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SPECTRUM

FOR ALUMNI & FRIENDS OF THE DEPARTMENT OF PHYSICS & ASTRONOMY

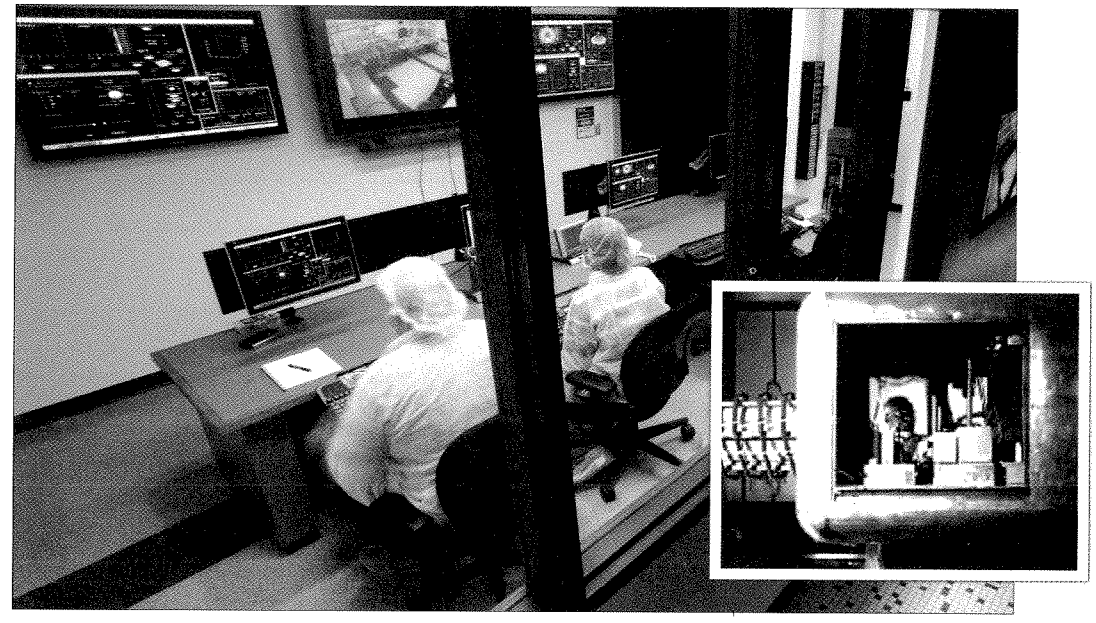
UNIVERSITY OF NEBRASKA–LINCOLN

ANTHONY F. STARACE, EDITOR

Umstadter Builds 100 Terawatt Laser Lab

Donald P. Umstadter

The accelerator laboratory in the sub-basement of Behlen, well-known to generations of atomic physics graduate students, postdocs, and faculty, is no more. Its major feature was the 300-keV Cockroft-Walton ion accelerator built by Professor **Theodore P. Jorgensen** following his return from service on the Manhattan Project during WWII. The approximately 4,000 sq. ft. laboratory, located under the grass between Behlen Lab and Richards Hall, is now gleaming and new, having been renovated this year to house one of the most powerful lasers in the world, dubbed "Diocles" (after the ancient Greek inventor of the parabolic mirror, still used today to intensify light). The ultra-short, ultra-intense bursts of laser radiation produced by Diocles will enable UNL researchers led by **Donald P. Umstadter,** the Leland J. and Dorothy H. Olson Professor of Physics, to probe matter under extreme conditions and enable a host of applications, including---like Jorgensen---the acceleration of charged particles. The accompanying photos illustrate this revolution in the technologies employed in our physics research laboratories.



Under the grass between Behlen Lab and Richards Hall, UNL researchers probe matter under extreme conditions using one of the world's most powerful lasers, dubbed "Diocles." (INSET): **Theodore P. Jorgensen** works on the 300 keV Cockroft-Walton accelerator.

Umstadter came to UNL in January 2005 from the University of Michigan, where he had joint professorial appointments in the Departments of Applied Physics, Electrical Engineering and Computer Science, and Nuclear Engineering and Radiological Science. He received his Ph.D. in plasma physics in 1987 from the Physics Department at UCLA. Following a two-year postdoctoral appointment at AT&T Bell Laboratories and the University of Maryland, he joined the University of Michigan in 1989. At Michigan his research thrived. He was awarded numerous outstanding achievement awards by the University, including the Monroe-Brown Foundation Research Excellence Award of the College of Engineering in 2003. He was a co-founder of two NSF-funded research centers there: the Center for Ultrafast Optical Science (CUOS) and the Frontiers in Coherent and Ultrafast Optical Science (FOCUS) Center. Umstadter has supervised (so far) 13 graduate students through to the Ph.D. He has produced over 175 publications, including 21 papers that have appeared in *Nature, Science,* and *Physical Review Letters.* He co-authored a highly cited article on "Extreme Light" in the May 2002 issue of *Scientific American.* In 2004 he was elected a Fellow of the American Physical Society.

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Editor's Note:
This second double issue of Spectrum *provides our Department's news up to approximately Summer 2006. We are working to improve the timeliness of future issues of* Spectrum.

INSIDE THIS ISSUE

Complex Physics and the New Physics Complex

As documented in many places in this issue of *Spectrum,* the Department continues to change, grow and improve. Our external funding has reached new highs, our young faculty continue to develop excellent research programs, the new ultra-high intensity laser facility (now named Diocles, after the Greek scientist ca. 520 AD who first derived the light focusing properties of parabolic surfaces) is now in operation, and some of our space issues are being resolved. The University has been very supportive of Department activities, providing enhancement funds for both atomic, molecular, optical and plasma physics and for nanoscale science and technology and providing strong support for new faculty hires. *In toto,* these ventures bring greater opportunities for the Department's graduate and undergraduate students.

A dominant issue the past couple of years has been laboratory, office and instructional space. Our growth in research funding, coupled with our long term effort to hire more experimentalists (who require more space than theoreticians), and our commitment to develop one of the most intense laser facilities in the world has led to severe constraints on our available research space and to many laboratory and office renovations. In addition, our methods of teaching now incorporate such things as interactive engagement methods (which require instantaneous electronic responses from students), computer-based simulations of physics concepts, in addition to conventional lecture demonstrations. These likewise put constraints on our use of classroom space.

Of course, it's not just the number of people: Physics research has gotten more complex, with more advanced instrumentation, more shared facilities, and more collaborations among disciplines. There is also more technology used these days in instructional delivery.

These various factors put additional requirements on the amount and quality of our research and instructional space. On a broader scale, the University has been renovating buildings through a previously funded bond issue, and this has resulted in Computer Science and Engineering moving out of Ferguson Hall. While CS&E temporarily retains some space in the Ferguson basement (for about one more year), we have now taken over all of the non-instructional space on the first, second and third floors.

Among moves and changes: The Business Office has moved from 204 Brace to a four-room suite on the first floor of Ferguson (we now have four full time employees in this office, so the increase in space was desperately needed); we are in the final stages of converting another first floor room to a seminar room/video conference facility; Olson Chair **Donald Umstadter's** research group is rapidly growing in size, and it has been located in five offices on the second floor; our burgeoning condensed matter theory group has been moved to a suite of offices on the second floor; other Ferguson rooms are being used as a reading/conference room and for storage, and one room will be used to reinstitute our Physics Resource Room as soon as it is no longer needed for short term storage of components for Diocles.

We are still in the initial stages of making effective use of some of the space that has become available: A new electron microscopy facility will soon be installed in the basement of Ferguson; as part of a campus-wide consolidation of library facilities to reduce costs, the Physics/Astronomy Library has been closed and all of the journals and books have been moved to Love Library. Our former library space will be used to house at least two new experimentalists, although we have not yet planned the details of the renovation.

Last year, University administrators developed a plan to seek a new bond issue for building renovations, with $36 M of the $150 M total on all four NU campuses being designated to renovate Behlen, Brace and Ferguson. Unfortunately, this plan was not approved by the Unicameral during the Winter 2005 session, but we were optimistic that it would be approved during the current legislative session. This plan would have created some significant problems, given that little "swing" space is available elsewhere on campus to temporarily house our research and instructional programs during the renovations.

In a recent twist, Chancellor Harvey Perlman decided that UNL and our Department would be better served if we could construct a new Physics Complex, which would house our Department as well as selected laboratories associated with the Center for Materials and Nanoscience and UNL's ongoing nanotechnology initiative.

The Unicameral considered funding the Physics Complex during its 2006 winter/spring session, and I am pleased to report that at the very end of the legislative session it gave its approval. Plans call for a new 100,000 square foot building to be located just west of the Walter Scott/Othmer Engineering Complex. While we would still be a bit crowded (as the new building is intended simply to replace our current space), the building would be designed according to our current needs and thus will be much more functional. It will also be designed to be expanded, permitting future additions. If all goes according to the tentative schedule, construction would be complete by July 2009. Once construction of the Physics Complex is complete, Ferguson will be razed, Brace will either be renovated or razed, and Behlen will be renovated for less technical uses.

These are indeed exciting times, and we look forward to new successes and accomplishments.

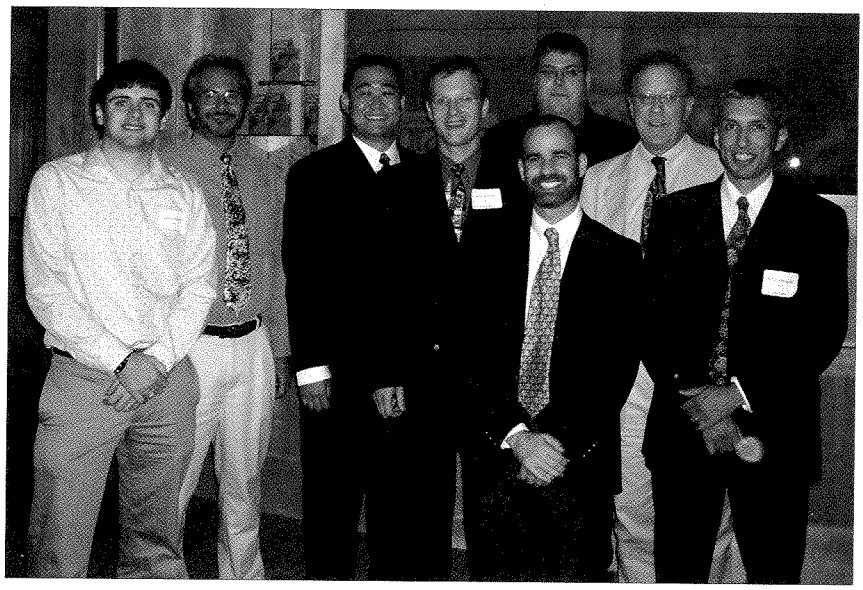
Sincerely,

Roger D. Kirby

Roger D. Kirby
Professor and Chair

Roger Kirby, Chair

> "The University has been very supportive of Department activities, providing enhancement funds for both atomic, molecular, optical and plasma physics and for nanoscale science and technology and providing strong support for new faculty hires."



UNL Tier-2 team (left to right): **Brian Bockelman, Dan Claes, Mako Furukawa, David Swanson, Ken Bloom** (foreground), **Carl Lundstedt** (background), **Greg Snow, and Aaron Dominguez.** (Photo by Roger Kirby)

'Tier-2' Computing Center to Advance Particle Physics Research, Greatly Expand Research Computing

Particle physicists around the world are preparing for a new era of discovery, and members of the UNL Departments of Physics and Astronomy and Computer Science and Engineering are going to be spearheading that effort. That's because UNL was chosen as the site for a major computing facility that will host and process a substantial portion of the data produced by a new accelerator, the Large Hadron Collider (LHC).

The computing project, known as a "Tier-2" computing center, is a partnership between faculty in the two departments. **Ken Bloom** and **Aaron Dominguez**, assistant professors in Physics and Astronomy, co-lead the project with David Swanson, assistant research professor in Computer Science and Engineering and director of UNL's Research Computing Facility (RCF). With $500,000 per year of funding from the National Science Foundation for the next five years, plus substantial support from UNL's Vice Chancellor for Research, the Tier-2 project represents a significant upgrade of RCF's capabilities, and will give UNL scientists a special role in the LHC project.

The LHC is being built at CERN, the international particle physics laboratory in Geneva, Switzerland. When it is completed in 2007, this accelerator, a ring 27 km in circumference on the French-Swiss border, will collide protons at a center-of-mass energy of 14 TeV. That energy is seven times greater than that of the Fermilab Tevatron in Illinois. As a result, the LHC will be able to explore particle interactions at a new order of magnitude in energy. All indications are that this is the energy scale for phenomena that give everyday particles their masses, and one on which new particles and new interactions may be discovered that might change our view of how the universe is put together.

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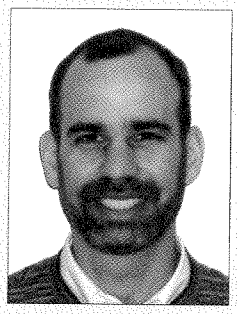

Bloom

Dominguez

Bloom, Dominguez Join Experimental High Energy Physics Group

BY DAN CLAES & GREG SNOW

During Spring 2004, the Department conducted a search for an assistant professor to join the Experimental High Energy Physics group. While there were a large number of excellent applicants, two stood out from all the rest. In an unexpected turn of events, the Department was able to make offers to both of these top candidates. **Kenneth Bloom** and **Aaron Dominguez** joined the Department in August 2004, doubling the number of faculty in this frontier research area.

Ken received his bachelor's degree with honors from the University of Chicago and his Ph.D. from Cornell University. His dissertation covered properties of B mesons produced at Cornell's electron-position collider. In subsequent postdoctoral positions at the Johns Hopkins University and the University of Michigan, Ken became a leading researcher on the CDF experiment at Fermilab near Chicago. Ken specialized in studies of the top quark that was discovered by both the CDF and DZERO experiments in 1995.

Aaron earned undergraduate degrees in math and physics (B.A.) from Whitman College and in applied physics (B.S.) from Caltech. His Ph.D. research at the University of California at San Diego used data from the L3 experiment at CERN's LEP collider to search for the elusive Higgs boson in electron-positron collisions. Aaron also joined Fermilab's CDF experiment as a postdoc at the Lawrence Berkeley National Laboratory and continued to search for the Higgs boson, this time in collisions between protons and antiprotons.

After arriving at UNL, Ken and Aaron joined faculty members **Dan Claes** and **Greg**

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UNL faculty members Bloom, Dominguez, **Dan Claes** and **Greg Snow** collaborate on an LHC experiment called the Compact Muon Solenoid (CMS). The detector takes its name from the 4 Tesla solenoidal magnet at its heart, which is used to measure the momentum of charged particles produced in the LHC collisions. The detector is being built by a world-wide collaboration of about 2,000 physicists from 37 nations. Forty-seven institutions in the United States, including UNL, are in the CMS collaboration. As a result, CMS will be one of the most complex experiments undertaken in the history of science.

> "The detector is being built by a world-wide collaboration of about 2000 physicists from 37 nations. Forty-seven institutions in the United States, including UNL, are in the CMS collaboration. As a result, CMS will be one of the most complex experiments undertaken in the history of science."

It will also produce an unprecedented amount of data. Each year the detector will produce more than a petabyte (PB) — a million gigabytes — of raw data. There will be even larger amounts of simulated data, which will be needed to understand the performance of the detector as well as what new-physics signals will look like in the experiment. All of this data must be processed (increasing the data size as more information is extracted), stored, transmitted to physicists located around the world, and analyzed. Each year's worth of data will require about 30,000 of today's CPUs of processing power and 14 PB of disk storage.

In the past, particle-physics experiments would concentrate all of their computing power in one physical location, typically where the experiment itself was located. But the computing demands of LHC experiments are so vast that no one site could host all of the necessary hardware — not to mention that there are 36 countries that don't want to invest in computer hardware that would be shipped from their countries to Switzerland. Fortunately, new technology allows us to pursue a more distributed solution. High-speed fiber-optic networks allow data to be shipped around the world quickly, and technologies to allow computers anywhere to work together — a process known as "grid computing" — have led scientists to break away from the one-site computing model.

CMS has thus designed a very distributed model of data processing, storage and analysis. It is a "tiered" system, in which computing hardware and tasks are arranged in a hierarchical structure. The structure starts at the Tier-0 facility, which is located at CERN. This computing cluster is responsible for doing a first-pass processing of the collision events, writing the data to tape, and then sending copies of the data to the next tier. There is only enough computing power at this tier to keep up with the rate of data taking. There will be several Tier-1 facilities, at most one per collaborating nation; the US site will be at Fermilab in Illinois. The total computing power at Tier 1 is equal to that of Tier 0. These facilities will be doing further data reduction, re-processing of older data with improved software tools, and data archiving. But even at this tier, there are no resources for detector simulations, or for everyday users who want to analyze the data and discover new physics.

Those jobs are delegated to the Tier-2 sites, which in aggregate have as much computing power as the Tier-0 facility. There will be about 25 Tier-2 sites spread around the world, seven of which will be in the United States. Subsets of the data will be sent from the Tier-1 sites over the network to the Tier-2 sites, which will have sufficient computing resources for about forty physicists to study the data and make the measurements that will lead to publications and discoveries. In addition, the Tier-2 computers will be used for detector simulations; the results will be sent over the network for archiving at Tier-1 sites. By the time of LHC startup in late 2007, each Tier-2 site will need to have CPU power equivalent to about 1000 of today's processors, 200 TB of disk, and a 2.5 gigabit/sec network link to Tier-1.

In fall 2004 the management of the United States contingent of CMS solicited proposals from universities to host Tier-2 sites, and UNL was one of the bidders. Our proposal was based around the local strengths of our site — the strength of our Research Computing Facility, our expertise in cluster computing, strong support from the Office of Reserach, and, perhaps most importantly, UNL's robust and growing particle-physics research group. With the appointment of Bloom and Dominguez to the faculty in 2004, UNL now has one of the larger university-based CMS groups in the US. In January 2005, UNL was selected to be one of the seven US Tier-2 sites, along with Caltech, MIT, UC San Diego, Wisconsin, Purdue and Florida. This opens the door to a new research path for UNL's Physics and Astronomy Department, scientific discovery through large scale computing, and a new collaboration between faculty in our department and those in Computer Science and Engineering.

One important feature of the UNL facility is the sharing of resources. The system will be configured so that when there is little CMS activity on the CMS cluster, it will be available to other researchers around the university for their use. To complement this, RCF will make idle CPU cycles available to CMS when the particle-physics experiment needs them. This "opportunistic use" of idle CPU cycles will result in more computing power for researchers in all fields. In addition, the required network bandwidth of 2.5 gigabit/sec is much larger than what we currently have at UNL. The University of Nebraska has made a commitment to do the necessary upgrades, taking the university's total bandwidth to 10 gigabit/sec, which will also benefit researchers throughout the university.

In the past year, we have built a cluster that can serve as a prototype for the system needed in 2007. The new cluster has 256 processors, and takes advantage of a new "dual-core" technology that puts two processors in a single computer chip. It also

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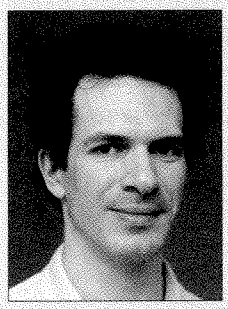
Belashchenko Joins Department

BY EVGENY TSYMBAL

In fulfillment of the goals of the Program of Excellence in Nanoscale Science and Technology, the Department successfully completed a search for a new faculty member in Condensed Matter Theory. **Kirill Belashchenko** joined the Department as a Tenure-Track Assistant Professor in Fall 2005. His research expertise lies in the areas of electronic structure theory, magnetism, spin-dependent transport, and alloy theory.



Belashchenko

Kirill Belashchenko was born and raised in Moscow, Russia, where he received his M.Sc. degree from the Moscow Institute of Steel and Alloys in 1996, and his Ph.D. degree in 1999 from the Kurchatov Institute, a Russian Research Center. His doctoral thesis work was devoted to the theory of phase transformation kinetics in alloys. He and his colleagues were awarded the prestigious Kurchatov Award for this research work.

After receiving his Ph.D., Belashchenko moved to the United States to work at Ames Laboratory as a Visiting Scientist. His research was focused on the development of a multiscale approach to the description of hysteretic phenomena in magnetic materials. He also contributed to the study of electronic properties of the MgB_2 superconductor, and to the development of novel many-body techniques for strongly correlated systems.

In 2002 he joined UNL as a Research Assistant Professor. He worked with Professor **Evgeny Tsymbal** on the theory of spin-dependent electronic transport in magnetic tunnel junctions. His research centered on the interplay between interface effects and tunneling conductance in magnetic tunnel junctions, such as $Co/Al_2O_3/Co$ and Fe/MgO/Fe, that are important for industrial applications.

Belashchenko's current research is in the area of electronic structure and transport in magnetic materials and nanostructures with particular emphasis on finite-temperature properties. His theoretical work complements the theoretical electronic structure and transport research of Evgeny Tsymbal, and overlaps with the experimental work of **Peter Dowben, Christian Binek** and **David Sellmyer.** ∞

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Snow on Fermilab's DZERO experiment, which will operate through 2008, and CERN's Compact Muon Solenoid (CMS) experiment, which will begin taking data in 2007. Ken and Aaron spent a very productive semester in Fall 2004 establishing their research programs and submitting several funding proposals. One such proposal, prepared jointly with David Swanson from UNL's Department of Computer Science and Engineering, has already paid off. UNL has been named a so-called Tier-2 Computing Center for CERN's CMS experiment. (For details, see the "Tier-2" article on page 3 of this issue of *Spectrum.*) In addition, each of their Career proposals were funded by the National Science Foundation. (For details, see "CAREER" article on page 11 of this issue of *Spectrum.*) Both are thus off to an excellent start of their academic careers. ∞

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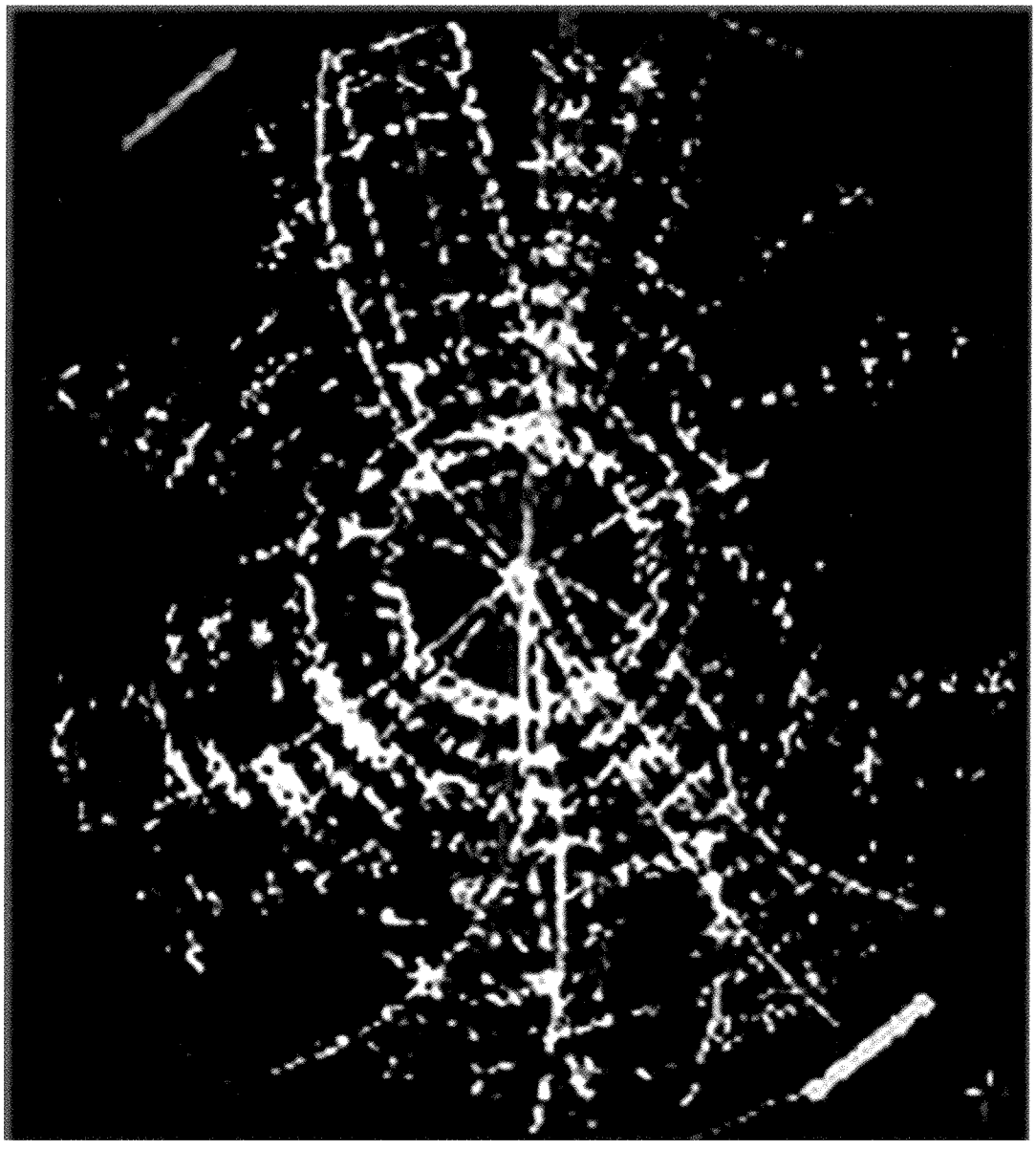
has 20 TB of disk, by far the largest disk pool available on campus. At this point, CMS activites have not dominated the system, so other research groups, especially that of Xiao Zheng in Chemistry, have put the processing power to good use. We have also hired two full-time staff members to operate the site and to expand it to its LHC-startup capacity. **Carl L. Lundstedt** (Ph.D. 2001), who earned his doctorate in particle physics at UNL and has served as a lecturer in the Department, is one of the staffers, along with Mako Furukawa, formerly of RCF.

> "One important feature of the UNL facility is the sharing of resources. The system will be configured so that when there is little CMS activity on the CMS cluster, it will be available to other researchers around the university for their use."

Already, UNL has taken a leadership role in the Tier-2 program at both the national and international level. Bloom was appointed as the project manager for the entire Tier-2 project in the US, with management responsibility for all seven sites. UNL has led the way on a number of technical fronts. During Fall 2005, the CMS experiment ran a three-month long worldwide test of its computing facilities. Over that time, UNL's Tier-2 site was one of the best performing sites. We successfully transferred 18 TB of simulated data from FNAL — more than any other Tier-2 site was able to do, despite the fact that others have much better network connectivity. We also successfully ran data-analysis jobs on these data, which were submitted from remote users. All of this bodes well for the future performance of the site, which needs to grow by more than a factor of four over the next year and a half.

By hosting this Tier-2 center, UNL and its researchers have positioned themselves to play a leading role in the development of large-scale computing and in the discovery of new physics that will set the research agenda in high-energy physics for decades to come. ∞



One of the top quark events discovered at Fermilab.

RESEARCH HIGHLIGHT

Top Quark Found to be Massive

BY TOM SIMONS/
UNIVERSITY COMMUNICATIONS

***Editor's Note**: The discovery of the top quark by a team including two members of the Department's experimental high energy physics group made Discovery magazine's list of the 100 top discoveries in science in 2004. We reprint below the article about the discovery from the 10 June 2004 issue of* Scarlet, *a weekly newsletter for UNL faculty and staff.*

One step closer in the search for the holy grail: That's how **Greg Snow** and **Dan Claes** describe their field, high-energy physics, with the publication this week of the surprisingly large mass of the top quark. Snow and Claes, both associate professors of physics and astronomy at UNL, have been part of the long-running *DZERO* experiment at Fermi National Accelerator Laboratory outside of Chicago that proved the existence of the top quark in 1995 and now has established its mass at about 178 billion electron volts, give or take 4.3 billion electron volts. Scientists use energy measurements to express the mass of subatomic particles because energy and mass are interchangeable in Albert Einstein's famous equation. In this case, mass equals energy divided by the square of the speed of light, $m = E/c^2$.

The result [was] published in the June 10, 2004 issue of *Nature,* the international weekly journal of science, and it's quite a surprise to physicists. Quarks come in six varieties and are the fundamental building blocks of matter - they're what make up the more familiar atomic particles such as protons and neutrons. The top quark has long been known to be the largest of the quarks, so large that it is unstable, which is why it was the last of the six to be observed. Still, it seemed logical that it would be smaller than a proton or a neutron. Not so, according to the Fermilab scientists. "A quark is supposed to be a fundamental particle," Claes said. "It's supposed to be essentially of no dimension, a point-like object, smaller than anything we can imagine—smaller than a proton, smaller than an electron. And yet the top quark is about 180 times heavier than a proton, it's enormously much more massive, which is a

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surprise. It's about as heavy as the nucleus of a gold atom."

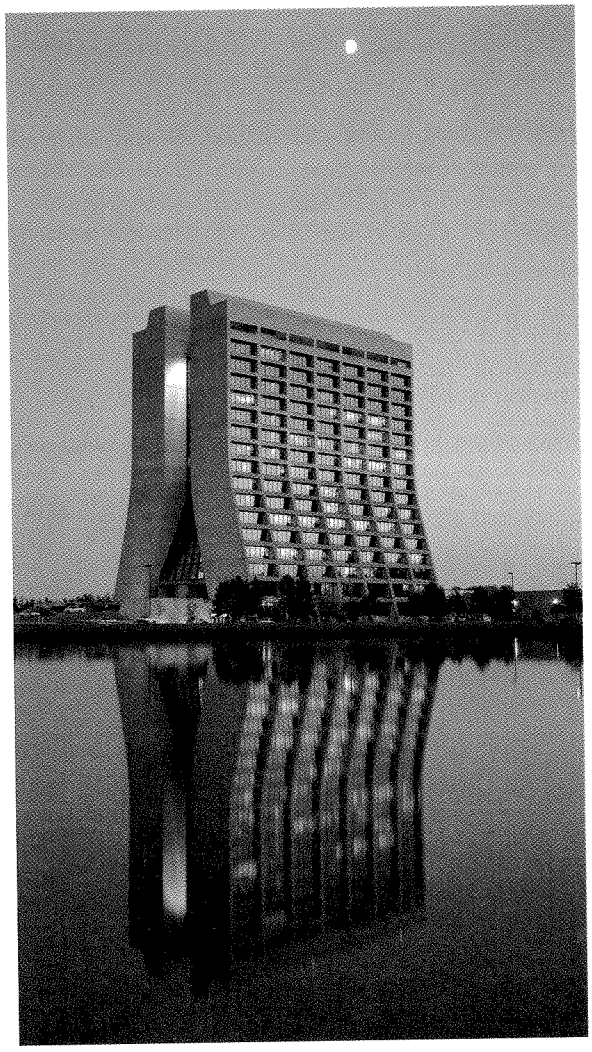
Snow said finding the mass of the top quark is important in itself, but the discovery's real significance is in narrowing the search for a particle called the Higgs boson. Finding the Higgs is necessary if physicists are to validate the Standard Model of particle physics, which describes the fundamental structure of matter. "The mass of the top quark is related to the next sort of holy grail in our field, which is looking for and hopefully discovering the Higgs boson," Snow said.

"How heavy the top quark is influences how heavy this Higgs boson needs to be in order for all the pieces of this Standard Model to hang together. The Higgs boson plays a very special and odd role in the Standard Model in that it's the entity which we think is responsible for the fact that all the different particles we observe have mass at all. The top quark is right around 180 billion electron volts, and this Higgs boson should be somewhere in the vicinity of 117. We've narrowed down the possible window in which the Higgs mass should exist and we know better how to look for it in the collisions that we see at Fermilab."

Snow said Fermilab experiments may discover the Higgs boson in the next few years, but if they don't, he said he's certain the Higgs will turn up sometime after 2007 in the next generation of high-energy experiments at the Large Hadron Collider [LHC], under construction near Geneva, Switzerland. He and Claes are also involved in the LHC. However, if the Higgs isn't found after all, Snow and Claes said, it may be back to the theoretical drawing board for high-energy physics, a development that could have rich rewards of its own. "The Standard Model is an elaborate mathematical construct," Claes said.

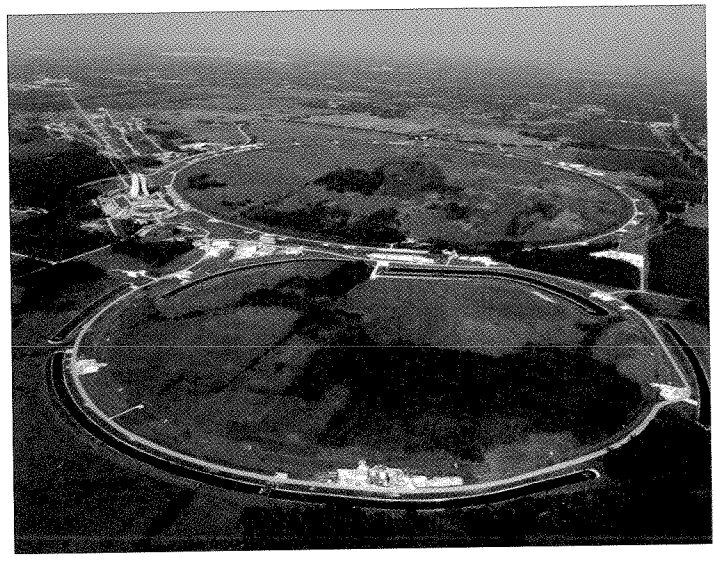
"Up until this point, it has been enormously self-consistent and very powerful in its predictive ability, but its validity hinges on the existence of this Higgs particle. If it's not found, then maybe high-energy physics is all the more interesting because that would be a bigger surprise than finding it."

The DZero experiment that discovered and measured the top quark is run by a team of scientists from nearly 40 U.S. universities and 40 foreign institutions on Fermilab's Tevatron. ∞



Fermi National Accelerator Laboratory (Fermilab) in Batavia, IL

> "The top quark has long been known to be the largest of the quarks, so large that it is unstable, which is why it was the last of the six to be observed. Still, it seemed logical that it would be smaller than a proton or a neutron. Not so, according to the Fermilab scientists."

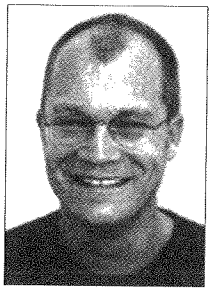


At six kilometers in circumference, Fermilab's Tevatron is the world's highest energy particle accelerator.

RESEARCH HIGHLIGHT

Femtosecond Optical Vortices, Whirling Bullets of Light

BY KEES UITERWAAL/
ATOMIC, MOLECULAR, OPTICS
AND PLASMA PHYSICS GROUP
February 2006



The first working prototype of a laser (the word is an acronym for light amplification by stimulated emission of radiation) was realized in 1960 by the American scientist Theodore Maiman. The laser was initially "described as 'a solution looking for a problem.' But before long the laser's distinctive qualities—its ability to generate an intense, very narrow beam of light of a single wavelength—were being harnessed for science, technology and medicine. Today, lasers are everywhere: from research laboratories at the cutting edge of quantum physics to medical clinics, supermarket checkouts and the telephone network." [1]

In our scientific research, we use ultrashort (~femtosecond, 10^{-15} s) and intense laser light pulses ("bullets of light") to break up atoms and molecules. In simple terms, we make our electromagnetic waves so strong that their electric field component pulls harder on the target particle's electrons than the particle pulls back, and ultimately one or more electrons are set free. The atoms or molecules then become positive ions, which we detect in our experiments. The process is called intense-field photoionization and sheds light not only on the structure of the target particles and on the interaction of matter with strong radiation, but also on the behavior of free electrons in a strong laser field. Under the right conditions, the laser light can speed up the freed electrons and drive them back to the positive ions to which they once were attached. This is called a recollision process and, depending specifically on the experimental conditions, more electrons may be kicked out of the ion, and/or a specific set of photons is produced. The latter process, called high harmonic generation (HHG), underlies all recent efforts to produce even shorter (attosecond, 10^{-18} s) radiation pulses. Such extremely short pulses are needed to follow the natural motion of electrons in atoms and molecules in real time.

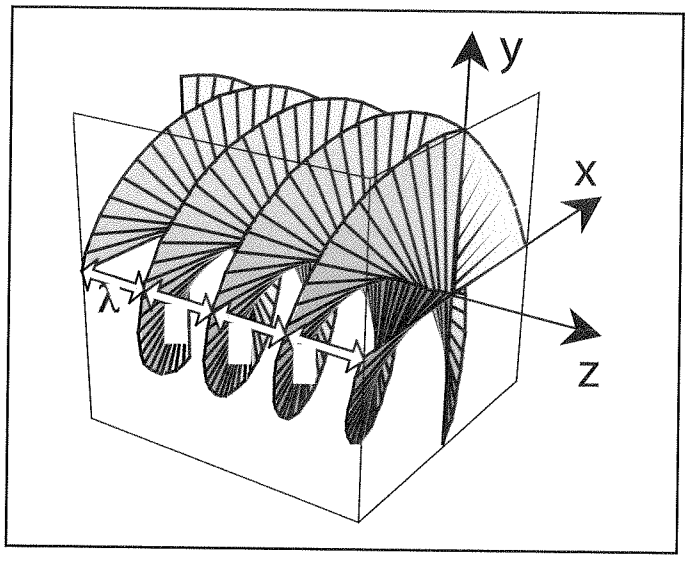


FIGURE 1: Example of a light mode with an optional vortex: wavefronts have the form of intertwined helicoids. Shown is the Laguerre-Gaussian mode with p=0 and ℓ=4 propagating in the z-direction (see e.g. [2]).

It is well-known that the polarization of radiation can be used to influence the recollision process. With circular polarization, electrons tend to "spiral away" from the ion, making recollision less likely than for linear polarization, which makes electrons collide head on with the ion. We are currently investigating if there are other ways to influence the recollision process. In particular, given the relevance of polarization, and knowing that this property is connected to the *spin* angular momentum of photons, we want to investigate if optical *orbital* angular momentum (OAM) could also affect intense-field ionization processes.

Photons possessing oam are found in optical vortex (OV) modes of light; these topics are now under widespread investigation after they were initially discussed by Allen in 1992 [2]. Some applications of OVs are the optical spanner [2], the microoptomechanical fluid pumps (based on arrays of OVs) [3], or the "cogwheel," a size-selective trapping tool of biological relevance [4]. Individual photons in an ov beam have a well-defined amount of optical OAM, which is important for quantum information [2]. A fascinating link with astronomy also exists: very recently, it was proposed to improve the search for exoplanets by using an ov mask to eliminate the light from the parent star [5].

Figure 1 shows a typical helicoidal wavefront of an OV, giving an undeniable feel of

OPTICAL VORTEX
continued on page 9

OPTICAL VORTEX
continued from page 8

whirliness. Last year, we were the first ones in the world to report [6] the experimental realization of pure optical vortices of femtosecond duration, or "whirling bullets of light." Our method is based on holographic techniques. We are now working on making our vortex pulses more intense, until we have reached a level where photoionization becomes possible. To this end, we have recently started employing a programmable phase modulator (PPM). With this device we can use a PC to program the wavefronts of our light pulses. Very recently we have successfully generated femtosecond OVs using our PPM, again being the first ones in the world to do so.

Today, 133 years have passed since Maxwell published his laws, and 106 years since Planck gave birth to quantum mechanics. Much has been learned since then about the structure of matter and its interaction with electromagnetic radiation. But much also still remains to be investigated. Using a computer to program optical vortices in pulsed laser light, we are investigating what role oam can play in intense field photoionization and its applications. ∞

REFERENCES

[1] Townes C H 2003 The first laser; in: *A Century of* Nature eds Garwin L and Lincoln T (University of Chicago Press)
[2] see Allen L *et al.* 2003 Optical angular momentum (Bristol: IoP)
[3] Ladavac K and Grier D 2004 *Opt. Expr.* **12** 1144
[4] Jesacher A *et al.* 2004 *Opt. Expr.* **12** 4129
[5] Foo G *et al.* 2005 *Opt. Lett.* **30** 3308
[6] Mariyenko I *et al.* 2005 *Opt. Expr.* **13** 7599

DIOCLES
continued from page 1

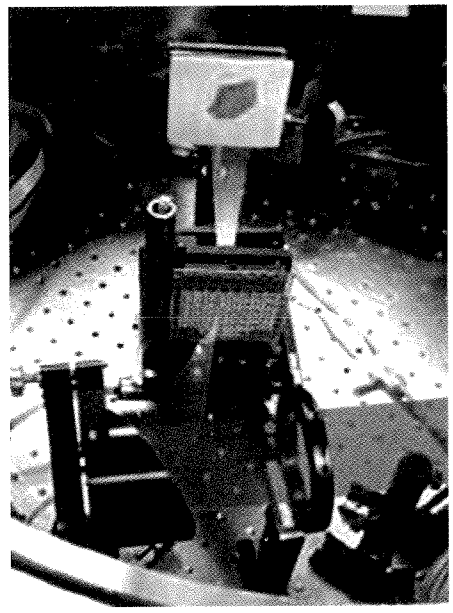
Umstadter and his research team team are pioneering a new research field ("high field science") involving the nonlinear optics of ultra-high intensity lasers interacting with plasmas, with applications to advanced radiation sources and particle accelerators. This research includes experiment, theory, and numerical simulation and involves both basic and applied research.

The group was the first to show experimentally how electrons behave when intense light fields accelerate them to relativistic velocities. Their results on relativistic Thomson scattering have led to the development of a novel compact, short-wavelength coherent light source. They hold a patent on a method to generate ultrashort pulse-duration x-rays. They made the first demonstration and characterization of the transverse geometrical emittance of an electron beam accelerated by a relativistically self-guided laser wakefield. Most recently, they demonstrated laser acceleration of a naturally collimated beam of MeV ions, with a million times higher acceleration gradient than Jorgensen's Cockroft-Walton accelerator.

Now that the new Diocles laser is up and running, further novel results are expected. Diocles produces light pulses of only 30 femtoseconds duration, each packing 3 Joules of energy and 100 Terawatts of peak power. With its 10-Hertz repetition rate, it has the highest combination of peak and average powers of any such laser system in the U.S.A. Renovating the laboratory to the exacting requirements of the new laser was a lengthy and complex process. First, a second entrance to the underground lab had to be constructed to meet current fire safety codes. Then the lab had to be designed to maintain constant ambient temperature, humidity (to within +/- 2%), and cleanliness (< Class 10,000). The floor that supports the laser had to be vibration-isolated from its surroundings. Finally, the target room had to be shielded to protect researchers from the x-rays and fast charged particles that will be produced.

The first experiments using the new laser are currently underway. The group receives well over $1M/year in funding from DOE, NSF, and DOD. For further information, see the Umstadter group web page: **http://www.unl.edu/diocles/umstadter.shtml** ∞

(ABOVE):The Diocles Laser research team (comprising faculty, staff, postdoctoral research associates, and both graduate and undergraduate students) in front of the entrance to their new Facility.



(RIGHT): Umstadter group's laser-particle accelerator.

DAMOP 2005 Held In Lincoln

BY TIMOTHY GAY & ANTHONY STARACE

The atomic, molecular, optical, and plasma physics group in the Department hosted the 2005 annual meeting of the American Physical Society's Division of Atomic, Molecular, and Optical Physics (DAMOP). Professors **Timothy Gay** and **Anthony Starace** served as the co-chairs of the local committee.

The meeting, which was held during 17–21 May at the Burham Yates Conference Center at the Cornhusker Hotel in downtown Lincoln, proved to be a stimulating and enjoyable meeting for the 724 conference attendees. The meeting comprised 78 invited talks and 560 oral and poster contributions. Of the 724 conference registrants, 316 were students, including 307 graduate students and 9 undergraduate students. Conferees came from all over the U.S.A., with the largest contingents from Colorado (72), Massachusetts (48), California (45), Texas (36), and Kansas (34). Significant numbers also came from abroad, including from Canada (26), Korea (12), Austria (6), Germany (6), and the U.K. (5).

It should be noted that this was actually the second DAMOP meeting hosted in Lincoln, the first being held in the first week of December, 1976. Since the average daily wind-chill temperature for that first meeting was approximately -40 degrees (Fahrenheit, Celsius—you pick), the balmy May weather the second time around was a decided improvement.

In addition to the stimulating new physics presented in the regular conference program, conferees benefited from a number of additional events associated with the meeting. Prior to the conference opening, there were two very well-attended tutorial workshops.

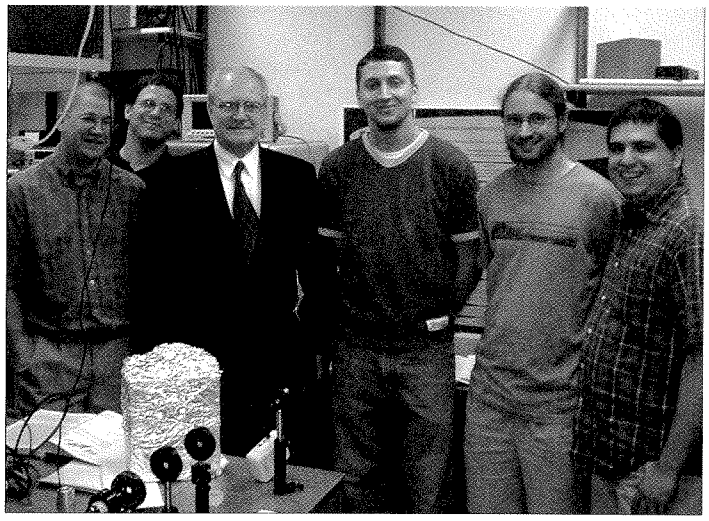
One, organized by Professors **Herman Batelaan** and **Cornelis (Kees) Uiterwaal,** was on "Modern Laser Technology." It included presentations by Henry Kapteyn of JILA and Ronald Walsworth of the Harvard-Smithsonian Center for Astrophysics. All participants received software developed by Batelaan and Uiterwaal that illustrated aspects of new laser technologies.

The second, organized by Robert C. Hilborn of Amherst College, was on "New Pedagogy in Introductory Physics and Upper-Level AMO Courses." It included presentations by Carl Wieman of JILA, Enrique Galvez of Colgate University, David Pritchard of MIT, and Steve Reaser of North Carolina State University).

The conference opened with a plenary prize session honoring recipients of American Physical Society prizes. During the conference, there were two Town Meetings to discuss the National Research Council's decadal studies of Low Temperature Plasmas and of AMO Science.

At the Friday evening banquet, John H. Marburger III, Science Advisor to the President and Director of the Office of Science and Technology Policy presented a talk on "Science, the Changing Frontier" during which he noted that AMO science is well-placed for priority in Federal funding. Earlier that day, Marburger was given a private tour of the site of the new 100 terawatt laser facility as well as other AMO experimental labs in the Department. On Saturday morning there was a Public Symposium for the World Year of Physics 2005 that included four talks by noted historians on Einstein and his work.

Finally, no one who attended will soon forget the outstanding one-woman dramatic performance by Susan Marie Frontczak on Wednesday evening in which she portrayed Marie Curie in *Manya, A Living History of Marie Curie.*



(Top) Presidential Science Advisor Jack Marburger visiting with UNL grad students (left to right) **Glen Gronniger, Steve Friedman, Adam Caprez, Brett Barwick,** and **Shawn Hilbert.**

(Bottom) UNL graduate student **Joshua R. Machacek** and alum **Kenneth W. McLaughlin** (M.S. 1991, Ph.D. 1995) visiting at the DAMOP opening night reception.

The conference ran very smoothly, due primarily to the outstanding efforts of the Conference Coordinator, **Marilyn McDowell,** and the shrewd machinations of the A/V Czar, **Orhan Yenen.** The assistance of **Beth Farleigh** and **Jenny Becic,** as well as that of undergraduates **Josh Machacek** and **Nick Loomis** was invaluable.

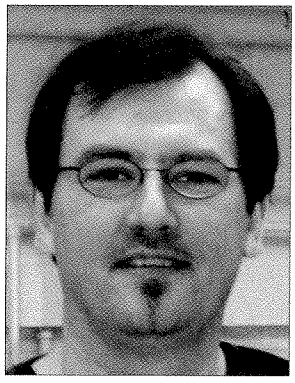
A large number of photos from the conference may be viewed on the conference web page: **http://damop2005.unl.edu.** ∞

Binek, Bloom, Dominguez Win National Science Foundation CAREER Awards

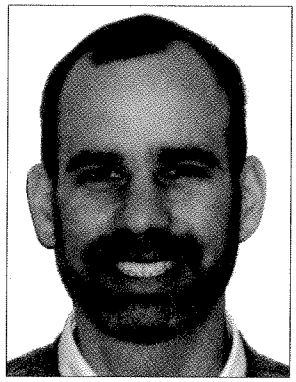
All three assistant professors in the Department who applied for National Science Foundation (NSF) CAREER awards in 2005 were successful in receiving them. **Christian Binek, Kenneth Bloom,** and **Aaron Dominguez** were each awarded $500,000 or more for five years. The Faculty Early Career Development (CAREER) Program is the National Science Foundation's most prestigious award in support of the early career-development activities of those teacher-scholars who most effectively integrate research and education. Such NSF support is intended to build a firm foundation for a lifetime of integrated faculty contributions to research and education.

Binek is an experimental condensed matter physicist whose research is in the field of nanoscale spintronic systems, with a primary focus on magnetic heterostructures. A main goal of spintronics is to create devices in which information can be encoded in the spin states of electrons. The education component of Binek's award is aimed at creating an innovative Web-based resource for students and the public providing information on current physics research. While using the Web to present science is not a new idea, Binek's system would permit students and others to direct questions at any time to an instructor represented by a human-like virtual character. Such "face-to-face" interaction would simulate the one-on-one interaction between student and teacher that is generally acknowledged to be the most effective way to learn. By use of computers, known physical principles can be demonstrated through animations rather than just in words or pictures.

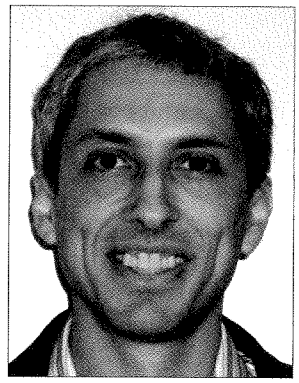
Bloom is an experimental high energy physicist whose research is centered on proton-antiproton collisions at Fermilab and, in the future, on experiments employing the Compact Muon Solenoid (CMS) at the Large Hadron Collider (LHC) at the European Center for Nuclear Research (CERN) near Geneva, Switzerland. Blooms's focus is on experiments that measure the properties of the top quark, the heaviest known elementary particle. (As noted elsewhere in this issue of *Spectrum*, he is currently the project manager for the CMS Tier-2 computing effort in the U.S. aimed at analyzing the data obtained in experiments at the LHC; he is overseeing the development of computing clusters at seven institutions, including UNL.) The education component of Bloom's award is aimed at introducing physics to students in rural areas of Nebraska by means of demonstrations that he carries out in the students' schools. He has already visited schools in central and north central Nebraska.



Christian Binek



Ken Bloom

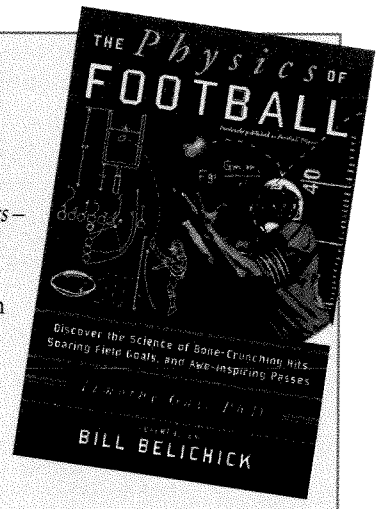


Aaron Dominguez

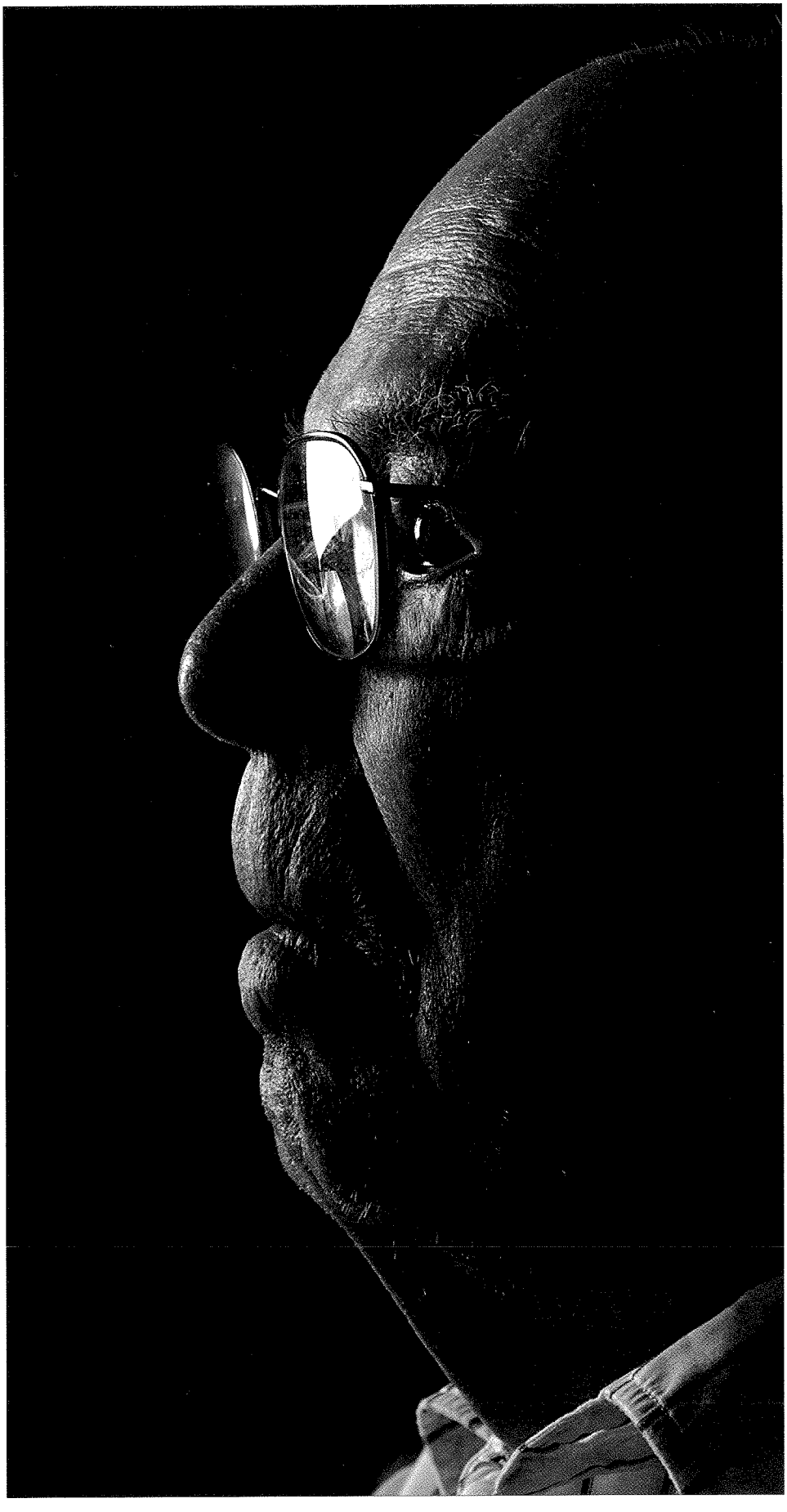
Dominguez is also an experimental high energy physicist whose research is focused on searches for an elementary particle known as the Higgs boson, which, according to high energy theorists, is thought to be responsible for giving mass to all matter in the universe. The Higgs boson is likely to be highly unstable and would decay into other particles. Dominguez is building a component of the CMS detector that is designed to detect these secondary particles. The education component of Dominguez's grant is focused on increasing the number of Hispanic students who embark on careers in physics. Dominguez will bring Latino students to the University and mentor them. Dominguez is familiar with the difficulties such students face and is determined to help them surmount those difficulties.

While these are not the first CAREER awards in the Department (e.g., in the late 1990s Professor **Diandra Leslie-Pelecky** won a CAREER award for her research on cluster-assembled magnetic nanostructures), this is the first time that three such awards were granted in one year. ∞

Football Physics Becomes *The Physics of Football*



Professor **Tim Gay**'s recent popular book, *Football Physics – The Science of the Game*, published in 2004 by Rodale, was picked in 2005 by Harper Collins, and published in a second edition as *The Physics of Football*. The name change was driven in large part by marketing considerations; the new version will be advertised in tandem with Bob Adair's classic of sports science: *The Physics of Baseball*. Although Gay was fired from the Husker Vision lineup as part of a recent general house cleaning in the UNL athletic department that also saw the departure of head football coach Frank Solich, he has kept busy giving talks on the subject for universities, government labs, civic groups etc. He was featured on the front page of the *New York Times* science section *Science Times* on Tuesday, November 16, 2004, and the following year appeared on ESPN's nationally-televised *Cold Pizza*. He continues to root for the Huskers. ∞



IN THE SPOTLIGHT

Jorgensen: Eyewitness to History

BY DON WALTON
LINCOLN JOURNAL STAR
6 AUGUST 2005

Editor's Note: Ted Jorgensen turned 100 on November 13th, 2005. In anticipation of this anniversary as well as to obtain Jorgensen's recollections of the Manhattan project, Don Walton of the Lincoln Journal Star wrote a feature article on an interview he had with Ted that was published on August 6th, 2005. As Jorgensen had such a significant role in the development of the Department and as he was known and loved by so many students, we reprint Walton's article here. We note in addition that Jorgensen was given a birthday party on the big day that he turned one hundred; many department faculty and friends attended. He died on April 2nd, 2006. An obituary, a tribute, and a report on his memorial service appear elsewhere in this issue of Spectrum.

Theodore Jorgensen, a former professor at UNL, was there for the test of the first nuclear bomb in July 1945 in New Mexico. Crouched in a bunker peering through dark shades, Theodore Jorgensen was there at the beginning. As the first nuclear bomb test rocked the New Mexico desert near Alamogordo, he watched the brilliant flash and cascading explosion that altered the course of history. It marked the birth of the atomic age. "We knew we were on the edge of a new world," Jorgensen recalled this week. "We knew what would happen next, but we didn't know when." A death warrant with more than 200,000 names on it was written that day. "We realized a lot of people were going to get killed, and I think everyone regretted that," Jorgensen said. "But we essentially knew the war was over that day." Twenty-one days later - 60 years ago today - the bomb fell on Hiroshima, decimating and frying a city of more than 200,000. About the size of Lincoln. Nagasaki was incinerated three days later. Japan surrendered within a week, bringing an end to World War II.

Jorgensen, who is four months away from his 100th birthday, was a Nebraska physicist with the super-secret Manhattan Project that developed the bomb. His first task was to craft a way to measure the size of the explosion that would take place, an important challenge because man had never played with fire on this scale. "Some people thought the universe would blow up," Jorgensen said. "Cooler heads knew pretty well what was going to happen." And yet, as the explosion erupted that July morning, Jorgensen said, "nobody knew." His measurement "turned out to be fairly precise," he said. A day after the blast flashed across the sky, Jorgensen said he probably became the first man in history to observe and measure the radioactive fallout from a nuclear explosion. "I led a group of two to the site," he said with a laugh. All in all, "I didn't make any great contributions" to the project, he said in summation. And, although he remembers much of what happened, "some of it is kind of hazy now."

Jorgensen, who said he gained a leave of absence from the University of Nebraska to join the Manhattan Project at the University of Chicago before moving to Los Alamos, is remarkably quick-witted at age 99, although his mobility has declined. He lives in an assisted-living apartment at Gramercy Hill, where he moved not long after a fall. "I rolled out of bed one night and went kerplunk on the floor. I picked myself up and had a good sleep, but I was limping the next day. "The doctors decided something must be wrong with me, not with the bed," Jorgensen said. He uses a walker now. "The process of getting old has its difficulties," he said, shrugging.

Jorgensen retains a vivid memory of "the terrific intensity of light" that morning on the desert. He recalls the red cloud moving to the north and east. But he doesn't remember hearing any sound. "It may have been the intensity of the experience. My eyes worked; my ears didn't." Jorgensen remained at Los Alamos after the test "doing atomic measurements called cross-sections," unlocking new knowledge about nuclear properties. Sixty years later, he feels no regrets. "We did what we set out to do. I was just doing my job. It was war. You got used to it after awhile." What happened 60 years ago today may have "spared other people from being killed," Jorgensen said. If a full-scale U.S. invasion of Japan would have been required to end the war, he said, it would have resulted in massive casualties on both sides. "A relatively large number of people have come up to me in past years to say they appreciate the fact that they are alive today because of what we did."

Jorgensen never went to Hiroshima or Nagasaki in the aftermath or since those two cities have been rebuilt. When he was done at Los Alamos, he came home, back to the university he entered as a freshman in 1923. Jorgensen taught math before becoming a fixture in the physics department. Following his retirement in about 1975, he said, he returned to the faculty for a few more years at the university's request, using his leverage to teach physics in a more user-friendly fashion that delighted students. "It's exciting to talk about," Jorgensen said as he leaned back in his easy chair, recalling those days of teaching and learning.

Actually, they haven't stopped. Jorgensen has studied the science of nutrition and is eager to share the value of ascorbic acid and reduction of sugar intake in cutting high cholesterol levels. He has used his body as an experiment and found it works. A box of Fiber One bran cereal sits on his kitchen counter and a well-worn copy of "Vitamin C, Infectious Diseases and Toxins" rests on the table. Jorgensen briefly explains logarithms to his guest and extols the value of learning by doing, a gift he received from his mother. Ask him where he grew up and he pauses before answering: "Under my mother's wing." And in Sorum, S.D. It's gone now, he said. As a physicist with his own ideas about quantum mechanics and the theory of relativity, Jorgensen regrets he could not have had a conversation with Einstein before the great man died.

Jorgensen has penned 50,000 words of an autobiography. "It's stuck away in here somewhere, I hope." He's also written a book about the tardiness of human beings in making progress and resolving problems. It's titled: "Why Does it Take so Long?" But his successful literary venture is "The Physics of Golf." Published in English and Japanese, it analyzes the golf swing and describes the skill required in terms of fundamental physics. Recently, a man telephoned from Illinois to say his 12-year-old son had studied the book and now is hitting the ball 250 yards. They want to come to Lincoln to talk with him. He said sure. Jorgensen used to play golf himself. But not very well, he said. So what did he shoot? "Whatever number of strokes were necessary to get the ball in the hole," he said after the requisite pause. "In the end, I will be remembered as the man who wrote the book on the physics of golf," Jorgensen said. "Everyone will have forgotten all the other stuff." ∞

"Jorgensen, who is four months away from his 100th birthday, was a Nebraska physicist with the super-secret Manhattan Project that developed the bomb. His first task was to craft a way to measure the size of the explosion that would take place, an important challenge because man had never played with fire on this scale. "Some people thought the universe would blow up," Jorgensen said."

Teachers and students work on cosmic ray detectors by Ferguson Hall on the UNL campus.

IN THE SPOTLIGHT

UNL Lawn Sprouts Cosmic Ray Detectors

BY ALGIS J. LAUKAITIS,
LINCOLN JOURNAL STAR

Editor's Note: *CROP is a statewide outreach project directed by Professors* **Dan Claes** *and* **Greg Snow** *and funded by the National Science Foundation. Its goal is to involve Nebraska high school students, teachers, and college undergraduates in a multi-faceted, hands-on research effort to study extended cosmic-ray air showers. Using simple particle detectors placed in numerous locations, for example on the rooftops of high schools around the state of Nebraska, measurements of the original cosmic ray energy and incident direction can be made. In summers, CROP holds workshops for the various high school student groups and their teachers on the UNL campus. A.J. Laukaitis wrote a feature story on the 2005 workshop that appeared on Friday, 22 July 2005, in the* Lincoln Journal Star. *We reprint his article here.*

2005 CROP Summer Workshop Participants

Cosmic rays bombarded the University of Nebraska-Lincoln city campus Thursday afternoon. Sounds serious. No need to worry, though. It happens all the time. Cosmic rays are everywhere. They come from outer space, pass through our atmosphere where they collide with molecules, and rain down millions of highly charged particles on the Earth's surface every second. Scientists call them cosmic ray air showers, and some of them cover 50 square miles or about an area as large as a city.

The 65 students and teachers enrolled in the Cosmic Ray Observatory Project, commonly referred to as CROP, know that and much more. They've been studying cosmic rays and, more importantly, how to build devices to detect them during a weeklong workshop at the University of Nebraska-Lincoln. Thursday afternoon, they set out about 50 new and refurbished cosmic ray detectors and global positioning system receivers on the lawn between Ferguson and Woods halls. They then strung long cables through the first-floor windows and hooked them up to personal computers inside the Department of Physics and Astronomy. Each detector is made up of 2-by-2-foot panels of special plastic. Students then polish them and test a photomultiplier tube, a light-sensitive instrument that can detect the flash given off by a cosmic ray particle as it passes through the detector. Students then assemble the detectors and make sure they work. They also learn how to collect the data.

Their efforts were part of an overnight experiment to detect cosmic ray air showers. Later today they will disassemble the detectors, which look like giant squares of chocolate, and analyze the data they collected. For many of the students, it was their first chance to do scientific research. Sabrena Clinebell, who teaches science at McPherson County High School in western Nebraska, brought three of her students with her for that reason. She said it is difficult to incorporate scientific research into the curriculum when you are trying to teach the basics.

"I had no idea of what it was all about," said Whitney Trumbull, one of Clinebell's students. "It's really been an eye-opener for me."

Greg Snow, co-director of CROP and fellow UNL physicist **Dan Claes,** started the workshop five years ago with a $1.3 million grant from the National Science Foundation. Their goal was to bring a group of Nebraska high school students and their teachers each summer to Lincoln to take part in a hands-on research effort to study cosmic ray air showers. Twenty-six Nebraska high schools have sent students and teachers to participate in CROP. They then take their knowledge and the detectors back to their communities, where the detectors are set up on high school rooftops.

Many of the detectors are in the Lincoln and Omaha area but they are also in places like Scottsbluff, Norfolk, Springview, Merna, Osceola and Fairbury. All together they make up a sprawling network of cosmic ray air shower detectors. Other high schools across the country have similar projects, but Nebraska's is unique because it was one of the first to involve high school students, Snow said. He said now there are about 100 high schools nationwide engaged in similar cosmic ray research.

> "To have more than 40 kids in summer learning physics — what could be better than that?"

The CROP workshop has attracted the attention of Pablo Bauleo, a researcher with the Pierre Auger Observatory in Argentina. The observatory is building a cosmic ray network in Argentina and Colorado. Each site will have 1,600 detectors and cover an area the size of Rhode Island. Bauleo said he was impressed with UNL's workshop and plans to use it as a model for a small start-up system in southeast Colorado.

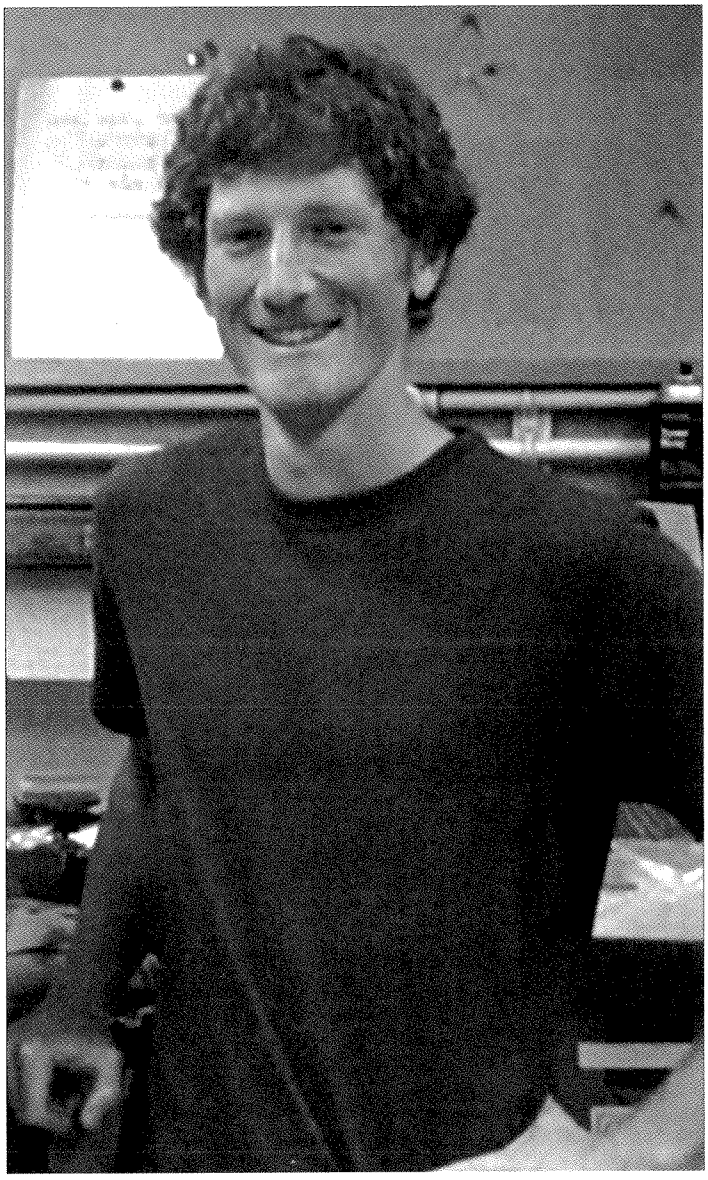
"I think it's really, really good," he said. "To have more than 40 kids in summer learning physics — what could be better than that?" ∞

Major Profile: Adam Scheer

Editor's Note: *On occasion, friends, colleagues elsewhere, and administrators ask us, "What are your physics majors like?" In this issue of* Spectrum, *we profile one of our recent graduates, describing his interests, the road to his physics degree, and his future plans.*

Adam Scheer came to UNL in 2000 after graduating from Waverly High school, just outside Lincoln. Intending originally to be a chemical engineer, he found the fundamental sciences more interesting and became a physics and chemistry major. During the summers following both his freshman and sophomore years, Adam held internships as a chemist in the analytical development department of Novartis Consumer Health in Lincoln. His experiences in chemistry gave him an excellent background for studying the physics of bio-molecules.

In his junior year he began to do research in the group of Professor **Paul D. Burrow.** In short order, he mastered the operation of the electron beam apparatus, and together with summer faculty associate **Kayvan Aflatooni** (B.S.1988, M.S. 1992, Ph. D. 1998; currently Associate Professor of Physics at Fort Hays State University), acquired data on the RNA base uracil and several halogenated uracils. This data demonstrated sharp structures in the total electron scattering cross sections, which were attributed to vibrationally excited levels of negative ion states created by the binding of an electron in the electric dipole field of the molecules. Furthermore, this work explained structure appearing in the cross sections for bond breaking in the DNA bases found by others but not assigned. This research led to Adam's first paper, which was published in *Physical Review Letters.*[1] It



Adam Scheer

was followed by two additional papers further exploring electron/uracil interactions, including measurement of the first absolute cross section for bond breaking by electron attachment. During this time he also received extensive tutoring in quantum chemical programs for computation of the electronic structure of molecules from Professor Emeritus **Gordon Gallup.**

In addition to being a 1-handicap golfer, playing soccer on the UNL men's club team and a more recent enthusiasm for rock-climbing, Adam found time to serve as an opinion columnist for the *Daily Nebraskan* (DN), the undergraduate student-run newspaper, winning the DN Publications Board award for the best editorial in Spring 2005.

Following his graduation in 2005, with a B.S. in physics, a B.A. in chemistry and minors in math and English, Adam entered graduate school here, earning an Master's degree in physics in Spring 2006. In Fall 2006 he entered the Ph.D. program at the University of Colorado–Boulder.

In response to a series of questions, Adam writes:

1. **Favorite album:** *Neon Ballroom by Silverchair*
2. **Favorite Lincoln restaurant:** *The Thai Garden*
3. **Latest novel read:** Steppenwolf *by Herman Hess*
4. **Best experiences at UNL:** *Having the opportunity as an undergraduate to work closely with Drs. Paul Burrow, Gordon Gallup, and Kayvan Aflatooni to do exciting and meaningful research; traveling all over the Midwest to play competitive soccer as a member of the UNL men's club team; writing editorials for the DN; climbing anywhere I could....*
5. **Best advice to undergraduates:** *Classes are important but are not everything. Find a professor who does research of interest to you and don't leave her or him alone until you are on board. Also, find something outside of academics and make time for it. In short, work hard but have a good time.*
6. **Current thoughts on future plans:** *Soon I will move on to a Ph.D. program in chemical or biological physics at UC-Boulder. Ten years from now I hope I'm on top of a huge cliff that I just climbed with my miniature Doberman named Sweep hanging out in my backpack barking frantically at the wind.* ∞

...

[1] A.M. Scheer, K. Aflatooni, G.A. Gallup, and P.D. Burrow, "Bond Breaking and Temporary Anion States in Uracil and Halouracils: Implications for the DNA Bases," Phys. Rev. Lett. **92**, *068102 (2004).*

RETIREMENTS

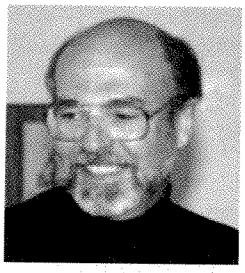
PAUL D. BURROW

BY
ILYA I. FABRIKANT

Professor **Paul D. Burrow** officially retired in Summer 2004, but he remains active in research and in undergraduate student supervision. Burrow received his B.S. degree from MIT and Ph.D. from the University of California, Berkeley. He came to UNL in 1976, after spending nine years at Yale University, where he collaborated with such outstanding scientists as George Schulz and Leon Sanche. In 1980 he won a Nebraska Legislature Award for Distinguished Teaching, and in 1987 he was named a Fellow of the American Physical Society.

Burrow's work at Yale stimulated his career-long interest in electron collision processes involving formation of temporary negative ions. At present, he is especially focusing on dissociative electron attachment processes whereby the formation of the temporary negative ion leads to the dissociation of the molecule into fragments, while the electron remains with one of them. This is a process important for astrophysics, atmospheric science, environmental applications and for radiation damage to biological molecules.

Burrow was the first to notice correlations between dechlorination rate constants and the energetics of electron attachment to chlorinated compounds. This led to his making connections with environmental remediation researchers on the East Campus at UNL. More recently he has become actively involved in the exciting new field of electron interactions with biologically-relevant molecules. This research is being accomplished together with his former student **Kayvan Aflatooni** (B.S. 1988, M.S. 1992, Ph.D. 1998), who is now an associate professor at Fort Hays State University, KS, undergraduate and master's degree student **Adam Scheer** (B.S. 2005, M.S. 2006), and his long-term collaborator **Gordon Gallup,** Professor Emeritus of Chemistry and Physics. His long-standing collaboration with Gallup at UNL continues to be particularly stimulating and fruitful for both of them. Many interesting new physics problems were unraveled as a result of their combined experimental and theoretical expertise.



Paul D. Burrow

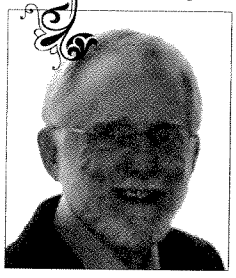
Paul's interests are very diverse and are not limited to physics. In particular, he has always been interested in music and early musical instruments. He plays medieval and renaissance music with the ensemble, *Lincoln Early Music Consort.* He is really an example of the modern Renaissance man, and students learn not only physics from him, but also relations between physics and music.

Apparently Burrow does not have plans for any immediate "real" retirement. As mentioned, he remains very active in his field, and he recently presented a very exciting invited talk about his current research at the May 2005 DAMOP conference in Lincoln. ∞

WILLIAM B. CAMPBELL

BY
ANTHONY F. STARACE

Professor **William B. Campbell** retired in 2004 after a career of 39 years at Nebraska during which he served as President of the Faculty Senate (1979) and as Department Vice Chair (1989-1995 and 1999-2001). In the early-1980s he served for four years on the College of Arts and Sciences Executive Committee. In the mid-1980s Campbell led the Department effort to become involved with the Superconducting Super Collider (SSC) by supporting Colorado's bid to land the SSC. When Texas was awarded the SSC, Campbell served for five years on the Steering Committee of the Rocky Mountain Consortium for High Energy Physics, which won a bid to work on one of the detectors to be built at the SSC. The Texas National Research Laboratory Commission awarded a grant to the Consortium to partially fund the salaries of newly hired experimentalists who would do their research at the SSC. Federal cancellation of the SSC in 1993 led to cancellation of this grant and to several years' delay in increasing the size of the Department's group. Nevertheless, the efforts and persistence of Bill Campbell over many years planted the seeds from which our current active group in experimental high energy physics grew.



William B. Campbell

Campbell received his B.A. degree in 1959 from Rice University and his Ph.D. in 1965 from the University of Colorado at Boulder. While a graduate student, he spent a year in Frascati, Italy at the Italian National Laboratory. He joined the University of Nebraska in 1965. In the 1970s Campbell collaborated with Professor **Thomas A. Morgan** on theoretical studies of gravitational radiation. Simultaneously he collaborated with Professors **Paul Finkler** and **C. Edward Jones** on the path integral formulation of scattering theory. In the 1980s his research interests turned to studies of Yang-Mills fields, collaborating on occasion with Professors **David W. Joseph** and Tom Morgan. In the mid-1990s his interests focused on super symmetry tests planned for the Large Hadron Collider (LHC) at CERN.

Campbell had three Faculty Development Leaves from the Department. In Fall 1975 he spent a semester at Cal Tech visiting the group of Kip Thorne. In the Fall 1985 he helped organize and run a workshop on relativistic electrons in atoms at the Aspen Center for Physics and he served as a consultant at Los Alamos National Laboratory. In Spring 1996 he participated in several workshops on the physics at the LHC, including those at CERN, at Fermilab, and at Snowmass.

Campbell was awarded a College of Arts and Sciences Distinguished Teaching Award in 1987. Campbell often taught the calculus-based introductory physics courses for engineering and physical science students, and he did this exceedingly well. He also taught a popular graduate level introductory course in General Relativity at least five times. ∞

RETIREMENTS

ROBERT G. FULLER

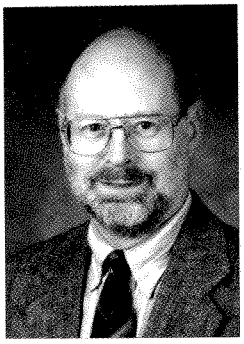
BY ROGER KIRBY

Robert G. Fuller fully retired prior to the 2004/2005 academic year after 35 years of service to the University of Nebraska. He received a B.S. degree in physics from the University of Missouri-Rolla in 1957 and a Ph.D. degree from the University of Illinois in 1965. Between his degrees, Bob was a high school teacher in Rangoon, Burma for three years. He spent four years as a scientist at the Naval Research Laboratory prior to joining the University of Nebraska as an Associate Professor in 1969. His research during these years was on defects and transport properties in alkali halides.

During his early years at Nebraska, Bob realized that there was a coming revolution in how science instruction is delivered, based on the increasing knowledge about how people learn, and he rapidly became engaged in many aspects of improving instruction. The first large lecture physics course Bob taught at UNL was the algebra-based course for life science students. That experience lead him to a career long interest in the human applications of physics. In 1978 a textbook he wrote together with his father and older brother, *Physics Including Human Applications* (informally known as *Fuller Cubed*), which was published by Harper and Row. Interestingly, his last externally funded project in 2004 was entitled "The Humanized Physics Project" and its materials are available at **www.doane.edu/hpp/.** Among his early efforts, Bob initiated individualized, mastery-based instruction (the so-called "Keller Plan") in some of our introductory courses. Several faculty members, including Paul Byerly, David Joseph, Paul Finkler and Donal Burns, contributed significantly to this effort.

At about the same time, Bob realized that technology, including the use of computers, could be effective in helping students learn, and could help them gain the repetitions and practice needed for problem solving. During the next 30 years, Bob's efforts to improve science education through implementation of results learned from cognitive science and the development of technology-based learning tools resulted in more than $6.4 M in grant funding from many different agencies including the National Science Foundation, the Department of Education, NASA, Exxon, and HHMI. Bob's interests in science education were diverse and multifaceted.

In the mid-1970s, he immersed himself in the ideas of Jean Piaget, the so-called "Galileo of cognitive science." Piaget illuminated the processes and steps by which students develop from "concrete" thinkers to "abstract" thinkers, a necessary transition if one is to understand science. Research at the time showed that students had wildly varying views of the universe and its behavior, and most of them had significant and strongly held misconceptions that had to be addressed.



Robert G. Fuller

To move these ideas into the curriculum, Bob collaborated with cognitive science experts, including John Renner (University of Oklahoma) and Robert Karplus (University of California-Berkeley), in order to implement Piagetian ideas in science courses. This led to the development of the ADAPT (Accent on Developing Abstract Processes of Thought) program at UNL. ADAPT was a unique program offered to all incoming freshmen for more than 20 years, with Bob as its Director. Students in the ADAPT program showed remarkable growth in their ability to use formal reasoning processes to address scientific problems.

Bob was among the first to realize that new technologies could be of great benefit to both physics students and physics teachers. He and his large staff (at times numbering more than 20) developed interactive videodisk lessons, computer programs for individual learning, a CD-ROM Toolkit for physics teachers that was nationally marketed, and numerous other projects. His Research in Physics Education Group (RPEG) attracted national attention and much funding. Information about the work of the group is available at **http://physics.unl.edu/ rpeg/rpeg.html**

During his tenure at the University of Nebraska, Fuller spent semester or year-long leaves at the VA Hospital in Syracuse, NY, at University of California-Berkeley (twice), the U.S. Air Force Academy (twice), and the U.S. Military Academy. He played many roles in the American Association of Physics Teachers, including serving as its President in 1980. Bob was honored with the AAPT's Robert A. Millikan Medal for Outstanding Contributions to the Teaching of Physics in 1992, the AAPT's highest honor. He was honored with UNL's Outstanding Teaching and Instructional Creativity Award in 1993, and he was among the first group of faculty admitted to UNL's Academy of Distinguished Teachers in 1995.

As you may have noted in previous *Spectrum* newsletters, our Department and many others have been developing interactive-engagement techniques for classroom instruction. Bob's research and instructional development efforts were indeed the forerunners of this revolution for years. He encouraged the Department to recognize that such instructional techniques were essential to the improvement of student learning, but few of us listened. Certainly, he must be considered a visionary.

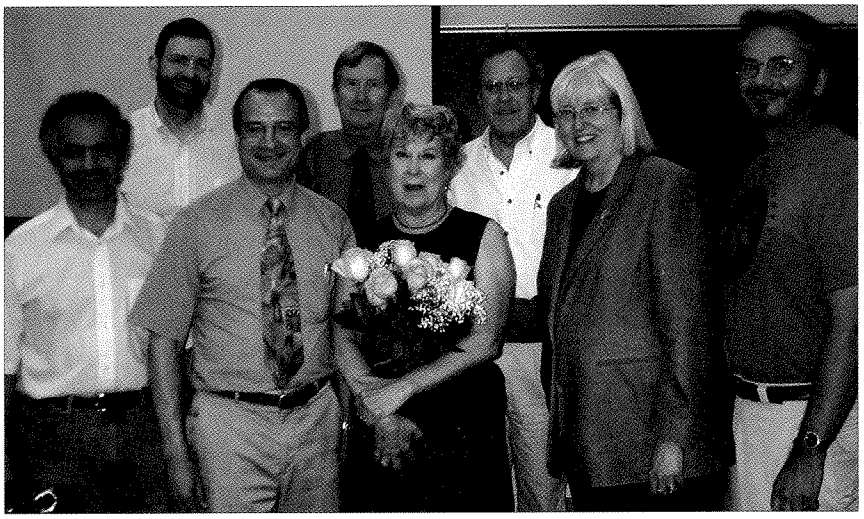
Bob and wife Margaret continue to live in Lincoln, although they spend considerable time at their second home in Colorado Springs, CO. ∞

RETIREMENTS

MARILYN T. MCDOWELL

BY
ROBERT G. FULLER & ANTHONY F. STARACE

Marilyn T. McDowell retired in August, 2005. Marilyn joined the Department in 1980 and served as the administrative associate for the ADAPT program, directed by Professor **Robert Fuller,** until 1997. In addition to her ADAPT activities, owing to her exceptional organizational skills she was frequently called upon to help organize various Departmental events as well as local, regional, national, and international conferences and workshops. For example, for approximately two decades she organized the annual get-together dinners for Department faculty with eastern Nebraska high school physics teachers following each Fall's Ruckman Lecture on physics education. She coordinated the Spring Recognition Luncheons in honor of Department graduates. She served as the Project Administrative Associate on a wide variety of externally funded summer workshops and institutes. After the ADAPT program ended, she worked for the Center of Mathematics, Science and Computer Education directed by



Marilyn McDowell (center) surrounded by grateful faculty (left to right): Ilya Fabrikant, Tim Gay, Anthony Starace, Jim Lewis, Greg Snow, Priscilla Grew, and Dan Claes.

MCDOWELL
continued on page 20

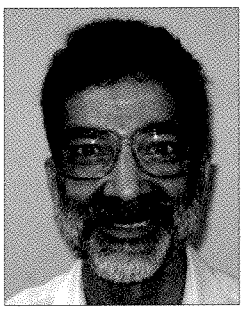
SITARAM S. JASWAL

BY
DAVID SELLMYER

Professor Sitaram S. Jaswal made the transition from Professor to Emeritus Professor in May, 2004. He remains quite active in research, however, and is a valued member of the NSF-supported Materials Research Science and Engineering Center.

Sitaram was educated at Panjab University (B.Sc. 1958, M.Sc. 1959) in India, and at Michigan State University (Ph.D. 1964). After a two-year Postdoctoral Fellowship at the University of Pennsylvania, he became Assistant Professor of Physics at Nebraska (in 1966). Over the years he has had a number of visiting professorships and leaves, including those at the Max-Planck-Institute in Stuttgart (twice), the Technical University of Vienna, and the Indian Institute of Technology in Roorkee, India. Sitaram has been a strong contributor to departmental teaching and service programs, especially as long-time Chair of the Graduate Committee. His professional activities and honors include Danforth Foundation Associate, organizing and chairing several Midwest Solid State Conferences, Fellowship in the American Physical Society, a Distinguished Teaching Award, and a Fulbright Fellowship.

Sitaram has made major contributions to the theory of condensed matter. His early work involved calculations of lattice vibration modes in alkali-halide crystals, as well as localized modes due to defects, Raman scattering and infrared absorption. In the early 1980s, Jaswal switched his research interests to calculations of the electronic structure of metallic glasses, compounds, and self-consistent spin-polarized studies of complex magnetic compounds. His most-cited paper is on the electronic and magnetic structure of the rare-earth compounds, $R_2Fe_{17}N_3$. His theoretical studies have been a huge benefit to the experimental program on permanent-magnet materials, nanoscale multilayers, and nanoclusters. In the last few years Sitaram's efforts have been devoted mainly to research on electronic structure and transport in magnetic nanowires, nanocontacts, and tunnel junctions.



Sitaram S. Jaswal

Professor Jaswal has had an enormous influence on the development of condensed-matter and materials physics at the University of Nebraska. This is evidenced by the group of Nebraska faculty with whom he has published papers: **J. Hardy, R. Hardy,**

JASWAL
continued on page 20

RETIREMENTS

MCDOWELL
continued from page 19

Jim Lewis, the Cosmic Ray Observatory Project (CROP) directed by Professors **Dan Claes** and **Greg Snow,** the Native American Remains Project directed by **Priscilla Grew,** and the UNL Summer Astronomy Camps directed by Professors **Kevin Lee** and **Edward G. Schmidt.** In July 2001, she helped organize the International Symposium on Electron-Molecule Scattering and Swarms that was held in Lincoln and chaired by Professor **Ilya Fabrikant.** Most recently, she helped organize the 2005 national meeting of the American Physical Society Division of Atomic, Molecular, and Optical Physics, whose local Co-Chairs were Professors **Tim Gay** and **Anthony Starace.**

The outstanding work that Marilyn did in her many years at UNL was recognized in 1997 when she was awarded the Floyd S. Oldt Silver Pen, which recognizes a University of Nebraska-Lincoln office/service employee who has demonstrated superior performance while employed at UNL and who has made significant contributions to the University community. She also received Parents Recognition Awards from UNL for several years when she was with the ADAPT program.

A retirement reception organized by the Department for Marilyn on August 2nd, 2005 drew a large number of people who expressed their appreciation for the outstanding assistance Marilyn provided in the many projects she undertook. Notable among testimonials was Greg Snow's recitation of Marilyn's work statistics for the CROP project. Professor Ed Jones also provided a Garrison Keillor-esque tribute to Marilyn. These and many photos from the reception may be found at the following CROP web site: **http://crop.unl.edu/Marilyn**

Since her retirement Marilyn has expanded her volunteer activities at LGH/Bryan West Hospital, continued her service to the Westminster Presbyterian church, and traveled to visit children and grandchildren. She still lives in Lincoln with her husband, **Ed Schmidt.** ∞

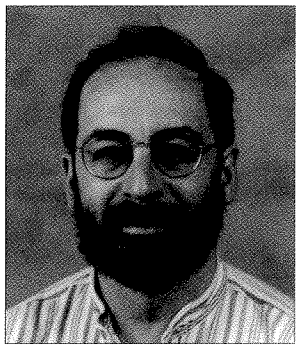
JASWAL
continued from page 19

R. Kirby, D. Sellmyer, S. Liou, M. Langell, J. Woods, B. Robertson, P. Dowben, J. Woollam, R. Skomski, E. Tsymbal, and **K. Belashchenko.** He has published about 145 research articles, book chapters and reviews, including 46 *Physical Review* articles, 15 *Physical Review Letters,* and 5 *Applied Physics Letters.* He also has given more than 60 invited talks at universities, research institutes and conferences.

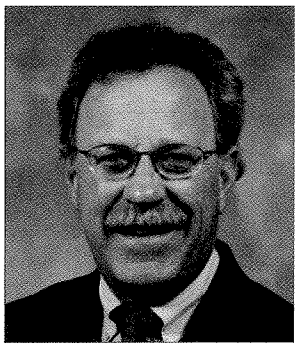
Sitaram shows little evidence of slowing down. In addition to his physics research, he has maintained several hobbies including serving on the Lincoln Human Rights Commission and the Mayor's Air Pollution Advisory Board; participating in antidiscrimination and antiwar vigils, rallies and marches as well as writing letters to the editor in the local newspaper on these subjects. ∞

Three Faculty Named APS Fellows

In 2004 three faculty members in the Department were awarded Fellowship in the American Physical Society (APS): **Peter A. Dowben, Gregory R. Snow,** and **Donald P. Umstadter.** Fellows are nominated by one of the units of the American Physical Society. These nominations are reviewed by the Fellowship Committee of the APS, and forwarded nominations are then voted upon by the APS Council. Fellowship is a distinct honor signifying recognition by one's professional peers. By APS policy, no more than one half of one percent of APS members may be awarded Fellowship in any given year.



Peter A. Dowben



Gregory R. Snow

Donald P. Umstadter

- **Peter Dowben,** Charles Bessey Professor of Physics, was nominated by the APS Topical Group on Magnetism and Its Applications, "for his significant experimental contributions to surface magnetism, spin polarization in complex magnetic systems, and metal-to-nonmetal transitions in reduced dimensionality." In 2004, Dowben was also elected a Fellow of the Institute of Physics, the United Kingdom's professional society of physicists.

- **Greg Snow,** Associate Professor of Physics, was nominated by the APS Forum on Education, "for outstanding contributions to education and public outreach initiatives associated with elementary particle physics and particle astrophysics." Among these innovative activities is CROP, the Cosmic Ray Observatory Project, which is discussed on page 14 of this issue of *Spectrum.*

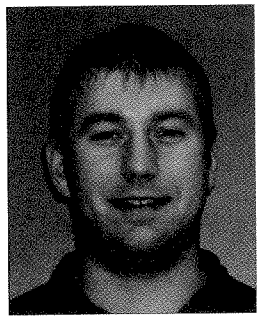
- **Donald Umstadter,** Leland J. and Dorothy H. Olson Professor of Physics, was nominated by the APS Division of Plasma Physics, "for outstanding contributions to the fundamental understanding of relativistic laser-plasma interactions, as well as high-field-gradient charged-particle accelerators and light sources." Umstadter was in transition between Michigan and Nebraska when his Fellowship was awarded (see page one of this issue of *Spectrum*). ∞

New Department Staff

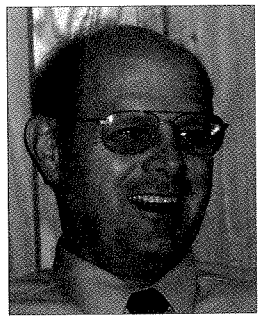
Jennifer L. Becic

Karen Gildea

Joyce L. McNeil



Keith A. Placek



Mike Trumble

Since our last issue of *Spectrum*, there have been a large number of new staff appointments in the Department, particularly in our Business Office. As the Department's research, teaching and service activities are growing relentlessly, our faculty, students, and other staff depend increasingly on these vital support personnel. Herewith is a brief introduction to these essential people who have joined us recently:

In our *Business Office*, **Milan (Mike) L. Trumble** joined the Department in October 2004 as an Accounting Technician. Before coming to UNL, Mike worked for 28 years as a Budget Analyst with the Nebraska Air National Guard. **Karen E. Gildea** began working in the Business Office in September 2005 as an Accounting Technician. Karen came to Physics & Astronomy from the UNL Benefits office. **Joyce L. McNeil** is the latest addition to the Business Office, filling the Accounting Clerk III position in July 2006. Before joining Physics & Astronomy, Joyce worked for the Mathematics Association of America.

In our *Main Office*, **Jennifer L. Becic,** Staff Secretary II, started in April 2004. Previously, Jenny volunteered for the Archeology Division of the Nebraska State Historical Society and worked part-time for an arts organization in Lincoln. Jenny is the Undergraduate Secretary and works at creating and maintaining webpages. She also helps produce our *Spectrum* newsletter, among many other duties.

Finally, in our *Machine Shop*, **Keith A. Placek** began working for the Machine Shop as a student worker in October 2004. He was hired full-time as an Instrument Maker III in May 2005. Keith earned an Associate's Degree in Machine Tool and CAD/CAM Technology from Southeast Community College and is currently working toward a B.S. in Mechanical Engineering at UNL. ∞

Starace Wins ORCA Award

Anthony F. Starace

Anthony F. Starace, George Holmes University Professor of Physics, was the recipient of the 2005 Outstanding Research and Creative Activity (ORCA) Award of the four-campus University of Nebraska system. He was cited for his career-long research in theoretical atomic physics focused on deciphering the mechanisms by which energy is transferred from electromagnetic radiation (from synchrotron or laser sources) to matter (in the form of atoms or ions). Only one award in the sciences is given annually. Selection is based in large part on anonymous external reviews by an international group of professional peers.

Starace was educated at Columbia College (A.B. 1966) and The University of Chicago (M.S. 1967, Ph.D. 1971), where he did his doctoral research under the supervision of Ugo Fano. During 1971-2 he was a postdoctoral research associate at Imperial College, London (U.K.). He joined the faculty at UNL in 1973. His expertise is in the areas of atomic photoionization, intense laser-atom interactions, many-body theory, coherent control of atomic processes, attosecond science, and quantum information. He has served as an Associate Editor of *Reviews of Modern Physics* (1995-2006) and as Chair of the APS Division of Atomic, Molecular and Optical Science (DAMOP) (1990-91). He has been awarded an Alfred P. Sloan Foundation Fellowship and an Alexander von Humboldt Foundation Research Fellowship (1979-80). He is a Fellow of both the American Physical Society (APS) and the American Association for the Advancement of Science (AAAS). He has served as Chair of the Physics and Astronomy Department (1984-95), Associate Dean for Science in the College of Arts and Sciences (2000-2001), and Sr. Associate to the Vice Chancellor for Research (2000-2001) at the University of Nebraska-Lincoln. He has published over 160 scientific papers in refereed scientific journals and presented over 60 invited talks at national and international scientific conferences and workshops. His research has been continuously funded by both the Department of Energy and the National Science Foundation since the early 1980s. ∞

Lab Manager Plano Clark Moves On

Vicki L. Plano Clark

Dr. Vicki L. Plano Clark, who became the physics laboratory manager in 1993, has taken a research assistant professorship in the Department of Educational Psychology in the UNL College of Education and Human Sciences. She serves as Co-Director of the Office of Qualitative and Mixed Methods Research (OQMMR) and as managing editor of the new Journal of Mixed Methods Research. The focus of the OQMMR is on promoting and advancing understanding of qualitative and mixed methods research and how these methods can be applied in social, behavioral, and health science research. As a methodologist, Dr. Plano Clark maintains ties to the department by working with **Diandra Leslie-Pelecky** on research related to Project Fulcrum.

Plano Clark graduated from Kalamazoo College where she did a senior research project on experimental investigations of two-electron processes in ion-atom collisions in the group of John Tanis at Western Michigan University. She continued her work in atomic experimental physics while at Michigan State University and Western Michigan University. However, a transforming experience for her was her participation in the Science Theatre outreach group at Michigan State University. That experience motivated her to switch from physics research to physics education. While in the Department, her interests in physics education research led her to develop expertise in applied social science research methods and complete her doctorate in that field.

As Laboratory Manager in the Department from 1993-2005 Plano Clark was instrumental in revitalizing all aspects of the Department's laboratory instructional programs. She initiated weekly meetings with graduate teaching assistants assigned to the laboratories and coordinated an orientation and training workshop for new teaching assistants each August. In collaboration with Professor **Robert Fuller** and with support from the Howard Hughes Medical Institute, she used a $75,000 grant to transform the instructional laboratories associated with our pre-medical physics courses (Physics 141-142). She also obtained a $50,000 remodeling grant from the University of Nebraska Foundation and designed an innovative laboratory classroom arrangement.

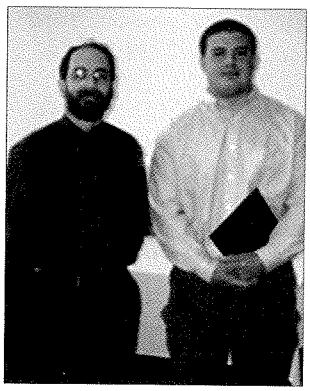
Subsequently she became a nationally recognized expert on physics laboratory architecture. Her last research grant was a collaborative NSF funded curriculum proposal for $500,000 entitled the Humanized Physics Project. It was done in cooperation with Mark Plano Clark and Christopher Wentworth, physics faculty at Doane College. The laboratory activities that she developed as a part of that project are available at the website for the "Humanized Physics Project" **(http://physics.doane.edu/hpp/)**. She also was active in the American Association for Physics Teachers (AAPT), serving as President of the Nebraska Chapter and the Nebraska Section Representative to the AAPT Council. Descriptions of many of her numerous projects are available on the Research in Physics Education Group (RPEG) website, **http://physics.unl.edu/rpeg/rpeg.html** ∞

Brief Notes

Herman Batelaan

- Associate Professor **Herman Batelaan** was named Male Athlete of the Year in the 2004 Cornhusker State Games. Batelaan has competed in badminton in the Cornhusker State Games since 1997 and has won, as of 2006, twelve gold and two bronze medals in singles and doubles events.

- Graduate students **J.D. Burton** and **Xiaohui Wei** were winners of the 2006 Graduate Studies-Sigma Xi Graduate Student Poster Competition awards in the physical and materials sciences. Graduates students **Anthony Caruso** and **Jihee Kim** were winners in the 2004 competition. The competition takes place during the annual UNL Research Fair each Spring. Awardees are recognized at the Sigma Xi Awards banquet held soon afterward. Recipients of the award receive a $50 check and are invited to present their posters at the annual Sigma Xi banquet.



Anthony Caruso (right) with mentor Peter Dowben

- Former graduate student **Anthony Caruso** (Ph.D. 2004) was selected to receive the 2005 Folsom Distinguished Doctoral Dissertation Award by the UNL Office of Graduate Studies. The award recognizes the outstanding research and creative activity of UNL graduate students. Recipients of the Ph.D. dissertation award receive a $1,000 stipend. Theses are evaluated by external referees. **Peter Dowben** supervised Caruso's thesis research. Caruso is currently a Research Scientist with the Center for Nanoscale Science and Engineering at North Dakota State University, in Fargo, ND.

- Former associate professor **Bernard Doudin** has taken a chaired professorship at the University of Strasbourg in France. His appointment is in the Institute of Physics and Chemistry of Materials of Strasbourg (IPCMS). In 2004 Doudin received the UNL Chapter of Sigma Xi's Outstanding Young Scientist Award "for investigations of the novel magnetic and transport properties of nanostructured nanowires and nanocontacts." Doudin was one of only five scientists attracted to France in 2005 by the Agence Nationale de la Recherche (ANR) program supporting "Chairs of Excellence." Doudin's award in that program is for research in nanospintronics.

Peter A. Dowben

- Charles Bessey Professor **Peter Dowben** was awarded an Excellence in Graduate Education Award in January 2006 by the Office of Graduate Studies at UNL. The award is given annually by Graduate Studies to recognize "demonstrated excellence and lasting impact on distinguished scholarly/creative activities" as well as "successful graduate research mentoring." The news release on the award notes that Dowben's

"major research focus is in the investigation of surface electronic structure in a variety of materials. He is a recognized innovator in instrumentation for photoemission and inverse-photoemission studies of solids and surfaces."

- Professor **Tim Gay** was seen in late summer 2005 on NBC television dispensing academic advice to Motley Crüe drummer Tommy Lee in "Tommy Lee Goes to College." The reality TV show was filmed during the 2004-2005 academic year on the UNL campus. Gay portrayed Lee's academic advisor and generated some notoriety in that role in recounting to Lee the outstanding scientific capabilities of one of his (that is, Gay's) heroes, Sir Neville Mott.

- Graduate students **Hae-Kyung Jeong** and **Cheol-Soo Yang** were selected in 2004 to receive the UNL Chapter of Sigma Xi's Outstanding Graduate Student Awards. Jeong was cited "for very high research productivity, for outstanding thesis research on electron-phonon coupling in local moment systems, and for the design and construction of a spin-polarized electron energy loss spectrometer." Yang was cited "for perseverance, enthusiasm, and scientific integrity in obtaining novel research results on the electrical properties of metallic contacts comprising only a few atoms."

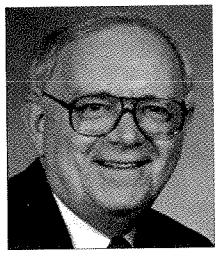
- **Shelli Krupicka** was selected by the UNL Chapter of Sigma Xi for their 2004 Support of Research Award. She was cited "for outstanding, efficient, and intelligent work since 1990 as Administrative Coordinator for the University of Nebraska Center for Materials Research and Analysis (CMRA)." Krupicka is now the Administrative Coordinator for the Nebraska Center for Materials and Nanoscience, the successor to the CMRA.

Shelli S. Krupicka

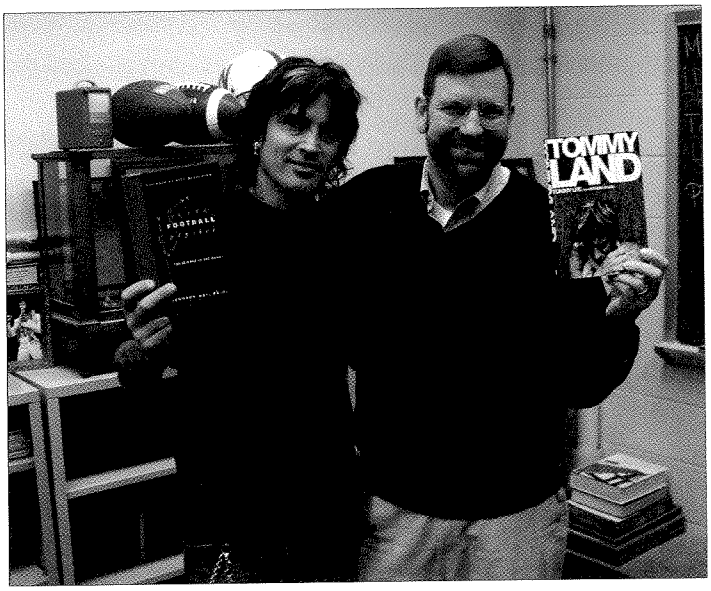
- Former Lecturer **Carl Lundstedt** (Ph.D. 2001) was selected by the UNL Chapter of Mortar Board as a "Person Who Inspires." Mortar Board is a national student honor society that recognizes college seniors for distinguished ability and achievement in scholarship, leadership, and service. Lundstedt was among those honored for "encouraging and motivating those around them" at its Fall 2005 celebration. Lundstedt is now a staff member with the Tier-2 Computing Center to Advance Particle Physics Research (see page 3 of this issue of *Spectrum*).

Carl Lundstedt

- George Holmes University Professor **David J. Sellmyer** was selected for the Outstanding Scientist Award by the UNL Chapter of the Society of Sigma Xi, The Scientific Research Society. Sellmyer is the founding Director of the Nebraska Research Initiative's Center for Materials Research and Analysis. At the award ceremony, held on 26 April 2006, he presented an after-dinner lecture on his award-winning research entitled "Superscale and Nanoscale Magnetism."

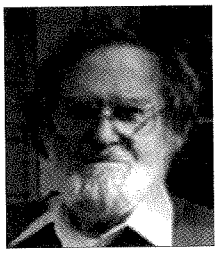


David J. Sellmyer



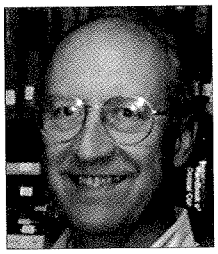
Tim Gay (right) and Motley Crüe drummer and television star Tommy Lee exchange and display their respective books: "Football Physics" and "Tommy Land."

- Professor Emeritus **John Weymouth** was elected as an Honorary Member of the International Society for Archaeological Prospection (ISAP) at the annual meeting of the society in London in December 2004. This honorary membership is intended to recognize Weymouth's "outstanding contributions to archaeological prospection." The ISAP was founded in 2003 to advance the education of the public in archaeology. Its scope and membership are international.



John Weymouth

- Professor **John A. Woollam** was the subject of a feature article entitled "John Woollam's Career in Ellipsometry" that appeared in the April/May 2004 issue of *The Industrial Physicist*, which was published by the American Institute of Physics. Woollam was "one of the first" physics entrepreneurs, who founded the J.A. Woollam Co., Inc. in 1987. The article notes that his company "has grown into a worldwide leader in spectroscopic ellipsometry...[holding] more than 40 patents and... [employing] 35-plus people, more than half of whom have engineering or science degrees." Ellipsometers measure the elliptical polarization of light reflected from or transmitted through a material surface. Through rather lengthy numerical calculations, one can extract from the raw data information about the optical properties of the surface material. In the 1980s computers were so slow that the process was very time-consuming. Nevertheless, Woollam automated the process and subsequently won a contract from NASA. It was that contract that stimulated him to set up his own company. Nearly all of his employees are former students. There are also synergies between his teaching and research at UNL and technological advances at the company that stimulate each other in both directions. ∞



John A. Woollam

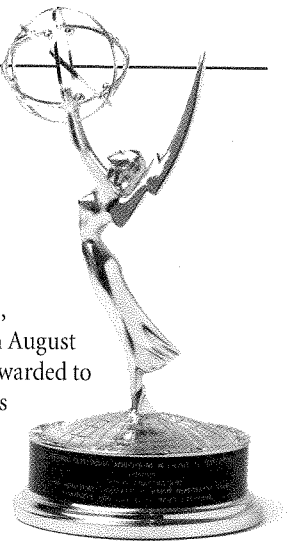
Allen Was First Nebraska Ph.D.

The first person to receive a Ph.D. at the University of Nebraska was **Harold Newman Allen** in 1896, whose degree was in Physics. Our Department was thus the first one to grant a Ph.D. degree at the University, according to Carmella Orosco in the Archives and Special Collections office of the UNL Libraries.

Orosco noted that this information was found in two sources: The Centennial History of Nebraska, Vol 1 by Robert Manley (pg. 136) and in a brochure produced by the Physics and Astronomy Dept. in the mid- to late-1980s (on page 1).

So now you know!

Sibbernsen Wins Emmy for Educational Programming



It is not often that one of our alumni wins an Emmy, but **Kendra Stahl Sibbernsen** (M.S. 1995) has. The 58th Annual Los Angeles Area Emmy Awards, administered by the Academy of Television Arts and Sciences, were announced on August 12, 2006. The Emmy for Instructional Programming was awarded to the 2005 college-level telecourse, "Astronomy: Observations and Theories," for which Kendra was a leading academic advisor. Sibbernsen states, "I knew that the series won an Emmy. The academic advisors received notification by email in August and the telecourse producers thanked us for being a part of the project. I did not realize that my name was given to the Academy as a member of the production team until my award arrived in the mail.... It is a great honor."

Kendra Stahl Sibbernsen

The telecourse comprises 20 half-hour programs and Kendra was one of three lead academic advisors out of a dozen from all over the U.S.A. She had served as a facilitator for a previous version of the telecourse, answering student questions, grading homework, and administering exams. In 2003 she and other academic advisors met with the author of the corresponding textbook to develop objectives for each program. Subsequently they reviewed and provided feedback on the video scripts. Kendra wrote much of the accompanying student guide, faculty manual, and bank of tests. Kendra notes that she enjoys keeping up with the latest developments in science and incorporating them in her teaching.

Kendra teaches Physics and Astronomy at Metropolitan Community College (MCC) in Omaha, Nebraska. Prior to joining MCC in 2005, she taught at Hawkeye Community College in Iowa for nine years. She lives in Papillion with her husband, Michael, and their 4 year old twin sons, Matthew and Lucas. Email: *ksibb@cox.net* ∞

Sorensen to Lead Aerosol Research Association

The Department learned recently that **Christopher M. Sorensen** (B.S. 1969) has been elected Vice President of the American Association for Aerosol Research (AAAR) for 2006-2007. He will then serve as President of the AAAR during 2007-2008.

The AAAR is a nonprofit association of scientists and engineers working in the field of aerosol research. Aerosols are solid or liquid particles in a gas such as clouds or smoke. When in a gas, they naturally bond to one another in chainlike networks, forming what is called an aggregate. In 2003 Sorensen received the David Sinclair Award of the AAAR. This award recognized his sustained excellence in aerosol research and technology and the lasting impact his work has had on aerosol science.

Sorensen's research on aerosols has focused on the physical characterization of aerosol particles and their aggregation. His research has shown how aerosol particles are formed, how they grow together, how the aggregates scatter light, and how this affects the environment. The application

Christopher M. Sorensen

of this research is particularly important in the areas of global warming and visibility problems due to smog in large cities. There are also various industrial applications, including the production of carbon black, a substance made from soot that increases the durability of tires, and in the production of titania, the product that replaced lead in lead-based paint. Sorensen's research has been used in the design of various instruments to measure the size of aerosol particles.

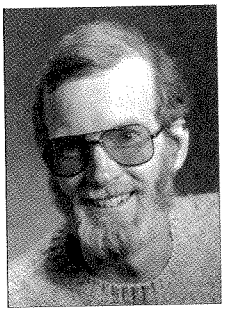
Sorensen is a University Distinguished Professor of Physics at Kansas State University in Manhattan. A native of Omaha, Sorensen did his undergraduate work at UNL, following which he served for two years in Vietnam with the Army. Upon returning to the U.S.A., he did his graduate work at the University of Colorado, where he received his Ph.D. degree in 1977. He joined the physics faculty at Kansas State in 1977.

Recently Sorensen has developed novel synthetic chemical techniques to create nanoparticles of uniform size that form two-dimensional superlattices. The flexibility permitted by being able to vary the particles and the lattices they form holds great promise for understanding matter and its properties as well as for designing matter with desirable properties. For this work he and three other researchers were awarded in 2006 a $1 million Nanoscale Interdisciplinary Research Team (NIRT) Award from the National Science Foundation. Sorensen is also funded by regular grants from NSF and NASA.

In addition to his outstanding research, Sorensen is also interested in curriculum development. For example, he has implemented studio instruction into his courses on engineering physics and optics. He has received numerous teaching awards at KSU including the Presidential Award for Outstanding Undergraduate Teaching. ∞

Swift Receives E.O. Lawrence Award

Gregory W. Swift (B.S. 1974 with High Distinction) received the U.S. Department of Energy's Ernest Orlando Lawrence Award in 2004 in the category of Environmental Science and Technology. The citation reads: "For developing the theory of thermoacoustic heat engines and for designing and building these engines and refrigerators that use the power of sound to operate at high efficiency with no moving parts."



Gregory Swift

The E.O. Lawrence Award was established in 1959 by President Eisenhower (upon the recommendation of the Chairman of the Atomic Energy Commission) to honor E.O. Lawrence. The Award aims to recognize mid-career scientists "for exceptional contributions in research and development supporting the Department of Energy and its mission to advance the national, economic and energy security of the United States."

Awards are made annually in seven categories. Each Lawrence Award recipient receives a citation signed by the Secretary of Energy, a gold medal bearing the likeness of Ernest Orlando Lawrence, and $50,000. Swift said in a recent email to us, "The award ceremony was very interesting and beautiful, because it was on the top floor of the State Department, where Cabinet officials have events. The whole floor is an 18th century museum. So after the ceremony we all wandered around looking at busts and furniture of the Founding Fathers, original maps of the 13 Colonies, etc."

Swift is a Fellow at Los Alamos National Laboratory (LANL) in condensed matter and thermal physics (MST-10). He did his graduate work on superfluid helium at the University of California at Berkeley, where he earned his Ph.D. in 1980. He joined LANL in 1981 and began the transition from pure to applied research.

As reported in the LANL NewsLetter 5(8) in April 2004, "For more than 20 years, Swift's research has focused on engines and cooling technologies based on using sound waves. He has submitted 27 invention disclosures and has been awarded 32 patents. Currently, he and his team have five additional patents pending. Swift's technology for acoustic heat engine technology uses no moving parts and converts heat into acoustic power that may be used in refrigeration. The heat engine also may be used to produce electricity.

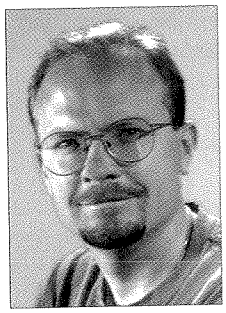
"In 1999, Swift won an R&D 100 Award based on the acoustic Stirling heat engine's potential for significant commercial promise. Swift's most recent collaborations focus on the use of the thermoacoustic technology for gas separation. This includes processes for separation of crude oil and for natural gas liquefaction, as well as other refrigeration technologies."

In the 1999-2000 academic year, the Office of Graduate Studies invited Swift back to UNL as a distinguished speaker in its Scholarship IN Society series. He spoke on "Thermoacoustic Engines...A Long Way from Superfluidity." For further details, see the 2000 issue of *Spectrum*, which is accessible from the Department's web page (**http://physics.unl.edu/news/spectrum.html**). Finally, we note that Swift's group includes another distinguished alumnus, **Scott Backhaus** (B.S. 1990), whose career is profiled below. ∞

CAREER SPOTLIGHT

Backhaus Speaks on 'Extremes of Acoustics'

Scott Backhaus (B.S. 1990) spoke at our Department's Recognition Luncheon on May 6, 2004 to Department graduates, outlining his career from his student days to the present cutting edge of technology. Backhaus says he began as a student in electrical engineering at UNO, but found his way to UNL and to physics. He noted that Professors **C. Edward Jones** and **Paul D. Burrow** made physics interesting, leading him to switch to Engineering Physics, and that he did undergraduate research in theory with Professor **Robert J. Hardy**. Following graduation from UNL, Scott went to the University of California at Berkeley for his Ph.D. His thesis research was on Josephson acoustic radiation from superfluid helium. Following his graduation in 1997, he accepted a Director's Postdoctoral Fellowship position in the Condensed Matter and Thermal Physics group at Los Alamos National Laboratory (LANL), working with **Gregory W. Swift** (B.S. 1974 with High Distinction) *[see article on Swift above]*. In 1999 he and Swift co-authored a ground-breaking article on "A Thermoacoustic-Stirling Heat Engine," *Nature* 399, 335-338 (1999). From 2000-2003 he held a Frederick Reines Fellowship and since 2003 he has been member of the Technical Staff at LANL.



Scott Backhaus

In 2003 Backus was selected by MIT's Technology Review as one of 100 Top Young Innovators. His work on increasing the efficiency of thermoacoustic engines was cited. See the 2004 issue of *Spectrum* (which is accessible at: **http://physics.unl.edu/news/spectrum.html**) for further details.

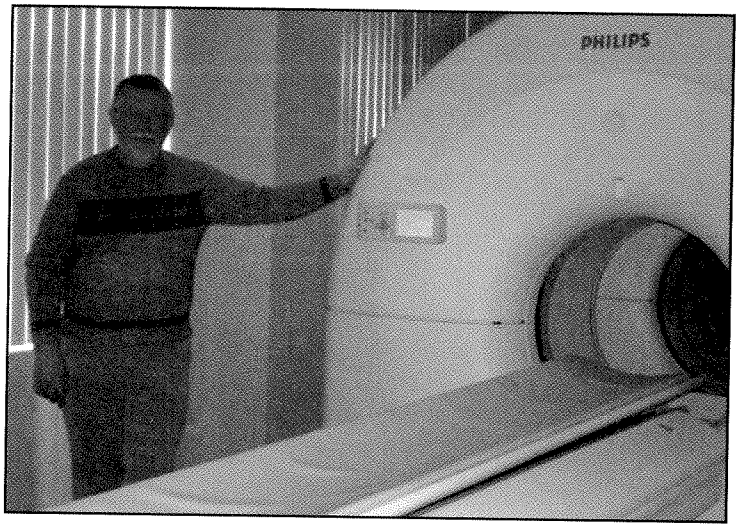
Backhaus's talk to graduates was titled "The Extremes of Acoustics: From Superfluid Helium to Industrial Gas Liquefaction." He noted that one can use sound to probe the thermal, transport, and mechanical properties of physical systems; to determine source properties (e.g., nuclear explosions); and to employ in a variety of medical, industrial, high tech, and military applications (e.g., to clear land mines). The thermoacoustic-Stirling hybrid engine that he built with Greg Swift (and that was the subject of their joint article in *Nature* cited above) is 30% efficient with 1 kilowatt (KW) of acoustic power output. This engine has many applications, e.g., as a 100W electric generator for deep space missions, as a 50 KW engine/refrigerator to liquefy natural gas (his current major endeavor), or as gas isotope separator.

Scott's parting words to graduates were: "Don't be afraid to change fields. And don't be afraid to work on applied problems, because one can learn quite a lot." ∞

CAREER SPOTLIGHT

Cacak Remarks on Medical Physics Career

BY ROBERT CACAK (M.S. 1967, PH.D. 1970)
SENIOR PHYSICIST, RADIATION ONCOLOGY DEPARTMENT
SALEM HOSPITAL, SALEM, OR



Editor's Note: *As readers of Spectrum may have noticed, a significant number of Department graduates over the years have forged successful careers in Medical Physics. One of the earliest to do so is Robert Cacak (M.S. 1967, Ph.D. 1970), who has been most recently a Senior Physicist in the Radiation Oncology Department of Salem Hospital in Salem OR [Email: bob.cacak@hotmail.com]. We recently asked Bob to describe for readers the circumstances that led him to that field, the kinds of problems he has worked on, and how well his physics education at UNL prepared him for work in this field. Herewith are his remarks.*

"Thank you for the invitation to contribute medical physics information to the *Spectrum Newsletter*.... [Physicists often group] 'medical physics' with 'health physics,' but I prefer to keep those professions separate (although there are areas of overlap). For those physics students who would like to learn more about the medical physics profession, I would suggest the American Association of Physicists in Medicine website **www.aapm.org.**

"I have always considered medical physics to be one of the most, if not *the* most, 'applied' of any of the physics sub-branches." In a separate communication, Cacak noted that "Medical physics has seen an explosion of technology since I first entered the scene in '75. CT scanning, magnetic resonance imaging, digital subtraction angiography, and intensity modulated radiation therapy have come to be standard tools in the medical field. All of these techniques rely heavily upon physical principles, and having a physicist on site in a hospital permits full utilization of these modalities. At least, that's what we tell hospital administrators who hold the purse strings."

Career since leaving UNL:
"After receiving my Ph.D. in 1970, I spent about three years as a post-doc at the University of Western Ontario. Jobs were very difficult to get in those days, and at the end of my first post-doc, I took a second post-doc at the University of Maryland. I spent more than two years at U of M. Both post-docs were related to my thesis project on ion-electron collisions and interactions. [Professors **Theodore P. Jorgensen** (B.A. 1928 with High Distinction, M.A. 1930) and **M. Eugene Rudd** (Ph.D. 1962) were his advisors.]

"My first exposure to medical physics happened over supper one night. A friend invited me to apply for a non-faculty position at the University of Colorado Health Science Center (UCHSC). I was looking for something more applied at this point in my career, and I landed the job. This was my first venture into medical physics. In a couple of years, I was promoted to Assistant Professor of Radiology. UCHSC had a very active master's degree program in medical physics and at its peak had fourteen Ph.D. faculty on staff. I taught and performed research and clinical duties for about eight years until staff cutbacks caught up with me and I was forced to get a totally clinical job at a private hospital in Dallas, TX. Seven years later, I applied for a position in Salem, OR since I have always loved the Pacific Northwest. I have been at this location for 15 years and find the work challenging and very rewarding."

Problems worked on:
"I developed test procedures for CT scanners, designed an instrument for accurate radiation measurements with applications in radiation therapy, and wrote several chapters in three textbooks (and one revision). I have designed a new radiation oncology department, including radiation shielding designs. I have developed tests for mammography equipment, some of which were recently incorporated into certification of mammography units. I have tested thermography equipment in rather unusual (but controlled) environments with the goal of making thermography more efficacious in detecting breast cancer lesions. I initiated work on a computer algorithm that would predict the bulk behavior

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of electron dose deposition in tissue." In a separate communication, Cacak added that "...most of all, I have enjoyed interacting with my fellow healthcare workers, who are, on the whole, an extremely dedicated and compassionate bunch of people."

Comments about UNL education: "Besides the problem-solving skills which are absolutely essential in medical physics, there are a couple of other strengths


Robert Cacak

that I have enjoyed as a result of my education at UNL. Although my thesis was in experimental physics, I was exposed to enough mathematics that I felt comfortable in tackling mathematical and theoretical problems. For example, my exposure to complex variables at UNL was valuable in understanding concepts of images (modulation transfer functions) used in clinical radiography.

"And the experimental, machine shop, and electronics skills I gained under the guidance of my thesis advisors (Jorgensen and Rudd) have served me again and again when I needed to develop some gadget or gizmo to test or measure some parameter of interest. And these simple engineering skills have saved employers that I have worked for thousands of dollars by my constructing equipment that was either very expensive or simply did not exist.

"Lastly, I feel that the physics taught by the UNL faculty was extensive. Other physicists I occasionally encounter do not have the breadth of physics experience that I enjoy, and I find myself explaining physics principles to them that I would assume that they should have learned in undergraduate and graduate programs.

"Again,...thank you for this opportunity to comment on the field of medical physics." ∞

CAREER SPOTLIGHT

Liphardt Speaks on Working in High Tech Small Businesses


Martin M. Liphardt

Martin M. Liphardt (M.S. 1992, Ph.D. 1997) spoke at our Department's Recognition Luncheon for graduating students on May 5th, 2005, using his career experience with the J.A. Woollam Company to give students insight into the work environment in a high-tech, small business. (A "Brief Note" on John A. Woollam is given on page 23 of this issue.) Liphardt was born in Göttingen, Germany and obtained his undergraduate degree in physics from the Carolo-Wilhelmina Technical University in Braunschweig in 1990. He came to UNL initially as a "study abroad" student, with the intention to "lighten things up a bit." He noted that "It was strange in the beginning, going to a far away place. But it was good for me." He said that he enjoyed the less hectic pace and greater interactions he had here with fellow students and with faculty. While a visiting student, Martin began doing research with Professor **Roger Kirby** on trying to observe charge density waves. He entered our graduate program in Fall 1991, doing his master's work with Kirby. Upon entering our Ph.D. program he joined the group of Professor **Stephen Ducharme** doing research on photorefractive polymers. Among his several publications stemming from his doctoral research, Liphardt was the lead author on the paper "High-Performance Photorefractive Polymers" published in *Science* **263,** 367 (1994), which initiated an exciting period of intense activity in the field worldwide.

Liphardt's talk, entitled "The High-Tech, Small Business Environment," focused on his work at the J. A. Woollam Co., Inc., which he joined following his graduation from UNL in 1997. The company, founded in 1987 by UNL Electrical Engineering professor **John A. Woollam,** manufactures spectroscopic ellipsometers for non-destructive thin film and bulk material characterization. At first, research grants supported the company, but now revenue is primarily generated by sales. The company sells and services ellipsometers worldwide and currently employs 40 engineers and physicists, most of whom have graduate degrees. Ellipsometry measures changes in light polarization resulting from reflection from sample surfaces. Spectroscopic ellipsometry is now the standard for measuring thin film thickness and optical constants and is used for characterization of many types of materials (e.g., dielectrics, semiconductors, metals, organics, etc.). Liphardt noted that it is used increasingly to monitor and control production processes. For example, he noted, "aluminum cans have a coating to keep your beverage fresh. We can help measure that coating." The company manufactures ellipsometers in many different spectral ranges, which are necessary for different applications.

Liphardt's job entails research and development, applications of ellipsometry, and customer support, both in-house and on-site. There are also production issues to be dealt with: "The company has many needs and cannot hire someone for each new thing." In small businesses generally, he noted, employees must do more than one job to meet the company's needs. For example, with regard to sales and marketing, he noted that "I've been to lots of interesting places." Initially he says he traveled to trade shows and conferences simply to promote the company's products. Now, however, he indicated that he keeps an eye out for results of his work that serve a need and that might lead to patents, thereby increasing the company's business. He remarked that "You don't need a brilliant idea to have a great patent.... A patent for a small but essential improvement upon a previous patent may bring in more money than the original patent."

Among his research accomplishments with the company, Liphardt has produced at least a couple of achromatic lens designs. In fact, he says, "I am involved in many innovative designs, none of which I can talk about!" His research has involved both geometrical and physical optical modeling, alignment procedures, and many kinds of applications, such as in the hard disk industry. In the question and answer period he noted that thin films of the order of 10-20 Å can be measured by means of ellipsometry techniques. ∞

We Heard That...

- **Aflatooni, Kayvan** (M.S. 1992, Ph.D. 1998) is now an Associate Professor of Physics at Fort Hays State University in Hays KS, Tel. (785) 628-5357. Kayvan often does research in collaboration with members of the atomic physics group at UNL during the summer. *Email: kaflatoo@fhsu.edu*
- **Al-Omari, Imaddin** (Ph.D. 1996), Department of Physics, P.O. Box 36, Sultan Qaboos University, PC 123 Muscat, Sultanate of Oman, has been promoted as of June 2005 to the rank of Associate Professor. *Email: ialomari@yahoo.com*
- **Andrianarijaona, Vola** (Former Jorgensen Postdoctoral Fellow) has joined the Physics Department at Pacific Union College, One Angwin Ave., Angwin, CA 94508. *Email: vola@puc.edu*
- **Baird, Leemon C.** (M.S. 1963), Acurad Systems, Inc., Box 6005, Brandon FL 33508, responded to Roger Kirby's inquiry regarding his career since he left UNL as follows: "I left Lincoln in the summer of 1964 for a faculty position at Brescia University [in Owensboro, Kentucky], an interdepartmental Math/Physics Ph.D. at Indiana University (1970), and a faculty position at Virginia Tech [in Blacksburg]. In 1976 I transitioned into Medical Physics via a University of Wisconsin postdoc. I went on to spend several years as Associate Director of the Mideast Center for Radiological Physics [in Pittsburgh, PA, 1978-1983] and as Director of Therapeutic Radiological Physics at Tampa General Hospital [1983-1987]." Since 1987, Lee has been based in Tampa FL as a freelance physics consultant (Acurad Systems, Inc.) operating nationwide (including a recent gig in Omaha) for advice concerning cancer treatments using radiation. Baird is also an FAA Certified Flight Instructor with over 3500 hours of flying experience. *Email: LCBAIRD2@ACURAD.COM*
- **Bao, Minqi** (M.S. 1992, Ph.D. 1995), 548 Tarter Ct. San Jose, CA 95136, received his M.B.A. degree from the Haas School of Business at the University of California-Berkeley in May 2006 with a focus on the management of intellectual property. Bao is a Senior Systems Engineer with Platform Computing, San Jose, CA, a global leader in grid computing. His work takes him about 50% of the time away from Silicon Valley to the rapidly growing Asian economies of South Korea, Singapore, Taiwan, and China. Bao's wife, Jing Jin, is a clinical scientist at Stanford University Hospital. They have two children. *Email: baominqi@yahoo.com*
- **Borca, Bogdan** (M.S. 1998, Ph.D. 2001) and Camelia (M.S. 1999, Ph.D. 2001) Zimmermannstrasse 33, CH-5200 Brugg AG, Switzerland, are both now working in northern Switzerland. Bogdan is working in the field of investment risk management at Credit Suisse in Zürich. Camelia is a beamline scientist at the Swiss Light Source (SLS), a third-generation x-ray synchrotron, at the Paul Scherrer Institute near Brugg, a small town about 30 minutes from Zürich. The SLS x-rays can be focused on the micron scale, providing the opportunity to characterize materials and chemical systems in ways not possible by other means. Previously, Bogdan and Camelia lived in Lausanne in French-speaking Switzerland; they are now learning Swiss-German. *Emails: bborca@gmail.com; camelia.borca@psi.ch*
- **Bykov, Tikhon** (Ph.D. 2003) is an Assistant Professor of Physics at McMurry University in Abilene, TX. *Email: tbykov@mcm.edu*
- **Cavagnero, Michael J.** (Former Postdoctoral Research Associate) is now Chairman of the Department of Physics and Astronomy at the University of Kentucky in Lexington. *Email: mike@pa.uky.edu*
- **Demmel, Paul** (B.S. 2005) 159 Morewood Ave., Pittsburgh, PA 15213, writes that he spent a year in Brazil studying both Portuguese and economics and that upon his return to the U.S.A. in Fall 2005 he entered the M.S. program in Computational Finance at Carnegie Mellon University. We note also that Paul, who graduated in August 2005, was elected the following November by the UNL Chapter to membership in Phi Beta Kappa. *Email: pauldemmel@yahoo.com*
- **Downsbrough, Melissa** (B.S. 2004), 1601 Spring Garden St., M102, Philadelphia, PA 19130, spent a year working for the Nebraska Health and Human Services System on West Nile Virus Surveillance. *Email: Melissa@downsbrough.com*
- **Egbert, Gary T.** (Ph.D. 1974) 12017 Gantry Lane, Apple Valley, MN 55124, is teaching part-time in the Physics Department at Augsburg College in Minneapolis. *Email: gtegbert@yahoo.com*
- **Friedman, Steve** (M.S. 2004) is a Process Engineer with Future Foam, Inc., 400 North 10th St., Council Bluffs, IA 51503, *Email: sfriedman88@yahoo.com*
- **Fuchser, Andrea Lynn** (B.S. 2003) is currently with J. A. Woollam Company in Lincoln, NE.
- **Gau, John** (M.S. 1971, Ph.D. 1975) worked two decades in industry and now is an Adjunct Assistant Professor of Physics at Worcester Polytechnic Institute in Massachusetts. *Email: jgau@wpi.edu*
- **Goderya, Shaukat** (M.S. 1991, Ph.D. 1995) Box T-930, Division of Engineering, Computer Science, Physics, and Hydrology, Tarleton State University, Stephenville TX 76402, is an Associate Professor of Physics and Astronomy at Tarleton State University (TSU). He writes that the TSU planetarium is a state-of-the-art facility located on TSU's agricultural research farm. It has a remotely-controlled 32" research grade astronomical telescope. Shaukat does research in both observational astronomy and computational physics. He teaches courses in both physics and astronomy. *Email: goderya@tarleton.edu*
- **Haddad, Gerry** (Former Postdoctoral Research Associate) CSIRO, P.O. Box 218, Lindfield NSW 2070, Australia, is Director of CSIRO-Division of Telecommunications and Industrial Physics. He is responsible for both directing the scientific research of a staff of 400 and managing the commercialization of that research. The main focus of the division is in testing and calibration services. Haddad frequently visits his industrial customers in the U.S.A. and on one of these visits in September 2005 dropped in to visit the Department. *Email: gerry.haddad@csiro.au*
- **Hu, Martin** (M.S. 1996, Ph.D. 1998) has been promoted to the (essentially permanent) position of Applications Physicist II at Fermilab. *Email: martinhu@fnal.gov*
- **Hu, Suxing** (Former Postdoctoral Research Associate) has joined the staff of the Laboratory for Laser Energetics, University of Rochester, 250 E. River Rd., Rochester NY 14623. *Email: shu@lle.rochester.edu*

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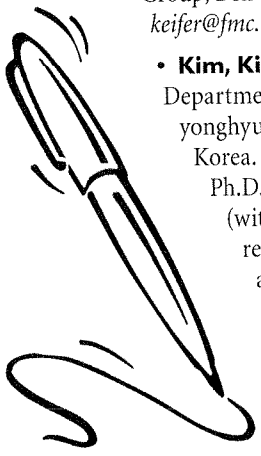
- **Istomin, Andrei Y.** (M.S. 2002, Ph.D. 2005) is a postdoctoral research associate in the Department of Physics and Optical Science, The University of North Carolina, Charlotte NC 28223-0001. *Email: ayistomi@email.uncc.edu*.
- **Jordon-Thaden, Brandon** (Ph.D. 2005) is a postdoctoral research associate at the Max-Planck Institute for Nuclear Physics in Heidelberg, Germany. His wife, Ingrid, is pursuing her doctorate at Heidelberg University studying plant gene evolution within the mustard family. *Email: Brandon.Jordon-Thaden@mpi-hd.mpg.de*
- **Kayl, Jonathan Patrick** (B.A. 2003) writes "I am currently a Signal Officer in the Army at Fort Hood Texas. I plan to deploy this fall to Iraq to set up tactical encrypted phone and data networks for operations in Operation Enduring Freedom. I am in charge of maintenance and supply for my company. I have found my physics background to be a huge advantage in both jobs I have done with the Army. Having a better idea of how the world works and systematic problem solving gives me an advantage whenever I am confronted with a new situation (which is almost everyday in the Army)." *Email: jonathan.kayl@us.army.mil*
- **Keifer, David W.** (B.S. 1968) recently visited the Department, where he once worked with Professors **Duane Jaecks** and **Eugene Rudd.** David is currently with FMC Corporation, Research and Technology Center, Agricultural Products Group, Box 8, Princeton, NJ 08543. *Email: david_keifer@fmc.com*



- **Kim, Kisik** (M.S. 1983) is a Professor in the Department of Physics, Inha University, 253 yonghyun-dong, Nam-gu, Inchon 402-751, Korea. He wrote recently, "After getting the Ph.D. degree from the University of Rochester (with Coherence and Quantum Optics as my research specialty), I spent one year there as a postdoctoral research associate and then two years at the Korea Atomic Energy Research Institute. I joined the Department of Physics of Inha University in 1991." His current research is in the area of quantum optics and atomic physics. *Email: kisik@inha.ac.kr*
- **LaBelle, Wilma Carol Marcy** (B.S. 1955), 2201 North Cambridge, Apt. 415, Milwaukee, WI 53202, writes that she is active in the Wisconsin Section of the Society of Women Engineers. LaBelle has founded the Omega Research Corp. in Milwaukee, works as a design and consulting engineer, and holds several patents. *Email: wlabelle@wi.rr.com*
- **Liu, Chih-Ray** (M.S. 1985, Ph.D. 1988) is an Associate Professor in the Department of Radiation Oncology at the University of Florida in Gainesville. *Email: liucr@ufl.edu*
- **Maleki, Nasser** (M.S. 1977, Ph.D. 1981) is Director of Medical Physics at Memorial Health University Medical Center in Savannah, GA. *Email: MalekNa1@memorialhealth.com*
- **Mariyenko, Igor G.** (Former Jorgensen Postdoctoral Fellow) is currently in the Department of Optical Quantum Electronics in the Institute of Physics of the National Academy of Sciences of Ukraine in Kiev. *Email: imariyenko3@unlnotes.unl.edu*
- **Meyers, Maria** (Former graduate student, ca. 1979-1980) 9904 E. 84th St., Raytown, MO 64138, writes: "I am now managing director of the Institute for Entrepreneurship and Innovation at the University of Missouri - Kansas City. Seems I have knack for starting things up. This will be my sixth start up. The Institute will add new programs to UMKC's business school, including a Ph.D. program in entrepreneurship, undergraduate and graduate major/minor, a strong research program in entrepreneurial activity and a number of commercialization activities. I've been working on a project called KCSourceLink, also through the University, for the past two years. We have incubated a concept that links entrepreneurial support organizations to the entrepreneurs that need them. We're excited to be expanding and are now moving into Kansas and have sold one of our products to support the state of Wisconsin in its efforts. Hopefully, this is a start toward a national expansion. It is a good news story for the new Institute." Maria and her husband Mark have three children, all of college age. Mark has been a workers compensation judge since 1990. *Email: Meyersnet@aol.com*
- **Miller, Donald L.** (Former Postdoctoral Research Associate), 17 Pheasant Run Dr., Export PA 15632, Tel. (724) 327-3903, is an Advisory Scientist in the Advanced Materials and Electronic Device Research Division of the Northrup Grumman Science and Technology Center, 1350 Beulah Rd., Pittsburgh, PA 15235. *Email: donald.l.miller@ngc.com*
- **Pan, Cheng** (Former Postdoctoral Research Associate) 7213 Sampal Place, Springfield VA 22153-1550, is working for Artech Information Systems LLC in MacLean, VA, as a software developer. Tel.: 703-831-0030.
- **Roth, Michael** (B.S. 2000 with High Distinction) 211 E. Ohio #1706, Chicago, IL 60611, is currently in an Internal Medicine Residency at Northwestern Memorial Hospital in Chicago. It is affiliated with the Feinberg School of Medicine and the McGaw Medical Center of Northwestern University. *Email: Mroth@md.northwestern.edu*
- **Schneider, Donald P.** (B.S. 1976 with High Distinction) Pennsylvania State University, Department of Astronomy and Astrophysics, 408A Davey Lab, University Park, PA 16802, is now the second most cited researcher in the area of space sciences in the world. In-cites [http://www.in-cites.com/top/2006/fifth06-spa.html] notes that Schneider's 276 published papers have each received nearly 47 citations (on average) over the past 10 years, or a total of 12, 949 citations. In additional to his many research endeavors, Don serves as Chairman of the Sloan Digital Star Survey (SDSS) Quasar Science Working Group and as the Scientific Publications Coordinator of the SDSS. Recently he has also served as Deputy Head of his Department at Penn State. In 2004 he accepted the position as the Hobby-Eberly Telescope (HET) Scientist. The HET is the third largest optical telescope in the world, managed collaboratively by Penn State, U.Texas-Austin, Stanford, and two universities in Germany. *Email: dps@miffy2.astro.psu.edu*

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- **Stevenson, Roger Dean II** (B.S. 1998), NYU Clinical Cancer Center, 160 E. 34th St., New York, NY 10016, received an M.S. degree in physics from the University of Pennsylvania and joined the Memorial Sloan Kettering Institute as a Medical Physicist specializing in radiation oncology. He stayed there for more than three years and then joined the Medical Center of New York University as a Medical Physicist. He is enjoying his job immensely. *Email: Roger.Stevenson@nyumc.org*
- **Sucha, Greg** (Former graduate student, M.S. EE 1984) is a Product Manager with IMRA America, Inc., 1044 Woodbridge Ave., Ann Arbor, MI 48105. IMRA America is a global company "dedicated to the leading edge in ultrafast and short-pulsed fiber laser technology for both commercial and research applications." Greg visited the department recently to discuss femtosecond lasers with Profs. Kirby, Uiterwaal, and Umstadter. He recalled studying quantum mechanics taught by Professor Starace in the early 1980s. Email: gsucha@imra.com
- **Sun, Zhenhua** (M.S. 1997, Ph.D. 1999) 4454 Falcon Dr., Fayetteville, AR 72701, is now working for Arkansas Blue Cross and Blue Shield insurance.
- **Swift, Gregory** (B.S. 1974 with High Distinction), Fellow in Condensed Matter and Thermal Physics, Los Alamos National Laboratory (LANL), was awarded LANL's Distinguished Patent Award and its Distinguished Licensing Award in 2004. The Patent Award was for his patent on "Oscillating Side-Branch Enhancements of Thermoacoustic Heat Exchangers." According to the LANL NewsLetter, "The Distinguished Patent Award is selected by Laboratory Fellows and recognizes a premier patent exemplifying a significant technical advance, adaptability to public use and noteworthy value to the Lab's mission." The Distinguished Licensing Award is given annually by the Laboratory's Technology Transfer (TT) Division. An article about Swift's receiving the E.O. Lawrence Award appears on page 25 this issue. *Email: swift@lanl.gov*
- **Teays, Terry** (Ph.D. 1986) Bloomberg Center for Physics & Astronomy, Rm. 206C, The Johns Hopkins University, 3400 N. Charles St., Baltimore MD 21218-2686, is the Assistant Director of the Maryland Space Grant Consortium, which is managed by Johns Hopkins University for NASA. Terry writes that the Consortium funds "education activities that support the future workforce for NASA and the aerospace community. This includes K-12, undergrads and graduate students, and teachers in STEM disciplines. I'm having a lot of fun and the work is important, challenging, and rewarding. Hopkins is a good place to work; they treat their senior staff well." Teays also runs his own consulting company, Teays Consulting, Inc., although he writes that he is quite selective in the jobs he takes on, doing work mostly for NASA missions or NASA headquarters or with companies doing business with NASA. However, he has also worked on putting together workshops for NIH and AAAS on how a scientist or engineer makes the transition to becoming a manager. "Since I had made the transition successfully myself, people were very interested in the practical details of how this all works." In addition to his other activities, Terry has also recently taught an astronomy course for non-science majors for the University of Maryland at College Park. "I had a smart classroom with all the latest technology and an interested group of students. I did very little classical lecturing, but used a lot of hands-on projects and collaborative learning techniques. The students took a few lectures to get used to my unorthodox approach, but in the end they gave me very high marks in the evaluations, especially citing the unusual methods as being valuable." *Email: teays@pha.jhu.edu*

WE WANT TO HEAR FROM YOU!

You may send us your news by using the postcard included with the mailing of this newsletter. Alternatively, send your news to:

Professor Roger D. Kirby, Chairman
Dept. of Physics & Astronomy
116 Brace Laboratory
The University of Nebraska–Lincoln
Lincoln, NE 68588-0111

Email: RKIRBY1@UNL.EDU

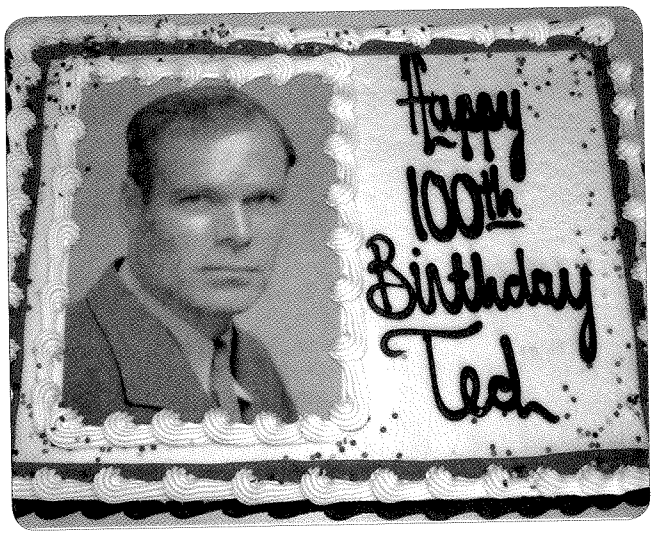
- **Thaden-Koch, Thomas** (Ph.D. 2003) is a postdoctoral research associate with the Physics Education Research Group at the University of Minnesota. *Email: ttkoch@physics.umn.edu*
- **Vetter, Jeremy** (B.A. 1997 with Highest Distinction) was a Rhodes Scholar at Oxford University. In 2005, he obtained a Ph.D. in the History and Sociology of Science from the University of Pennsylvania. He is currently a Postdoctoral Research Fellow in Department II of the Max Planck Institute for the History of Science in Berlin. *Email: jvetter@mpiwg-berlin.mpg.de*
- **Volz, Donald J.** (M.S. 1965, Ph.D. 1969) has been Director of the Vascular X-Ray Business Unit for Toshiba America Medical Systems Inc. since 2002.
- **Wang, Jin** (Former Jorgensen Postdoctoral Fellow) is now an Assistant Professor in the Department of Physics and Astronomy (#2352), The University of Tennessee, 615 McCallie Ave., Chattanooga TN 37403- 2598. *Email: Jin-Wang@utc.edu*
- **Webster, Jennifer Lee** (B.S. 2000) is a Multi-Discipline Engineer at MITRE Corporation in Maclean, VA and has been accepted into the Masters of System Engineering Program at the University of Virginia.
- **Zeng, Hao** (M.S. 1998, Ph.D. 2001) is currently an Assistant Professor of Physics at SUNY-Buffalo. He was recently awarded a prestigious NSF-CAREER grant. *Email: haozeng@buffalo.edu.* ∞

In Memorium

OBITUARY: THEODORE "TED" JORGENSEN

Editor's Note: *This obituary of Theodore P. Jorgensen was published in the April 13th, 2006 issue of* Scarlet. *We have added a photo taken by his former student and Professor Emeritus* **M. Eugene Rudd** *(Ph.D. 1962) at his 100th birth party celebration on Sunday, 13 November 2005.*

Theodore "Ted" Jorgenson, Retired Professor of Physics, Died April 2 in Lincoln. He was 100.



Ted Jorgenson's 100th birthday cake.

Jorgensen's association with what is now UNL's Department of Physics and Astronomy went back more than 80 years, to his enrollment as an undergraduate in 1923. He went on to earn his bachelor's (1928) and master's (1930) degrees at Nebraska, and his doctorate in theoretical physics from Harvard (1935). He served as an instructor at Harvard and at Clark University in Worcester, Mass., until 1938 when he joined the faculty at Nebraska.

He taught at Nebraska through his official retirement in 1975, except for an interlude during World War II, when he was recruited to work on the top-secret Manhattan Project, first in Chicago, then at Los Alamos, N.M. Jorgensen was in charge of measuring the size of the atomic explosion.

"Some people thought the universe would blow up," Jorgensen said in a *Lincoln Journal Star* interview last fall. "We knew we were right on the edge of a new world."

In 1946, Jorgensen returned to the University of Nebraska, where he directed the Nebraska Accelerator Project from 1946 to 1967 and served as chair of the physics department from 1949 to 1952.

"Ted really started the modern research in physics at Nebraska that we're known for today," said **Roger Kirby,** professor and chair of physics and astronomy. "There's no question that we've become what we are because of the start that he gave us."

After his retirement, Jorgensen became best-known for his book, "The Physics of Golf," which he spent decades researching before publishing it in 1994 at the age of 88. The book has gone through several editions and has been published in 11 languages.

Jorgensen received a Distinguished Teaching Award in 1963, was a fellow of the American Physical Society and was a member of Sigma Xi, Phi Beta Kappa, Pi Mu Epsilon and Sigma Tau.

Born in Connecticut, he grew up the son of a South Dakota minister and homesteader and was the oldest of five children. In 1923, he rode a motorcycle to Lincoln to enroll at NU, where two decades earlier, his mother, Anna Jorgensen, had studied with Willa Cather.

He is survived by his wife, Dorothy; her three children and two grandchildren; and his daughter, Joanna Prey Kaestner and her husband, Pete, of Albuquerque, N.M., a grandson and two great-grandchildren. Jorgensen's first wife, Helene Hansen, died in 1959. ∞

A JORGENSEN STORY

At the Memorial Service for **Theodore Prey Jorgensen** on April 8th, 2006 at Sheridan Lutheran Church in Lincoln, Ted's stepson, **John Pelton,** told a classic Jorgensen story that is worth sharing with *Spectrum* readers. Pelton related to the many assembled family and friends (perhaps a couple of hundred people in total) that in 7th grade he was in the living room at Ted's house trying hard to memorize the names of the Prime Ministers of all Southeast Asian countries for a homework assignment. When Ted came home, Pelton complained to him how difficult it was to memorize the long list of strange names. Ted responded in his inimitable way:

"That's a waste of time! Those people change all the time. If you want to know who they are you can just look that up in a reference book. That's what reference books are for. If I were you, I would memorize instead a fine piece of literature."

Pelton did as Ted suggested and, as might be expected, got called on the carpet the next day by his teacher when he repeated the words of Professor Jorgensen to the whole class. Upon hearing of this unfortunate outcome, Ted felt badly for his stepson and so went personally to the school to talk with the teacher and smooth things over.

Nevertheless, Pelton said, it was from interactions such as this that Ted taught him a valuable life lesson: that what is important is to learn principles and how to apply them, and not simply to memorize facts. That is something that Pelton—and most of Ted's many students over the years—will never forget. ∞

—Anthony F. Starace

In Memorium

JORGENSEN: A TRIBUTE FROM ANDREW N. SMITH

Editor's Note: *Following Jorgensen's death on April 2nd, 2006, Andrew N. Smith (B.A. 1947) wrote a Letter to the Editor of the* Lincoln Journal Star *that was published on May 1st, 2006. His letter, titled "Jorgensen was one of the best professors," provides some of his recollections of Ted Jorgensen. We reprint it here.*

Jorgensen Was One of the Best Professors

"...In the 1920s, Ted Jorgensen had been a student of my father, T. Townsend Smith (emeritus, 1952), in the University of Nebraska Physics Department. I was a faculty brat in kindergarten when Ted left for Harvard, so I had no awareness of him then. My folks welcomed him and his young family back in '38, putting them up at our house while they found one for themselves. Four years later as an entering U. of N. student I began to appreciate him as one of the fairest, straight-up, pragmatic, most understandable teachers of physics I've ever had.

"He left for the Manhattan Project in 1943. Upon his return, he again stayed at our house until he shortly found one of his own. They lived there temporarily while he started the design of the thermally efficient house he designed and built in the early 1950s out near 33rd and O. Meanwhile, he constructed a couple of acoustical Klipsch horns for a stereophonic record player. He also played violin, forming a chamber music trio with the Math Department's Miguel Basoco and another whose name escapes me.

"He revitalized the Physics Department through his Cockcroft-Walton accelerator project, financed in part by a government grant. This enabled his mentoring three graduate students (I was still a senior but took his graduate-level theoretical physics course) through the first Ph.D.s awarded by the department (about 1950) since John T. Tate's in 1915. He was totally at ease with his subject matter, both theoretical and practical, and he had a rare ability to make it seem like everything was mostly common sense. 'Don't take notes, follow along what I'm doing and work it out from the book later if you have to.'

"The high point in the days of a number of us students was [the] bag lunches in his office with discussions about world events, politics, ethics, etc., almost anything but physics as such. He insisted that you speak in complete sentences with every word well chosen and defined; if he felt one were not, he'd ask pointedly, 'What do you mean by that?' Being very keen on semantics, he made many a reference to Korzybski and Hayakawa.

"We also heard a lot (unclassified) about Los Alamos, and enjoyed his locally famous Chinese dinners (grew his own bean sprouts). Chopsticks were required. One time, we were treated to an evening's show of unclassified photos he took of the 1945 Trinity Test from the 10-mile observation location at Alamogordo.

"My wife (also a '47 U. of N. alum) and I enjoyed occasional later contact with Ted at various times, mostly after he reluctantly left his special house for a more conventional one on High Street. He never gave an opinion about my drifting from particle physics to high voltage engineering, except to make it clear that whatever one did, one should give it his very best. Not being a golfer, I still obtained an early copy of his [book], *The Physics of Golf,* but somehow never got around to having it autographed." ∞

—Andrew N. Smith,
Eldridge, Mo.

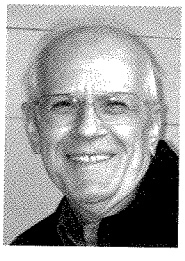
Jacobses Establish Ted Jorgensen Fund

BY ROGER D. KIRBY

Upon learning of **Ted Jorgensen's** failing health, **Loyd Jacobs** (M.S. 1958) and wife **Barbara** established the Ted Jorgensen Fund with a substantial initial endowment in December 2005. They recognized Ted's importance to the renewal of our Department's research programs following WWII, as well as Ted's inspirational teaching of our students over the decades.

Since then the fund has grown with additional contributions from the Jacobses, from the Jorgensen family and friends, and from Department faculty and staff. It is an endowment fund, so that only income may be spent. Although the terms of the fund, as agreed to by Ted's wife Dorothy and daughter Joanna Kaestner, are quite flexible, income from the fund will initially be used to provide a scholarship to a deserving undergraduate physics student. The first Jorgensen Scholarship will be awarded in Fall 2007.

Loyd received a B.A. degree from Emporia State University (Kansas) prior to joining our graduate program. It was here that he met wife-to-be "Bobbie," who, as a student, was a typist in the Physics Department in 1955. Obviously, meeting Bobbie was one of the highlights of his stay in our Department, but Loyd also fondly remembers working with **Donald C. Lorents** (M.A. 1954, Ph.D. 1958) and the late **Chris E. Kuyatt** (B.S. 1952, M.A. 1953, Ph.D. 1960) on the sometimes balky "Jorgensen" accelerator. Professor **Herbert Jehle's** lecture on the occasion of Einstein's death also left a lasting impression.



Loyd Jacobs

Loyd spent his entire career working at The Boeing Company, first in Wichita, KS (for 5 years) and then in Seattle, WA (for 32 years). He worked on many aspects of airplane design and function, including noise engineering, vibration, and maneuver and gust loads. He worked on the B-52 bomber, and on the Boeing 707 through 777 aircraft, and became both a manager and a Senior Principal Engineer. He and Bobbie have been involved in their community and enjoying life in Bellevue, WA since his retirement in 1995.

We thank Loyd and Barbara for their generosity and for their foresight. ∞

In Memorium

CHRISTOPHER P. KEIM (M.A. 1932, PH.D. 1940)

Christopher P. Keim, 97, died on August 5th, 2003 in Oak Ridge, TN. He was born on April 6th, 1906 in Tecumseh, NE, where he graduated from Tecumseh H.S. He received his B.A. in mathematics in 1927 from Nebraska Wesleyan College, and then began graduate work in physics at UNL, where his master's thesis was supervised by Professor **John E. Almy.** His doctoral research at UNL (Ph.D.1940) was done in both the chemistry and physics departments, according to UNL Alumni Association records.

In February 1944 Keim joined Oak Ridge National Laboratory (ORNL), and soon became Director of the Isotope Research and Production Division. There he made major contributions in the field of physics and physical chemistry. Keim was later named superintendent of the so-called "Y-12 Pilot Plant" and initiated separation of stable isotopes of all elements that have isotopes. According to the Oak Ridge National Laboratory Review (Vol. **25,** Nos. 3 and 4, p.76 (1992)), Keim "later recalled that copper isotopes were the first to be collected. Using enriched copper-65 as the source material for neutron irradiation, ... [ORNL scientists] positively identified nickel-65 as a nickel isotope with a half-life of 2.6 hours. This discovery represented the first use of calutron-separated stable isotopes in research....Stable isotopes of iron, platinum, lithium, and mercury, for example, were separated and shipped to university, government, and industrial laboratories worldwide to aid basic research....They became especially valuable to medical science, for which they were converted into radionuclides used as tracers to diagnose cancer, heart disorders, and other diseases affecting human internal organs and bones.... the Laboratory's stable isotopes program continued to expand through the 1970s. At its height, the program generated more than $1 million annually in sales revenue."

In addition to his work in stable isotope production, in 1957 Keim established the Division of Technical Information at ORNL. After his retirement in 1971, Keim began working with Roane State Community College, where he participated in the development of the continuing education program and the Oak Ridge campus.

Christopher Keim (left) displaying containers of stable isotopes to ORNL managers. (From *ORNL Review* 25, Nos. 3 and 4, p.75 (1992))

On June 29, 1929, Keim married Lucille Parli, who died March 9, 1998. Keim and Lucille met at Nebraska Wesleyan College and were married on her parents' farm. "We had more than 68 great years together," Keim said in 1998. "We had a beautiful life together."

During Keim's years in Oak Ridge, he was active in the Oak Ridge Rowing Association, in which he worked with the Rowing for Handicapped program. He was a licensed official with the United States Rowing Association. Keim was also active in various ways during the transitional years of Oak Ridge from an AEC operation to the incorporated city.

—Excerpted from *The Oak Ridger, The ORNL Review,* and other sources

Editor's Note: *Roger Kirby, Department Chair, together with Vice Chancellor for Research Prem Paul visited Keim in Oak Ridge about one year before he died. Kirby remarked upon what an interesting person Keim was. Below Kirby describes this meeting with Keim.*

"We had dinner with Keim at a restaurant in Oak Ridge called the Bleu Hound (converted from a gas station). The food was excellent, and Keim drove himself there. He kept us entertained with stories about his career. Among interesting things: His parents emigrated from Germany, where his father was employed to build stone bridges. He continued to build stone bridges once in Nebraska, although I think it wasn't a growth industry. Keim was very hopeful that he would be able to attend his 75th class reunion at Nebraska Wesleyan, but he didn't. (The reunion took place before he died, but I think he just wasn't in good enough shape to attend.) Among other interesting tidbits, he got a pilot's license after his retirement from Oak Ridge so that he could fly himself to some of his consulting jobs. When we visited him, he was still working out at a gym quite regularly."

—*Roger D. Kirby*

FRANK G. ULLMAN (1926-2004)

Editor's Note: *We thank Ullman's daughter, Eileen Rendahl of Davis, CA, for providing us with a detailed obituary of our former colleague, Professor Frank G. Ullman, which is reproduced with only minor editing below. We have included also a brief description of Ullman's scientific contributions written by his colleagues and published in the journal* Ferroelectrics, *whose publisher, Taylor and Francis, has kindly given us permission to reproduce below an excerpt from that obituary.*

Dr. Frank G. Ullman died peacefully from congestive heart failure while surrounded by his family at California Pacific Medical Center in San Francisco on October 2, 2004. He was 77. He was born in New York City on December 14, 1926, at his parents' apartment in the Bronx. Upon graduation from the prestigious Bronx High School of Science in 1943, he enlisted in the Army Reserve, eventually serving in Japan with the 27th Ordnance Company in the First Cavalry Division.

Frank G. Ullman

Frank returned to New York City and enrolled in New York University where he received his B.A. degree in Physics in 1949. He then went on to graduate school at the Polytechnic Institute of Brooklyn (now the Polytechnic University of New York). He

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completed his M.S. degree in 1951 and was hired by Sylvania Electric Company's Research Laboratories. In 1954, he returned to the Polytechnic Institute to complete his Ph.D., which he received in 1958, whereupon he took a position at National Cash Register Co. (now NCR) in Dayton, Ohio, where he worked until 1966.

In 1966, he accepted an offer to be a full Professor of Electrical Engineering at the University of Nebraska-Lincoln. A few years later, he received an additional appointment as a Professor in the Physics Department. As his colleagues, **S. Ducharme, J. Hardy,** and **R. Kirby** (University of Nebraska – Lincoln), V.M. Fridkin (Institute of Crystallography, Moscow, Russia), and journal editor G.W. Taylor (Princeton, NJ) wrote in an obituary they co-authored for the journal *Ferroelectrics* (Vol. 315, page i, 2005):

"[At UNL] he organized and performed light-scattering studies of improper commensurate and incommensurate ferroelectrics. After the discovery of the soft mode by Ginzburg and Cochran and the first observation of the soft mode in perovskites, Professor Ullman found the zone-boundary soft mode in gadolinium molybdate and incommensurate A_2BX_4 compounds. He confirmed the idea of mode-coupling with an anomalous central peak with the Raman and Brillouin scattering experiments in K_2SeO_4 and Rb_2ZnC_{14} incommensurate ferroelectrics."

For many years, Ullman served on the Editorial Board of the journal, Ferroelectrics.

Ullman retired in 1996 and moved to Davis, California in 2000. He is survived by his wife, Deborah, three daughters, and five grandchildren. He will be remembered by all who knew him for his quick wit, his warm compassion, and his love of handball, tennis and chocolate.

WALTER G. ELWELL (M.S. 1951)

Editor's Note: *We thank Ruth Elwell, wife of Walter, Linda Montag in the Academic Affairs Office of Nebraska Wesleyan University, and UNL Professor of Physics Emeritus Edgar A. Pearlstein for kindly contributing information for this obituary.*

Walter G. Elwell died in Lincoln on June 22, 2004 at the age of 82. He was born in the town of Stuart in Holt County, Nebraska. He received his B.A. degree in physics from Peru State College in 1948. His M.S. degree research at UNL was done with Professor **Donald C. Moore** (B.A. 1942 with High Distinction). Elwell, **Roger J. Hanson** (M.A. 1953, Ph.D. 1956) and **Donald C. Lorents** (M.A. 1954, Ph.D. 1958) were close "physics" friends at UNL in the early 1950s.

Walter G. Elwell

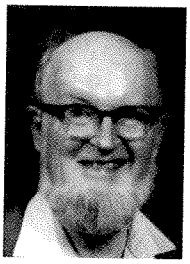
Elwell graduated in 1951 and then joined the physics faculty at Nebraska Wesleyan College (now University), where he rose from Assistant Professor to Associate Professor. At Nebraska Wesleyan, he also served as the first Director of the Computer Facility at a time when computing was centralized, the IBM mainframe occupied two rooms, and "real" programming was done in machine language. Later on, Elwell became Director of the Plant and Library Records.

Upon his retirement in 1986, Elwell was designated Professor Emeritus of Physics and Director Emeritus of Plant and Library Records. In retirement he took up genealogy, visiting his relatives around Nebraska to gather information and tracing his ancestry to England. For a number of years, he enjoyed fly fishing in mountain streams in Colorado. Elwell is survived by his wife, Ruth, two sons and a daughter.

WILLIAM L. BADE (B.S. 1949, M.S. 1951, Ph.D. 1954)

William L. Bade died February 12, 2005 in Hyannis, MA. Bade is survived by Maria, his wife of 56 years, son Chris, and three grandchildren. Bade was born in Lincoln and showed an early interest in mathematics and science, ultimately earning his Ph.D. in physics from the University of Nebraska under the guidance of Professor **Herbert Jehle.** He was a gifted theorist, and his article on "An Introduction to Spinors" with Jehle (*Reviews of Modern Physics* **25,** 714 (1953)) on spinor fields in general relativity is an important and well-cited paper.

As senior scientist at AVCO Systems Division in Wilmington from 1957 to 1975, Bade made major contributions to understanding the physics of atmospheric re-entry that were essential in development of the heat shields used on the Apollo spacecraft and the Titan and Minuteman missile programs. The focus of his research was on thermal transport issues related to spacecraft reentry and to properties of arc-induced plasmas. He collaborated with Nobel Laureate Hans Bethe (a long-time consultant with AVCO) to develop what is known as the Bethe-Bade theory describing how x-rays from nuclear explosions affect re-entry vehicles. In collaboration with another UNL physics graduate, **Jerrold M. Yos** (B.A. 1952 with High Distinction, M.S. 1954, Ph.D. 1956), Bade developed NASA's NATA code to calculate gas flow in nozzles and channels. Bade and Yos collaborated on many projects during their years at AVCO.



William Bade

Bade had wide ranging interests. He wrote and published a number of science fiction stories while still a graduate student, and several of these stories (e.g., *Ambition* (1951)) have been included in compendia along with stories of such well-known writers as Ray Bradbury and Isaac Asimov. He was also an amateur astronomer and geologist and became an accomplished cabinet maker.

Bade's very productive scientific career ended prematurely in 1975 when he developed cryptococcal meningitis. He survived that life-threatening disease, and thereafter pursued his avid interests in photography and cycling. For the eight years prior to his death, he and his wife lived on Cape Cod.

As reported on page 35 of this issue, his wife Maria and son Chris have established the *William L. Bade Scholarship Fund* in his memory. ∞

Acknowledgments

Gifts Raise Department Endowments Above $1 Million

Owing to the generous gifts of Department alumni, faculty, and friends, endowment funds benefiting our Department and its students now exceed $1 million, which generates spendable annual income in excess of $50,000. An important use of these funds is to provide academic scholarships to our undergraduate students. At present approximately $35,000 is awarded annually from a large number of separate endowment funds. A recent listing of such funds (and of students who have benefited from scholarship awards that these funds provide) is given on the following web page: **http://physics.unl.edu/directory/ducharme/MISC/PhysScholar.html**

We note that a number of our alumni (including **Stephan M. Eddy** (B.S. 1978), **Loyd Jacobs** (M.S. 1958), **Vanvilai Katkanant** (M.S. 1979, Ph.D. 1983), and **Kurt Meyer** (B.S. 1988)) as well as Professor **Sitaram Jaswal** have recently established scholarship endowment funds for undergraduate physics and astronomy students. Frequently these funds are in honor of the parent(s) or other relative(s) of the donor.

In other cases, funds are established in honor of one of our alumni. We note that the fund established by **Loyd Jacobs** and his wife Barbara is in honor of **Ted Jorgensen** (B.A. 1928 with High Distinction, M.A. 1930) (see article on page 26). As another example, in 2005 an undergraduate scholarship fund in honor of **William L. Bade** (B.S. 1949, M.S. 1951, Ph.D. 1954) was established by his wife, Maria, and his son, Chris. (An obituary for William Bade is given on page 34 in this issue of *Spectrum*.) Owing to the increasing cost of higher education, the scholarship support provided by these generous gifts of alumni, faculty and friends helps make it possible for undergraduate students in physics and astronomy to pursue their educations at UNL.

> "The Department is extremely grateful to our alumni, faculty, and friends who provide gifts such as these that make a real difference in how well we can carry out our teaching, research, and outreach programs."

Other endowment funds benefit the Department in other ways. The Department still benefits substantially from income (approximately $15,000/year) provided by the Kositzky Memorial fund established by **James C. Coe** and his wife many years ago. This income is used to help purchase the equipment needed by newly-hired faculty to set up their laboratories so that they (and our students) can do research at the cutting edge of our discipline. The Department is very grateful to **Jerry Ruckman** (B.S. 1962), whose endowment fund provides unrestricted income that the Department so far has used primarily to further physics education, both at UNL and in Lincoln-area high schools.

Recently, Professor **David J. Sellmyer** and his wife Catherine have established an endowment fund to advance the condensed matter and materials area in the Department. Some of our income (about $2,000) is used to support the visits of a couple of outstanding Colloquium speakers to our Department annually. The family of **Burton Evans Moore,** a Department faculty member from 1896-1925, has established an endowment to fund a professorship in his honor. The income from this fund is currently being reinvested until the fund grows to sufficient size.

Finally, in addition to these Department-controlled endowment funds, the Department also benefits from endowment funds given to the University by various UNL alumni that support graduate student fellowships and undergraduate student scholarships in a number of departments, including ours.

The Department is extremely grateful to our alumni, faculty, and friends who provide gifts such as these that make a real difference in how well we can carry out our teaching, research, and outreach programs. Even small donations, given time, can grow to make a significant contribution. A listing of the account numbers for several of the endowment funds benefiting the Department and its students are given on the Acknowledgments page (page 36) in this issue of *Spectrum*. We urge alumni, faculty, and friends to aid the growth of our endowments by contributing to one or more of these funds (or by establishing a new one!). ∞

— Roger D. Kirby

Acknowledgments

The Department is very grateful to the following individuals and corporations for their new and continuing financial contributions during the period 1 November 2003 – 31 October 2006. 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 Alumni Scholarship Endowment Fund (Account No. 3303.0)**

Alternatively, former students, friends, and/or colleagues of Professors Sitaram Jaswal, Ted Jorgensen, or David J. Sellmyer may wish to contribute to the following endowment funds:

4.) **Banti & Mela Ram Jaswal Fund** (for undergraduate scholarships) **(Account No. 6843.0)**
5.) **Ted Jorgensen Fund for Physics** (for undergraduate scholarships) **(Account No. 8846.0)**
6.) **David J. & Catherine J. Sellmyer Fund** (for support of condensed matter and materials science) **(Account No. 6781.0)**

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. ∞

Bishan Agrawal (M.S. 1973, Ph.D. 1973)
Maria Bade
Chris Bade
Min-Qi Bao (M.S. 1992, Ph.D. 1995)
William A. Barrett (B.S. 1952, M.S. 1953)
Kenneth Bloom
The Boeing Company
Louis Caplan (M.S. 1963, Ph.D. 1974)
Geoffrey B. Crooks (B.S. 1965, M.S. 1967, Ph.D. 1972)
Stephan M. Eddy (B.S. 1978)
Ilya and Marina Fabrikant
FMC Corporation
Robert and Margaret Fuller
Jay Gallagher
Timothy Gay
David Gray (B.S. 1977)
James and Delores Gunnerson
Robert Haberman
Willa B. Hassell
Maurice Hawthorne (B.S. 1964)
Ping He (M.S. 1989, Ph.D. 1993)
Alan J. (B.S. 1957, HDS 1999) **and Ruth Heeger**
Curt Hieggelke (M.S. 1966, Ph.D. 1971)
Robert Hilborn
Miriam Howard
IBM Corporation
Loyd Jacobs (M.S. 1958)
Duane and Jan Jaecks
Sitaram and Alice Jaswal
Kathleen Jorgensen
Steven Kaestner
Joanna and Peter Kaestner
Vanvilai Katkanant (M.S. 1979, Ph.D. 1983)
David W. Keifer (B.S. 1968)
Roger and Sue Kirby
Byron Krauter (B.S. 1976)
William J. Lannan (M.A. 1956)
Diandra Leslie-Pelecky
Michael Lewis (B.S. 1992)
Joseph and Ellen Macek
Robert Maher (M.S. 1975, Ph.D. 1980)
Igor Mariyenko
Peter Martin (Ph.D. 1975)
Kurt Meyer (B.S. 1988)
Thomas R. Miller
Rosalind Morris
Gordon Niva (M.S. 1975, Ph.D. 1979)
Labros Pilalis (B.S. 1978)
Mrs. C.G. Pritchard
Jerry E. Ruckman (B.S. 1962)
M. Eugene (Ph.D. 1962) **and Eileen Rudd**
James J. Schmidt (B.S. 1956, M.S. 1957)
David J. & Catherine J. Sellmyer
Joseph Shavlik
Roy F. Simperman (M.S. 1965)
Anthony F. Starace
Fred and Edna Swihart
Terry J. Teays (Ph.D. 1986)
Alan Tveten (M.S. 1959)
John and Laura Weymouth
Doug and Leann Yost