 (1998).

CONDENSED MATTER PHYSICS

L. Loffler, J.P. Meier, **B. Doudin**, J. Ph. Ansermet, W. Wagner, "Random and Exchange Anisotropy in Consolidated Nanostructured Fe and Ni: Role of Grain Size and Trace Oxides on the Magnetic Properties," Physical Review B **57**, 2915 (1998).

J.E. Wegrow, S.E. Gilbert, D. Kelly, **B. Doudin**, J.Ph. Ansermet, "Anisotropic Magnetoresistance as a Probe of Magnetization Reversal in Individual Nano-sized Nickel Wires," IEEE Transactions on Magnetics **34**, 903-905 (1998).

B Doudin, J.E. Wegrowe, S.E. Gilbert, V. Scarani, D. Kelly, J.-Ph. Ansermet, "Magnetic and Transport Properties of Electrodeposited Nanostructured Nanowires," IEEE Transactions on Magnetics **34**, 968-972 (1998).

P.A. Dowben, "Comments on Some Experimental Measures of the Nonmetal to Metal Transition," Philosophical Transactions of the Royal Society London **A356**, 267-278 (1998).

D.N. McIlroy, S.-D. Hwang, K. Yang, N. Remmes, **P.A. Dowben**, A.A. Ahmad, N.J. Ianno, J.Z. Li, J.Y. Lin, and H.X. Jiang, "The Incorporation of Nickel and Phosphorus Dopants into Boron Carbon Alloy Thin Films," Applied Physics **A67**, 335-342 (1998).

J. Choi, **P.A. Dowben**, S. Pebley, A. Bune, **S. Ducharme**, V.M. Fridkin, S.P. Palto, and N. Petukhova, "The Changes in Metallicity and Electronic Structure Across the Surface Ferroelectric Transition of Ultra Thin Crystalline Poly(vinylidene flouride-triflouroethylene) Copolymers," Physical Review Letters **80**, 1328-1331 (1998).

P.A. Dowben, C. Waldfried, T. Komesu, D. Welipitiya, T. McAvoy, and E. Vescovo, "The Occupied and Unoccupied Electronic Structure of Absorbed Ferrocene," Chemical Physical Letters **283**, 44-50 (1998).

C. Waldfried, D. Welipitiya, T. McAvoy, **P.A. Dowben**, and E. Vescovo, "Finite Size Scaling in the Thin Film Limit," Journal of Applied Physics **83**, 7246-7248 (1998).

C. Waldfried, D.N. McIlroy, T. McAvoy, D. Welipitiya, **P.A. Dowben**, and E. Vescovo, "Strain Induced Alteration of the Gadolinium Surface State," Journal of Applied Physics **83**, 6284-6286 (1998).

C. Waldfried, T. McAvoy, D. Welipitiya, **P.A. Dowben**, and E. Vescovo, "The Influence of Enhanced Surface Magnetism on Finite Size Scaling," Europhysics Letters **42**, 685-690 (1998).

C. Waldfried, T. McAvoy, D. Welipitiya, T. Komesu, **P.A. Dowben**, and E. Vescovo, "Wave Vector Dependent Exchange Splitting in a Local Moment System," Physical Review **B58**, 7434-7442 (1998).

R. Skomski, C. Waldfried, and **P.A. Dowben**, "The Influence of the Surface on the Spontaneous Magnetization of Gd Thin Films," Journal of Physics: Condensed Matter **10**, 5833-5838 (1998).

J. Choi, **P.A. Dowben**, **S. Ducharme**, V.M. Fridkin, S.P. Palto, N. Petukhova, and S.G. Yudin, "Lattice and Band Structure Changes at the Surface Ferroelectric Transition," Physics Letters A **249**, 505-511 (1998).

D. Welipitiya, C. Waldfried, C.N. Borca, **P.A. Dowben**, N.M. Boag, H. Jiang, I. Gobulukoglu, and B.W. Robertson, "Adsorption of Nickelocene II: Decomposition and Selective Area Deposition," Surface Science **418**, 466-478 (1998).

Z.C. Zhong, **P.A. Dowben**, and **D.J. Sellmyer**, "Selective Area Induced Deposition of Rare Earth Hexaborides from Solution," Materials Letters **37**, 320-324 (1998).

A.A. Amad, N.J. Ianno, S.-D. Hwang, and **P.A. Dowben**,

"Sputter Deposition of High Resistivity Boron Carbide," Thin Solid Films **335**, 174-177 (1998).

C. Waldfried, O. Zeybek, T. Bertrams, S.D. Barrett, and **P.A. Dowben**, "The Growth of Strained Thin Films of Gadolinium," *Mechanisms and Principles of Epitaxial Growth in Metallic Systems*, Ed. By L.T. Wille, C.P. Burmester, K. Terakura, G. Comsa, and E.D. Williams, Materials Research Society Symposium Proceedings **528**, 147-152 (1998).

C. Waldfried, E. Vescovo, and **P.A. Dowben**, "The Spin Polarized Band Structure of Strained Thin Films of Gadolinium," *Applications of Synchrotron Radiation Techniques to Materials Science IV*, Ed. by S. Mini, S. Stock, D. Perry, and L. Terminello, Materials Research Society Symposium Proceedings **524**, 191-196 (1998).

C. Waldfried, and **P.A. Dowben**, "The Wave Vector Dependence of the Ferromagnetic Band Structure in Gadolinium," *Magnetism and Electronic Correlations in Local Moment Systems*, Ed. by M. Donath, **P.A. Dowben**, and W. Nolting, Word Scientific (1998).

J.R. Hardy, "Structural Phase Transitions in Ionic Molecular Solids," Phase Transitions **67**, 521 (1998).

L.X. Zhou, **J.R. Hardy**, and X. Xu, "Molecular Dynamics Simulation of $MgSiO_3$ Perovskite," Chinese Physics Letters **15**, No. 6, 444 (1998).

R.J. Hardy, D.J. Lacks, and R.C. Shukla, "Quantum Corrections to the Simulated Properties of Solids," Physical Review B **57**, 833 (1998).

R.F. Sabiryanov, and **S.S. Jaswal**, "Electronic Structure and Magnetic Properties of Y-Fe Compounds," Physical Review B **57**, 7767 (1998).

R.F. Sabiryanov, and **S.S. Jaswal**, "Magnetic Properties of Hard/Soft Composites: $SmCo_5/Co_{1-x}Fe_x$," Physical Review B **58**, 12071 (1998).

R.F. Sabiryanov, and **S.S. Jaswal**, "Electronic Structure and Magnetic Properties of Hard/Soft Multi-layers," Journal of Magnetism and Magnetic Materials **171-181**, 989 (1998).

R.F. Sabiryanov, and **S.S. Jaswal**, "Magneto-Optical Properties of $MnPt_3$: LDA+U Calculations," Journal of Applied Physics **83**, 6745 (1998).

J.M. Meldrim, **R.D. Kirby**, J.A. Woollam, and **D.J. Sellmyer**, "Magnetic and Magneto-Optic Study of Co/Pt Multilayers on Bismuth and Aluminum-Doped Dysprosium Iron Garnet," IEEE Transactions on Magnetics **34**, 1991 (1998).

T. Matsui, R.D. Stevenson, **R.D. Kirby**, and **D.J. Sellmyer**, "Structural and Magnetic Properties of PrCo3-xSix Compounds," Journal of Applied Physics **83**, 7381 (1998).

D.L. Leslie-Pelecky, M. Bonder, T. Martin, E.M. Kirkpatrick, Yi Liu, X.Q. Zhang, S.-H. Kim, and R.D. Rieke, "Using High-Temperature Chemical Synthesis to Produce Metastable Nanostructured Cobalt," Chemical Materials **10**, 3772 (1998).

D.L. Leslie-Pelecky, M. Bonder, T. Martin, E.M. Kirkpatrick, X.Q. Zhang, S.-H. Kim, and R.D. Rieke, "Chemical Synthesis of Nanostructured Cobalt at Elevated Temperatures," IEEE Transactions on Magnetics **34**, 1018 (1998).

D.L. Leslie-Pelecky, X.Q. Zhang, S.-H. Kim, M. Bonder, and R.D. Rieke, "The Structural Properties of Chemically synthesized Nanostructured Nickel and Ni_3C:Ni Nanocomposites," Chemical Materials **13**(1), 164 (1998).

S.H. Liou, R. Li, Q. Cai, M. Chandrasekhar, W.B. Yelon, A.L. Vasiliev, and E.P. Kvam, "Structure and Raman Studies of $HgBa_2CuO_{4+x}$," Journal of Superconductivity **11**, 59 (1998).

Y. Liu, R.A. Thomas, S.S. Malhotra, Z.S. Shan, **S.H. Liou**, and **D.J. Sellmyer**, "Phase Formation and Magnetic Properties of in Co-Rare Earth Magnetic Films," Journal of Applied Physics **83**, 6244 (1998).

J. Choi, C. Waldfried, **S.H. Liou**, **P.A. Dowben**, "Can Photoemission Accurately Probe the Bulk Electronic Structure of the Complex Oxides?," Journal of Vacuum Science Technology **A16**, 2950 (1998).

M. Yu, Y. Liu, **S.H. Liou**, and **D.J. Sellmyer**, "Nanostructured NdFeB Films Processed by Rapid Thermal Annealing," Journal of Applied Physics **83**, 6611 (1998).

S.H. Liou, and Y.D. Yao, "Development of High Coercivity Magnetic Force Microscopy Tips," Journal of Magnetism and Magnetic Materials **190**, 130 (1998).

J.P. Liu, C.P. Luo, Y. Liu, and **D.J. Sellmyer**, "High Energy Products in Rapidly Annealed Nanoscale Fe/Pt Multilayers," Applied Physics Letters **22**, 483 (1998).

J.P. Liu, Y. Liu, and **D.J. Sellmyer**, "Coercivity and Exchange Coupling in PrCo:Co Nanocomposite Films," Journal of Applied Physics **83**, 6608 (1998).

S.Y. Jeong, Z.S. Shan, and **D.J. Sellmyer**, "Magnetization Reversal Mechanism and Magnetic Properties of Co/Pd Multilayers," Japan Journal of Applied Physics **37**, 819 (1998).

D.J. Sellmyer, M. Yu, R.A. Thomas, Y. Liu, and **R.D. Kirby**, "Nanoscale Design of Films for Extremely High Density Magnetic Recording," Physics of Low-Dimensional Structures **1/2**, 155 (1998).

M. Yu, M.F. Doerner, **D.J. Sellmyer**, "Thermal Stability and

Nanostructure of CoCrPt Longitudinal Recording Media," IEEE Trans. Mag. **34**, 1534 (1998).

T-Y. Zhao, Z.S. Shan, B.-G. Shen, J.-G. Zhao, and **D.J. Sellmyer**, "Oscillatory Interlayer Coupling with Cu and Zr Underlayer Thickness for Co/Cu Multilayers," Acta Physica Sinica **7**, 8 (1998).

R. Skomski, J.P. Liu, J.M. Meldrim, and **D.J. Sellmyer**, "Intergranular Exchange in Magnetic Nanostructures," in *Proc. Tenth International Symposium on Mag. Anisotropy and Coercivity in Rare Earth-Transition Metal Alloys*, Eds. L. Schultz, K.H. Mueller, (Werkstoff Informationsgesellschaft, Dresden, 1998), p. 277.

HIGH ENERGY PHYSICS

P.L.Frabetti, ...**D. Claes**, *et al*, "A New Measurement of the Lifetime of the χ_c^+," [The E687 Collaboration], Physics Letters **B424**, 221 (1998).

P.L. Frabetti, ...**D. Claes**, *et al*, "Observation of a Narrow State Decaying Into $\chi_c^0 \pi^+$," [The E687 Collaboration], Physics Letters **B426**, 403 (1998).

S. Abachi, ...**D. Claes, G. Snow**, *et al.*, "Search for Top Quark Pair Production in the Dielectron Channel," [DØ Collaboration], Physical Review **D57**, 589 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Search for the Trilepton Signature from Associated Gaugino Pair Production," [DØ Collaboration], Physical Review Letters **80**, 1591 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Measurement of the Top Quark Mass Using Dilepton Events," [DØ Collaboration], Physical Review Letters **80**, 2063 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Measurement of Dijet Angular Distributions and Search for Quark Compositeness," [DØ Collaboration], Physical Review Letters **80**, 666 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Experimental Search for Chargino and Neutralino Production in Supersymmetry Models with a Light Gravitino," [DØ Collaboration], Physical Review Letters **80**, 442 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Measurement of the W Boson Mass," [DØ Collaboration], Physical Review **D58**, 092003 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "$Z\gamma$ Production in $\bar{p}$ p Collisions at $\sqrt{s}$ =1.8TeV and Limits on Anomalous $ZZ\gamma$ and $Z\gamma\gamma$ Couplings," [DØ Collaboration], Physical Review **D57**, 3817 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Search for First Generation Scalar Leptoquark Pairs in $\bar{p}$ p Collisions at $\sqrt{s}$=1.8 TeV," [DØ Collaboration], Physical Review Letters **80**, 2051 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "A Measurement of the W Boson Mass at the Fermilab $\bar{p}$ p Collider," [DØ Collaboration], Physical Review Letters **80**, 3008 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Direct Measurement of the Top Quark Mass," [DØ Collaboration], Physical Review **D58**, 052001 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Search for the Decay $b \rightarrow X_s \mu^+\mu^-$," [DØ Collaboration], Physics Letters **B423**, 419 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Measurement of the Shape of the Transverse Momentum Distribution of W Bosons Produced in $\bar{p}$ p Collisions at $\sqrt{s}$=1.8 TeV," [DØ Collaboration], Physical Review Letters **80**, 5498 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Limits on $WW\gamma$ and WWZ Couplings from W Boson Pair Production," [DØ Collaboration], Physical Review **D58** Rapid Communications 051101 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Search for Charge 1/3 Third Generation Leptoquarks in $\bar{p}$ p Collisions at $\sqrt{s}$=1.8 TeV," [DØ Collaboration], Physical Review Letters **81**, 38 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Limits on Anomalous $WW\gamma$ and WWZ Couplings," [DØ Collaboration], Physical Review **D58** Rapid Communications 031102, July 1998.

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Search for Heavy Pointlike Dirac Monopoles," [DØ Collaboration], Physical Review Letters **81**, 524 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al.*, "Probing Hard Color-Singlet Exchange in $\bar{p}$ p Collisions at $\sqrt{s}$ =630 GeV and 1800 GeV", [DØ Collaboration], Physics Letters **B440**, 189 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al*, "Determination of the Mass of the W Boson Using the DØ Detector at the Tevatron", [DØ Collaboration], Physical Review **D58**, 12002 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al*, "A Measurement of the W Boson Mass", [DØ Collaboration], Physical Review **D58**, 092003 (1998).

B. Abbott, ...**D. Claes, G. Snow**, *et al*, "Direct Measurement of Top Quark Mass by the DØ Collaboration", Physical Review **D58**, 052001 (1998).

G. Ballocchi, ...**G. Snow**, *et al*, "Direct Photon Cross Sections

in Proton-Proton and Antiproton-Proton Interactions at $\sqrt{s}$ =24.3 GeV," [The UA6 Collaboration], Physics Letters **B436**, 222 (1998).

T. Armstrong, ...**G. Snow**, *et al*, "A Detector to Search for Antiproton Decay at the Fermilab Accumulator," [The APEX Collaboration], Nuclear Instruments and Methods **A411**, 210 (1998).

M. Hu, ...**G. Snow**, *et al*, "Search for Muonic Decays of the Antiproton at the Fermilab Antiproton Accumulator", [The APEX Collaboration], Physical Review **D58**, 111101 (1998).

INTERDISCIPLINARY PHYSICS

Archaeometry

J.W. Weymouth, "A Magnetometer Search for Fort Remon: The First Season," Report submitted to the Museum of the Rockies, Montana State University, Bozeman, Montana (February 1998).

J.W. Weymouth, "Three Geophysical Surveys of the Hopeton Earth Works: The Second Season," Report submitted to the Midwest Archeological Center, National Park Service, National Park Service, Lincoln, Nebraska (March 1998).

J.W. Weymouth, "Two Geophysical Surveys in the Village Area, Arkansas Post National Memorial," Report submitted to the Midwest Archeological Center, National Park Service, Lincoln, NE (May 1998).

J.W. Weymouth, "Final Report on Geophysical Surveys on the Lake Dumond Site (3AR110)," Report submitted to the Midwest Archeological Center, National Park Service, Lincoln, NE (June 1998).

J.W. Weymouth, "On Two Tests Using the EM38 at the Lake Dumond Site, Arkansas," Submitted to the Midwest Archeological Center, National Park Service, Lincoln, NE (July 1998).

J.W. Weymouth, "Analysis of a Magnetic Survey of the High Bank Site, 1998 Season," Report submitted to the Cleveland Museum of National History, Cleveland, OH (August 1998).

History

M.E. Rudd, "The Dollond Family: Five Generations of Opticians," Journal of the Antique Telescope Society **15**, 4-10 (1998).

Physics Education

R.G. Fuller, "ADAPT A Multidisciplinary Piagetian-based Program for College Freshmen," The Genetic Epistemologist **vol. 26**, No. 2, 1-5 1998.

Track Physics

R. Katz and F.A. Cucinotta, "Track Structure Models: Application to Radiobiology and High LET Therapy," Bolletino della SIRR (Societa Italiana per le Richerche sulle Radiazioni) pp 6-10, Anno 1- n.1-3 (1998).

F.A. Cucinotta, **R. Katz**, and J.W. Wilson, "Radial Distribution of Electron Spectra from High Energy Ions," Radiat. Environ. Biophys. 37, 259-265 (1998).

New Research Grants and Contracts

during the period 1 November 98 - 31 October 1999 the following new and renewal grants and contracts were received by our faculty

Principal Investigator	Title (Source of Funds)	Amount ($Thousands)
Adenwalla	Single and Multi-Layered Magnetic Arrays: A Study of Their Magnetic Properties (NSF)	58.9
Burrow	Temporary Anions and Dissociative Attachment: Probes of Intra- and Intermolecular Interactions (NSF)	110.0
Doudin	Development of a Single-Spin Transistor (Layman Fund)	7.0
Doudin	Faculty Fellowship-Mesoscopic Magnetism (Research Council)	6.5
Doudin	Single Spin Electronics (NSF)	75.0
Doudin	Electrodeposition of Ferromagnets in Organic Solvents (ACS)	12.5
Dowben	Syracuse Subcontract (SU)	49.7
Dowben/Liou/Adenwalla	The Metal-Nonmetal Transition in Magnetic Local Moment Systems (NSF)	113.8
Dowben/Adenwalla	Boron-Carbide Thermal Neutron Detectors and Cameras (NRI)	66.0
Dowben/Adenwalla	Development of Spin Polarized Electron Scattering (NSF)	180.0
Ducharme	Ferroelectricity in Langmuir-Blodgett Polymer Films (NSF)	11.4
Ducharme	Development of Low Voltage Ferroelectric Thin Film Switching In Collaboration with The Institute of Crystallography in Moscow (Opticom ASA)	75.0
Ducharme/Dowben/ Adenwalla	ONR-DEPSCOR/Structure of Ferroelectric Polymers (ONR)	96.7
Fabrikant	Collision Processes Involving Low-Energy Electrons (NSF)	60.0
Fabrikant	Strong External Field Effects in Decay and Photodetachment of Negative Ions (DOE)	34.2
Fuller	Bicycle Project (KC)	12.1
Gaskell	A Study of Emission Line Profiles in Low Redshift Quasars (NASA)	4.9
Gay	REU Supplement-Polarized Electron Physics (NSF)	10.0
Gay	Polarized Electron Physics (NSF)	163.0
J. Hardy	Studies on the Microwave Optics of Ionic Molecular Solids (ARO)	80.0
Jaecks	ROA Supplement to NSF 9731869 (NSF-ROA)	10.0
Jaecks	Supplement to PHY-9731890 (NSF-REU)	10.0
Jaecks	Correlated Motion, Energy and Angular Momentum Partitioning in Multielectron and Massive Three Body-Coulomb-Interacting Quantum Systems in the Continuum (NSF)	180.0
Kirby/Doudin	Purchase of Impedance Spectroscopy Instrumentation for Research In Synthesis by Electrochemistry Techniques (NSF)	46.0
Lee	Astronomy Manual Development (Harcourt Brace College)	.9
Lee	Photometric Survey of Multiperiodic RR Lyrae Stars (American Astronomical Society)	2.9
Leslie-Pelecky	Metastable Phases in Chemically Synthesized Nanoparticles (ACS)	10.0
Leslie-Pelecky	Career: Cluster-Assembled Magnetic Nanostructures (NSF)	80.0
Leslie-Pelecky/Ducharme	Research Experiences for Undergraduates in Nanostructured Materials (NSF)	63.0
Leung	6000 Years of Chinese Ceramics (Asian Arts & Cultural Guild/Lentz Center/NE Arts Council/ Leung/Cooper Foundation)	12.1
Liou	Study of Advanced Magnetic Force Microscopy Tips (Digital Instruments)	13.0
Liou	Homologous-Series Superconductors and Multilayer Junctions (Midwest Superconductivity Consortium)	133.9
Liou/Kirby	High Temperature Stability of Magnetic Clusters (ARO)	77.5
P. Liu/Sellmyer	Intergrain Exchange Coupling in Nanostructured Composites (NSF)	27.3
Sellmyer	Advanced Magnets for Power Systems (ARO)	250.0
Sellmyer	Fundamental and Magnetic-Hardening Studies of Nanocrystalline and Nanocomposite Magnets (DOE)	170.0
Sellmyer	Extremely High Density Recording (NSIC-EHDR)	22.5
Sellmyer/Doudin	Development of a Cluster-Deposition System for Nanoscale Magnetic Materials (NSF)	40.0
Sellmyer/Jaswal/ Leslie-Pelecky/Liu	Advanced High-Temperature Magnetic Materials (AFOSR)	96.6
Sellmyer/Doudin/ Dowben/Kirby/Liou	Nanoscale Materials for Information Technologies (NRI)	250.0
Starace	International Supplement for NSF Award PHY-9722110 (NSF)	7.2

Starace	Coherent Control of Continuum Quantum Processes (NSF)	78.0
Starace	Dynamics of Few-Body Atomic Processes (DOE)	89.3
Bandyopadhya/Liu-Sellmyer	Self Assembled Nanostructures (ARO)	24.8
Weymouth	Montana State University	1.9
Weymouth	Remote Sensing on St. Catherines Island (American Museum of Natural History)	2.8
Weymouth	Mitchell Indian Village National Historic Landmark Site, South Dakota (National Park Service)	1.0

Total $2,921.8

AAPT - American Assoc. of Physics Teachers
ACS - American Chemical Society
AFOSR - Air Force Office of Scientific Research
ARO - Army Research Office
DE - Dale Electronics
DOE - U.S. Department of Energy
EPSCoR - Experimental Program to Stimulate Competitive Research
IBM - International Business Machines
KC - Kalamazoo College
LTF - Layman Trust Fund
NASA - National Aeronautics and Space Administration
NRI - Nebraska Research Initiative
NSF - National Science Foundation
NSIC - National Storage Technology Development Corporation
ONR - Office of Naval Research
PU/MISCON - Purdue University/Midwest Superconductivity Consortium
SU - Syracuse University
UI - University of Iowa
UND - University of Notre Dame
UNF - University of Nebraska Foundation