UNIVERSITY OF WISCONSIN MADISON 150 YEARS

Special Sesquicentennial Issue Celebrating 150 Years of Wisconsin History in 1998 & 150 Years of UW–Madison in 1999.

THE WISCONSIN PHYSICIST

Vol. 5, No. 1 *A Newsletter for University of Wisconsin Physics Alumni* *Fall, 1998–99*

From The Editor

by Jean Meyer Buehlman

Greetings Physics alums and friends.

History is the buzz word here in Wisconsin this year. Everywhere you look, local folks are doing something special for the Sesquicentennial of the State of Wisconsin.

Citizens of Wisconsin have been gearing up for a year already by purchasing special Sesquicentennial license plates for their cars. In May, a celebration was held on the Capitol Square, complete with cake and ice cream, and the issuance of a special postage stamp in honor of Wisconsin. In June, a train of twenty wagons, complete with passengers and horses, made the trek from Prairie du

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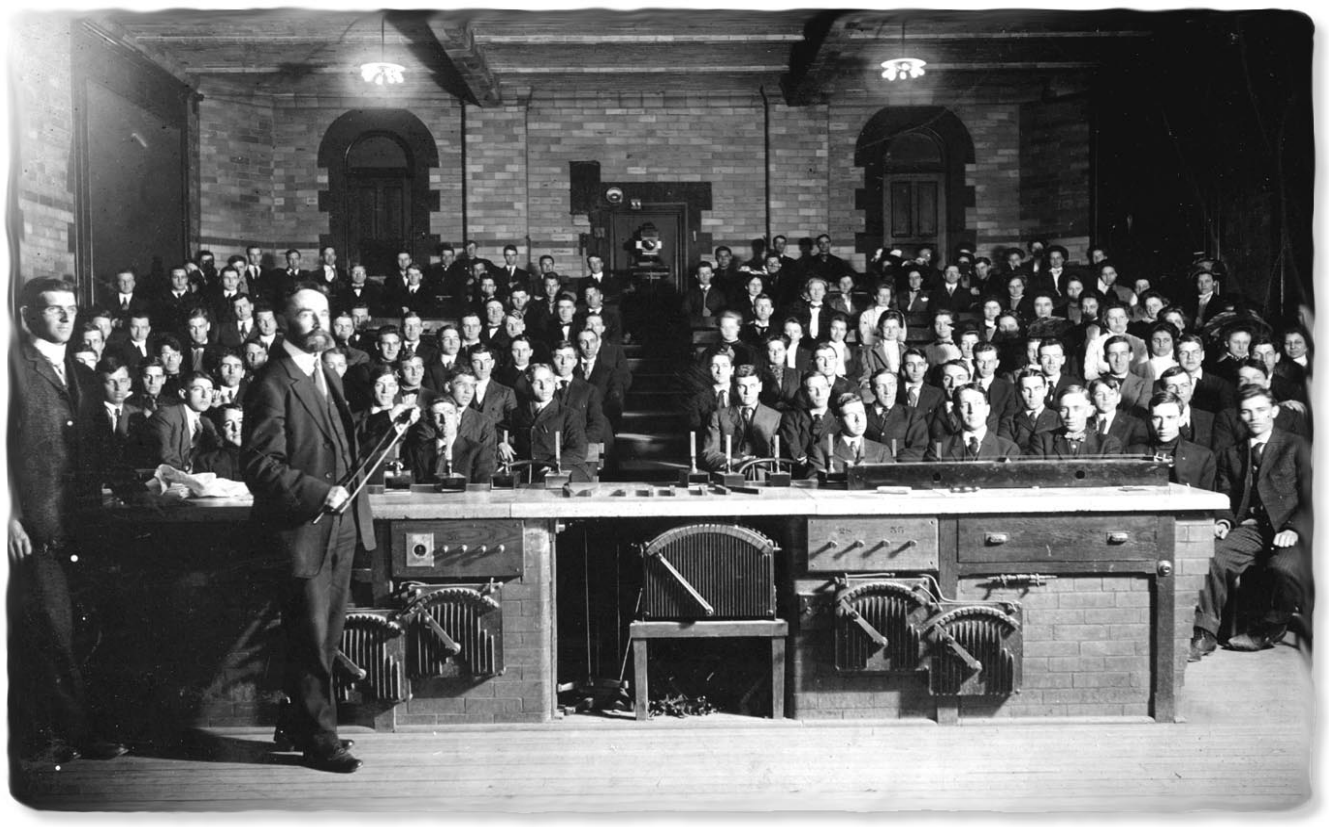
Inside Features:



Early physics classroom, with Professor Benjamin Snow as instructor.

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Chien to Green Bay, Wisconsin, stopping in small towns along the way. In many towns, they spent the night and provided entertaining historical campfire stories. (Check out these interesting web sites: **http://www.shsw.wisc.edu/WisconsinStories/**) This is a site sponsored by the Wisconsin State Historical Society. You might also want to look at **http://tourism.state.wi.us/** sponsored by the Wisconsin Department of Tourism, for more Sesquicentennial information.)

On campus, we are even more excited about L&S celebrating 150 years in 1999. In addition, Physics is starting to plan for a gala event October 8 & 9 of 1999 to celebrate the 100th anniversary of our first Ph.D. Our idea for this celebration is to have a day filled with talks about the exciting future of Physics in the 21st Century. (You might want to note this on your calendars and make tentative plans for an October visit to Wisconsin. If so, see more particulars on page 12 and visit **http://visitmadison.com/whatsnew.htm**)

Jean Buehlman, Editor

Hopefully, all of these historical rumblings will be inspiring to folks who have a historical bend. If that includes you, I encourage you to venture back in time to help uncover some ancient department history. Unfortunately, up to this point in time, most of this history has been stored in the heads of retired faculty and in a drawer or two in the department office. To get you in the mood for this project, I've tried to include a few historical photos in this issue.

My vision for the future would be to make our history more visible. It would be nice to find a few people interested in gathering and sorting information. And, to then have the means to put it in an appropriate place for public display. Are you a history buff? If so, give me a call and let's talk! (If you have an interesting historical photo, please send me a copy. Thanks!) ❑

Chairman's Report

by Lee G. Pondrom, Chair

I have now completed my first year as Department Chair. I said in my introductory article last year that it will be interesting to read what I have to say after a year in office. Perhaps that was an overstatement, but I will try to make it as interesting as possible.

First I should make an announcement along the lines of Jean Buehlman's history editorial. In addition to Sesquicentennial anniversaries for the state of Wisconsin (1998), the University of Wisconsin (1999) and the Physics Department first Ph.D. celebration (1999), next March there will be a Centennial Meeting of the American Physical Society in Atlanta. On Tuesday, March 23 from 6:30 to 9:30 p.m. there will be a Grand Reunion in which our Department will participate. So if you plan to attend the March APS meeting — which next year replaces the regular March and "Washington" meetings — please be sure to come to the reception.

As chair of the Department my attention has focused principally on faculty matters, such as recruiting, retention, promotion, salaries, etc. The future strength of the Department depends on our ability to recruit and retain good young people. We have hired a new assistant professor in experimental high energy physics, Yiban Pan, who will begin in January, 1999.

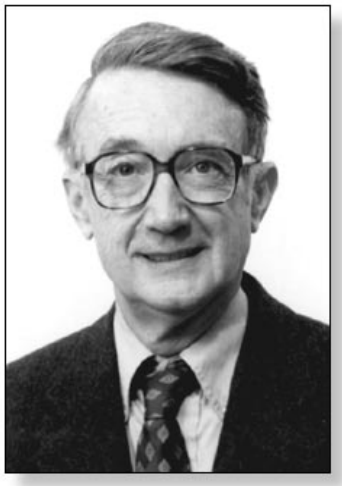
Mark Rzchowski has been promoted to associate professor with tenure. Michael Winokur has been promoted to full professor. One tenured faculty member, Jo van den Brand, has resigned to accept an appointment in Europe.

Recruiting activities for next year will include searches in experimental astrophysics, with emphasis on the AMANDA project at the South Pole, and in experimental atomic physics. The Department is also involved in two interdepartmental hires. The interdepartmental hire program was instituted in the fall of 1997 by the UW-Madison Provost, John Wiley. The idea was to set up areas of research and teaching which spanned several different disciplines, and to make appointments available to staff these interdisciplinary activities. Proposals were solicited campus wide. The Physics Department participated in several letters of intent, two of which became full proposals which were ultimately selected for funding. Five proposals in all were chosen, so the Department did very well in having two winners. The successful proposals are called "Biophotonics," defined by the techniques of photon-based experimental manipulation and advanced optical imaging of live tissues; and "Nanophase inorganic materials and devices" which is, among other things, the study

of molecular level machines. Both of these initiatives will bring into the Physics Department new and exciting areas of research and teaching. Recruiting to fill these positions will take place over the next two years.

The Department Self Study document was completed this past year, and sent to the L&S Dean. The Self Study serves as a point of departure for the periodic departmental review which is being carried out in the fall of 1998. This review is internal to the UW-Madison. A review committee chaired by Jay Gallagher of the Astronomy Department has been appointed by Dean Certain. I will be responsible for coordinating the review within the Department. We want to make sure that this process strengthens the position of the Department as a whole.

One new space allocation item has arisen as a consequence of the construction of a new building for the Pharmacy School out near the University Hospital complex. Ground breaking for this building was held in May, and beneficial occupancy is planned for the year 2000. At that time the parts of Chamberlin Hall now occupied by Pharmacy could be modified for Physics, and most of the Physics Department could then move out of Sterling Hall. In this way the air conditioning and heating of Sterling Hall could be modernized. Some facilities, like the lecture room 1300 and the museum, would remain in Sterling, but most of the research space would move. Lots of details remain to be worked out.



Lee Pondrom, Chair

Speaking of room 1300, we started TV broadcasts of the Physics Colloquia to UW System campuses last fall. This project was funded by the UW System office of learning and technology. The visual aids in 1300 were upgraded over the Christmas break, partly in response to the needs of the TV hookup. This project has proven to be more complicated than was originally anticipated, and has had mixed results. Reliable TV transmission of a colloquium with overhead transparencies and demonstrations is not trivial. Nevertheless, it is a very good outreach activity for the Department to pursue. With experience gained this year, next year's transmissions should be more reliable.

An assessment of the graduate program was carried out last year, and forwarded to the L&S Dean. This assessment will form part of the documentation for the upcoming campus accreditation exercise.

The graduate recruiting effort for next year was quite successful. As you know, an important part of our graduate student recruiting package has been a signing bonus which comes from Wisconsin Foundation funds. To supplement this fund we sent out 2,000 hand signed letters to you, our alumni, requesting donations. This exercise has yielded many generous and substantial donations, for which we are very grateful. The success of this year's recruiting class is due in no small part to our use of supplementary money. I urge you to continue your support. A related news item in this regard is that the University has waived tuition payments for all TA's and RA's, with at least a $\frac{1}{3}$ time appointment, beginning this fall.

The companion assessment of the undergraduate program is planned for next year. As a part of this exercise the introductory course materials will be reviewed with an eye towards satisfying the needs of our students, and the curriculum for majors will be assessed to make physics appeal to a wider audience as a useful major.

So there has been lots going on. I must have left lots of things out, but this should give you a general idea. Check in again next year, and thanks again for all of your support. ❑

Lee Pondrom

Lee Pondrom
Professor of Physics
Chair of the Physics Department

Faculty Research Awards

Sau Lan Wu Winner of Vilas Professorship

Sau Lan Wu was one of six UW-Madison faculty appointed to a named professorship following campus-wide competition and approval by the UW System Board of Regents in May, 1998. Her Vilas Professorship began on July 1, 1998.

The Vilas Professorships are named after William E. Vilas, former UW graduate and Civil War hero who served on the UW law faculty and the Board of Regents. Vilas, who was also Postmaster General and Secretary of the Interior under President Grover Cleveland and a Wisconsin Senator, established a trust that has provided considerable support for a number of university activities. Vilas Professors receive $10,000 contributions to their base salary and $20,000 for expenses and special projects.

Sau Lan Wu

Wu is one of the discoverers of the gluon, a subatomic particle that is one of the fundamental building blocks of matter.

She joined the UW-Madison Physics faculty in 1977. Since 1990, she has had the title of Enrico Fermi Distinguished Professor of Physics. From 1986 to present, Sau Lan Wu has also been a Visiting Scientist at CERN in Geneva, Switzerland.

In 1996, Wu became an elected fellow of the American Academy of Arts and Sciences. Wu has also received the 1995 High Energy and Particle Physics Prize of the European Physical Society (individual) and the 1995 Executive Committee Special Prize of the European Particle Society. ❑

Cary B. Forest Sloan Foundation Fellow

Cary B. Forest, assistant professor of physics, was one of two faculty members who have been named fellows by the Alfred P. Sloan Foundation. The Sloan Research Fellowship Program was initiated in 1955 as a means of encouraging and supporting young scholars at a critical time in their careers. Each fellowship includes an unrestricted grant of $35,000 administered over a two-year period.

Forest also received a Research Innovation Award in the amount of $34,000 from the Research Corporation, Tucson, Arizona in support of his project entitled, *Design of a MHD dynamo.*

Research Innovation Awards are so named because innovation is a hallmark of much original research. They feel that "innovation may not be the safest course for the new faculty scientist, but it is through creative research that the beginning scientists may reach their full creative potential." Research Corporation seeks to encourage this activity by supporting proposals with plans that offer promise for significant discoveries.

Cary Forest

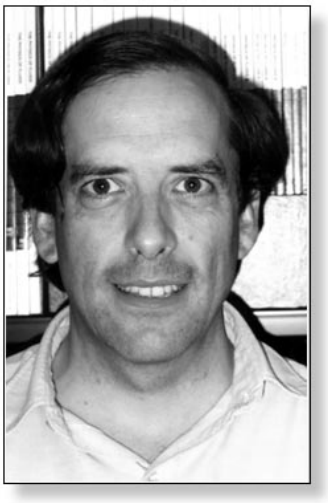
Forest joined the UW-Madison faculty in 1997. His research is focused on current and magnetic field generation in plasmas, phenomena of importance to understanding many aspects of space physics, astrophysics and geophysics. ❑

(from May 13, 1998, "Wisconsin Week")

New Vilas Associates

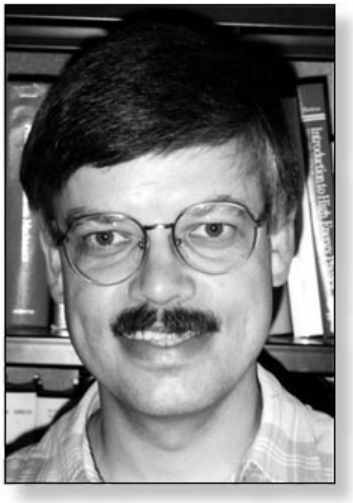
Both **Dieter Zeppenfeld** and **Paul Terry** became Vilas Associates in January, 1998. This recognition is made possible for tenured faculty by the Vilas Trustees. It provides for ⅔ summer salary for two summers, plus $5,000 in flexible research funding for two years.

Paul Terry, a member of the plasma group, received his Ph.D. at the University of Texas at Austin, TX in 1981. He joined the UW-Madison Physics Department in 1988 as an assistant professor. He became a full professor in 1994. He is also an elected fellow of the American Physical Society.



Paul Terry

Dieter Zeppenfeld received his Ph.D. in physics at the Universität München in 1984. In 1989 he became an assistant professor, followed by a full professorship in 1994. Other honors include being a Scientific Associate at CERN in 1995 and receiving a Romnes Faculty Fellowship in 1995. Zeppenfeld is a member of the phenomenology group. ❑



Dieter Zeppenfeld

Sabbaticals

Congratulations to **Ugo Camerini** (Fall 1998), and **Francis Halzen** (Spring 1999) for receiving semester sabbaticals and to **Jim Lawler**, who is on sabbatical for the 1998–99 academic year.

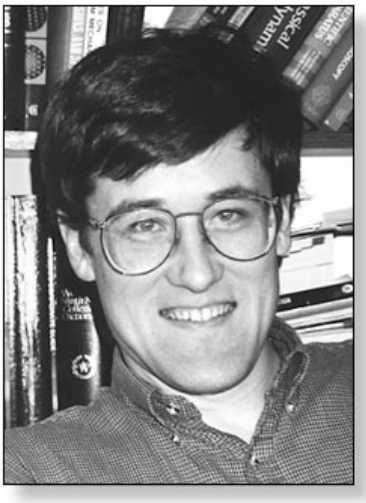
Returning from 1997–98 one year sabbaticals are **Baha Balantekin** and **Hakki Ögelman**. Welcome back! ❑

Faculty News

Promotions

Four Physics faculty received promotions during the past year. Thad Walker and Michael Winokur were promoted to full professors, while Andrey Chubukov and Mark Rzchowski became associate professors. Our congratulations to all!

Thad Walker received his Ph.D. at Princeton in 1988. He became an assistant professor (Atomic Physics) at UW in August of 1990; an associate professor in May of 1993. His research interests are in laser cooling and trapping of atoms: ultracold collisions, collective behavior, electron scattering, beta decay. Another interest is spin-exchange optical pumping.



Thad Walker

His teaching career has included courses in wave motion and optics, quantum electronics, introduction to modern physics, introduction to electronics, and applied optics.

Walker has received several honors in his career including the Romnes Fellowship (1996), the Packard Fellowship in Science and Engineering (1992), the National Science Foundation Young Investigator Award (1992), and the Sloan Fellowship Award (1991).

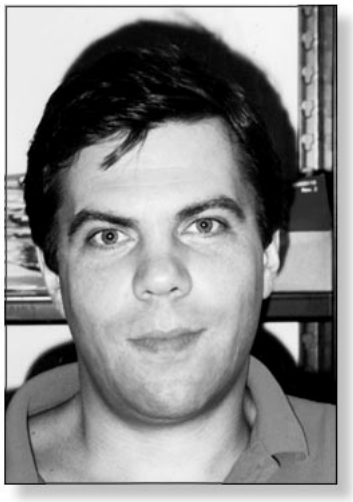
Michael Winokur became a full professor during the spring 1998 semester. He completed his Ph.D. in 1985 at the University of Michigan. He joined the department in August 1987 as an assistant professor, becoming an associate professor in 1993.

Michael Winokur

Professor Winokur has taught thermal physics, solid state physics, quantum mechanics, intermediate lab, and wave motion and optics. He has also been involved in recent computer lab development projects.

Winokur is a condensed matter physicist, specializing in polymer structures, especially x-ray and neutron diffraction studies and computer modeling of conducting polymer systems.

Andrey Chubukov joined the solid state faculty at UW-Madison in September 1993 as an assistant professor. He received his Ph.D. from Moscow State University, Moscow, USSR, in 1985.



Andrey Chubukov

Associate Professor Chubukov teaches statistical physics, advanced solid state, classical electrodynamics, mechanics, and many body problems in solid state physics in our physics program. His research interests are superconductivity, quantum magnetism, low-dimensional systems, Raman scattering in solids.

Associate Professor Mark Rzchowski is also a member of the condensed matter group. He came as an assistant professor in 1992. His Ph.D. work was done at Stanford University.

Mark Rzchowski

Rzchowski's research focuses on the Josephson effect in high temperature superconductors, and transport and magnetic behaviors of magnetic thin films and heterostructures.

He has taught thermal physics, electronics, modern physics, a new course in superconductivity, and solid state physics. ❑

New Faculty Members

Yibin Pan will begin as a new assistant professor in January of 1999. He is presently an assistant scientist in Professor Sau Lan Wu's group at CERN in Geneva, Switzerland. Pan received his Ph.D. in Physics from the University of Wisconsin in 1991.

During his first three years, Pan plans to divide his time between teaching in Madison, and working both at CERN and at Stanford on three different research projects: studies of e+e- collisions at the highest energies achievable by LEP with the ALEPH detector; preparations for the next generation of proton-proton collider experiments with the ATLAS detector now under construction at CERN; and a search for CP violation at the new B factory at the Stanford Linear Accelerator Center.

He will teach particle physics, 735, during his first semester. ❑

Change

Professor Jo van den Brand has resigned his UW-Madison faculty post. He will continue his work at The Free University of Amsterdam and at NIKHEF (Amsterdam). ❑

Obituaries

Emeritus Professor John William Anderegg passed away on February 2, 1998. He was born on November 12, 1923, at White Lake, Wisconsin. He completed his undergraduate and graduate work at the University of Wisconsin, receiving his Ph.D. in Physics at UW in 1952.

He began his career at the UW in 1957 as an assistant professor in physics, zoology and at the Primate Lab.

Professor Anderegg served for more than 33 years at the University of Wisconsin during which time he made many contributions to the Biophysics Laboratory and the Department of Physics. He had a profound influence in the field of biophysics, especially in small angle x-ray scattering. In addition, many students have benefited from his efforts and enthusiasm in developing the advanced laboratory course in Physics into a practical and popular learning experience. Some of his early courses included physics 75, general physics for biologists, physics 115, kinetic theory and thermodynamics, and physics 160, biological physics.

Professor William Allen Fitzsimmons, age 58, died on Saturday, May 2, 1998. He was born on February 21, 1940 in Canton, Ohio. He was the son of Albert and Mildred Fitzsimmons. Bill spent his childhood in Canton and his high school years in Toronto, Canada. He graduated from the University of Michigan in 1961 with a B.S. in mechanical engineering and physics. He continued graduate work at Michigan in nuclear physics and assisted in building a cyclotron, a major research project. He received his MS in physics in 1964. At Rice University in Houston, Texas, Bill changed his focus in physics to low temperature atomic physics. He joined the Physics Department at the University of Wisconsin-Madison as an assistant professor in September 1968. Bill became a full professor in 1972. In 1974, he cofounded the National Research Group (NRG) with L. Wilmer Anderson. Both men did the basic research for their product, a nitrogen laser, which was used as a research tool to detect particles in liquids. Bill published in various trade journals and had numerous patents. His memberships in organizations included the APS and The Madison Exchange Club. (from obituary, WSJ-Madison, WI)

Emeritus Professor Ragnar O. Rollefson, age 91, died on Tuesday, May 5, 1998 in Madison, Wisconsin following a prolonged illness. He was born in Chicago, Illinois on August 23, 1906, the son of Carl J. and Marie Rollefson. He grew up in Superior, Wisconsin and moved to Madison in 1924 to pursue his studies in physics at the University of Wisconsin. Rollie joined the faculty of the Physics Department at the University in 1930 and remained with the department for the next 46 years, serving as chairman of the department from 1947 until 1961. In 1936, he met and married Erna C. Brambora of Brooklyn, New York, with whom he shared his life for almost 62 years. Together they raised a family of four children. During World War II he worked with the Radar Laboratory at MIT and was Chief Scientist of the Naval Research Laboratory Field Station in 1946. He also served as Chief Scientist for the United States Army from 1956 to 1957; as acting directory of the Midwest University Research Association Development Laboratory from 1957 to 1960; and as Director of International Scientific Affairs for the US State Department from 1962 to 1964. Rollie retired from the University of Wisconsin Physics Department in 1976, but remained an active member of the department for many more years as an Emeritus Professor. A private memorial service was held on May 16, 1998. (from obituary, WSJ-Madison, WI) ❑

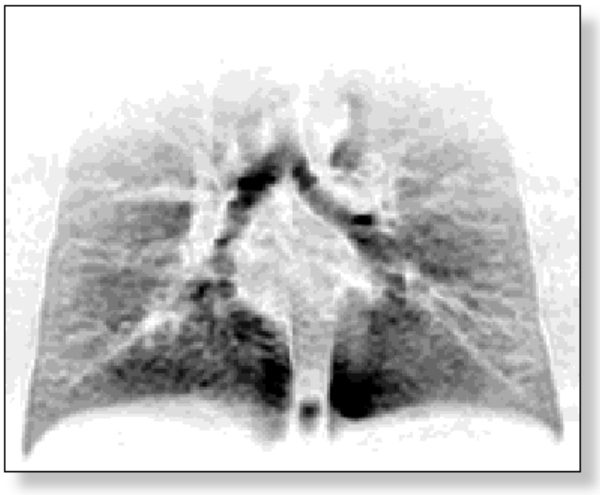
Physics Research

What do ultracold collisions have to do with medical imaging?

by Thad Walker, Professor of Physics

Two areas of intense interest in AMO (atomic, molecular, and optical) physics over the past decade have been ultracold collisions and hyperpolarized nuclei. Ultracold collisions are collisions between atoms that have been cooled by lasers down to temperatures of 100 microKelvin and below. These collisions are of interest because the collision times approach 1 microsecond (as compared to picoseconds at room temperature), making the collision pathways exceptionally sensitive both to very weak, long-range interatomic forces and to the presence of light. Since the characteristic interaction time for atoms with light is tens of nanoseconds, during ultracold collisions the atoms can potentially absorb and emit dozens of photons, and so the photons become an integral part of the collision dynamics. At Wisconsin, we have been fortunate to make a number of investigations into many unique features of these collisions.

Nuclei whose spins are polarized to a higher degree than thermodynamic equilibrium have been termed hyperpolarized. Hyperpolarized noble gases, such as ^{3}He, have generated great interest due to their uses in polarized targets for nuclear and high energy physics as well as their application to a novel type of Magnetic Resonance Imaging (MRI). MRI with hyperpolarized gases allows imaging of proton-scarce regions of the body, notably the lungs, and is complementary to conventional proton MRI. Though the density of the He gas is much smaller than that of protons in normal body tissue, the high degree of polarization (exceeding thermodynamic equilib-



An MRI of a human lung

rium by 5 orders of magnitude) more than compensates and results in an extremely high signal-to-noise ratio. Spatial resolution of 100 microns has been demonstrated on human subjects, and clinical trials of the method are pending.

Hyperpolarized ^{3}He is most often produced by the technique of spin-exchange optical pumping, where collisions between laser-polarized Rb or Cs atoms and the ^{3}He atoms transfer polarization from the Rb/Cs to the ^{3}He. This process takes place at typically 500K. Again, at Wisconsin we have been very active in studying the physical processes involved in hyperpolarization.

One might think that collisions at 500K and 5 microK (8 orders of magnitude) would be quite unrelated. For example, ultracold collisions often occur through a single partial wave while the trajectories for the hot collisions can be very accurately described using classical physics. However, a collaboration between scientists at Wisconsin, Princeton University, and the National Institute of Standards and Technology recently showed (Physical Review Letters, published in the Aug. 17, 1998 issue) that at both temperature extremes the spin-relaxation process Cs(+)+Cs(+)->Cs(-)+Cs(-)† is out of agreement with theory by about a factor of 16. Here the (+) and (-) refer to the two possible orientations of the electron spin of the Cs atoms. At low temperature, this process limits the number and temperature of trapped atoms and prevents (so far) the production of a Bose condensate of Cs atoms. At high temperature, this same process limits of the efficiency of production of hyperpolarized ^{3}He. Using the measured high temperature rates to scale the ab-initio theory, we were able to place the strongest constraints to date on the Cs-Cs scattering length.

It is interesting to note that the measured spin-relaxation rates, which are a factor of 16 larger than theory would predict for Cs, are a factor of 150 greater than theory for Rb! Understanding this gigantic disagreement is a major challenge for both theorists and experimentalists. At Wisconsin we are pursuing experiments that we hope will explain this mysterious effect, and enjoying every minute of it. ❑

†Those of you worried about angular momentum conservation will be glad to learn that the process changes the orbital angular momentum by two units.

Neutrino Physics and Astrophysics

by A.B. Balantekin, Professor of Physics

More than half a century after their existence was first postulated, we finally seem to be getting closer to understanding the elusive physics of neutrinos. Neutrinos started as a solution to a serious problem in some radioactive decays. In nuclear beta decay one of the neutrons of the decaying nucleus is transformed into a proton accompanied with the emission of an electron. Conservation of energy indicates that all the electrons in this decay should carry the same energy, determined by the mass difference between the neutron and the proton. However electrons coming from such radioactive decays are observed with a continuous energy spectrum. These observations can be accounted for by assuming that another undetected particle, the neutrino, shares the released energy with the electron. Later the existence of neutrinos was directly confirmed by using the inverse reaction where the neutrino from a nuclear reactor is captured by a proton, producing a neutron and a positron. Later experiments using higher energy neutrinos demonstrated that electron neutrinos are different from muon neutrinos — each charged lepton has its own neutrino. Their seemingly very small masses and feeble interactions with ordinary matter make neutrinos rather special. For a long time very little experimental information was available about neutrino properties, even though even a small neutrino mass has intriguing cosmological implications. The properties of the neutrino appear at long last to be yielding to an intensive experimental assault. Strong indications of neutrino mass and oscillations between different neutrinos are now seen in the solar-neutrino spectrum, in atmospheric neutrinos, and in recent accelerator neutrino experiments.

At about the same time when the existence of neutrino was postulated, the basic mechanism with which the sun and the other stars shine was elucidated. The energy radiated by the sun is released from nuclear fusion reactions among light elements taking place near the center of the sun. Most of this energy is carried away as light and other forms of electromagnetic radiation from the surface, but about 3% of the energy is emitted as neutrinos directly from the center, where nuclear reactions are occurring. The first experiment located in the Homestake mine has been detecting solar neutrinos for the last 30 years using radiochemical techniques and a cleaning fluid target which contains chlorine. The pioneering chlorine experiment was joined by several others within the last decade. One of these is the Superkamiokande water Cherenkov detector located in the Japanese Alps. In a water Cherenkov detector the incoming neutrino hits an elec-

tron, making it move faster than light does in water. Just like a Concorde plane emits a shock wave when it starts moving faster than sound in air, a high-energy electron, traveling faster than light in water will radiate photons in the form of a "Cherenkov cone" of light. The arrival times of these Cherenkov photons at optical detectors are used to reconstruct the direction of the radiating electron, hence the direction of the neutrino that hit it. A radiochemical experiment cannot detect the direction of the neutrino. An earlier version of the Superkamiokande experiment, named Kamiokande, established that the neutrinos are indeed coming from the sun, providing the first direct confirmation of the theories of stellar nucleosynthesis. Both Homestake and Superkamiokande are sensitive to somewhat higher energy neutrinos coming from the sun. In the last decade two radiochemical experiments using gallium (the GALLEX experiment in the Gran Sasso tunnel in Italy and the SAGE experiment in Southern Russia) have detected lower energy solar neutrinos. There are three components of the solar neutrino flux: with low (less than 400 keV), medium (about 1 MeV), and high (more than 7 MeV) energies. Low energy neutrinos are the primary component of the solar neutrino flux. The low-energy neutrino flux that the gallium detectors are sensitive to, is one thousand times more than the high energy neutrino flux, detectable at Superkamiokande and Homestake. Homestake chlorine experiment is also sensitive to the medium energy neutrinos, the flux of which is still one order of magnitude less than that of the low energy neutrinos. The flux of the low energy neutrinos is more reliably predicted than the rest.

The solar neutrino observations are not easily reconciled with the predictions of the standard solar model. All experiments observe a deficit. Except the gallium experiments, which agree with each other, the amount of the deficit is somewhat different for different experiments. Since different experiments are sensitive to different neutrino energies, this indicates that the amount of deficiency is energy dependent. Furthermore, it does not seem to be possible to change assumptions that go in modeling the sun to obtain a different neutrino flux. Indeed, with the presently achieved precision, a solar neutrino problem exists independent of any detailed model — with 95% confidence, no combination of low, medium, and high energy neutrino fluxes fits the experimental data. Comparison between the rates of different experiments suggest that a transformation, also called oscillation, between different types of massive neutrinos may be taking place. Superkamiokande directly observes the energy spectra of the solar neutrinos and results they obtain may distinguish between different oscillation scenarios.

More recently atmospheric neutrinos provided an even more spectacular evidence of neutrino oscillations. Atmospheric neutrinos are produced after a series of reactions which start when cosmic ray protons hit oxygen and nitrogen in the upper atmosphere. These ultra-relativistic nuclear collisions mostly produce pions with a distribution of energies. Some of those pions decay in the atmosphere into muons and muon neutrinos. If they have the appropriate energy some of these muons further decay into one electron, one muon neutrino, and one electron neutrino. Consequently one expects roughly two muon neutrinos for each electron neutrino. Careful consideration of the phase space does not appreciably alter this result. For a long time experiments have been seeing about equal numbers of electron and muon neutrinos. Zenith angle distribution of the atmospheric neutrinos correlates with the distance they traveled since they were created. By observing the zenith angle distributions of both muon and electron neutrinos Superkamiokande experiment confirmed that the longer distance muon neutrinos travel the more of their flux is lost whereas electron neutrino flux does not seem to change with distance. This result is consistent with muon neutrinos oscillating into a third species.

There are many profound astrophysical implications of these recent results. In particular, the neutrino mass scale hinted at by these new data would imply that neutrinos form a significant (though subdominant) fraction of the dark matter on very large scales. This is tantalizing, since it is in accord with at least some interpretations of the COBE observations of anisotropy in the cosmic microwave background radiation. Since neutrinos interact weakly they play a very important role in a number of astrophysical phenomena. Weakly interacting neutrinos can easily carry energy away from hot regions of the cosmos. For example, they cool the hot proto-neutron star formed after the collapse of a type II supernova. Such supernovae are currently considered to be prime candidates for the r-process nucleosynthesis. (Most nuclei lighter than iron are formed either during the evolution of the early universe or stellar evolution. Most nuclei heavier than iron are formed in the r-process where neutron capture on a series of nuclei is followed by beta decay). Details of both primordial and r-process nucleosynthesis depends on the ratio of protons to neutrons, which in turn is controlled by the ratio of electron neutrinos to electron antineutrinos. Since the neutrino oscillation phenomena can significantly alter the latter ratio, it can put strong restrictions on the distribution of elements.

There is a very strong interest in the Physics Department in neutrino physics and astrophysics. The theoretical nuclear physics and astrophysics group is investigating

neutrinos of astrophysical origin (solar, atmospheric, and supernova neutrinos) with energies less than about 1 GeV and neutrino propagation in dense media. The phenomenology group has an ongoing interest in neutrino phenomenology. The Amanda group is currently running an experiment in Antarctica designed to detect yet higher energy neutrinos that may come from active galactic nuclei and other sources.

Very rapid developments in neutrino physics and astrophysics make a medium such as the World Wide Web more suitable for keeping up with the recent work. The home page of the theoretical nuclear physics and astrophysics group (**http://nucth.physics.wisc.edu/neutrinos/**) and the special home page at SLAC (**http://www.slac.stanford.edu/slac/announce/9806-japan-neutrino/**) may be useful starting points. ❑

The Puzzle of Supernova Remnant W44

by Don Cox, Professor of Physics

Since my latest paper is just on its way to the Astrophysical Journal for nitpicking, it's also on my mind. Perhaps you alums might be interested in hearing about the research in which I have just invested two years of my life.

The paper is about a supernova remnant called W44 that has had people perplexed and stumbling over themselves to understand for several years, with new observations pouring in all the time. Its emission has been studied in radio continuum, 21 cm radiation from hydrogen, x-ray emission from its hot interior, Balmer alpha and forbidden sulfur lines, infrared continuum and a line of neutral oxygen, gamma rays, and OH masers. Its most perplexing aspect is that the x-ray emission comes mainly from the middle rather than the denser outer edge as usually seen in remnants. People have dreamed up all sorts of reasons why this thing looks as it does, including postulating a population of evaporating clouds in the middle, and bashing into very high density molecular clouds at the edge. I think they have been badly misled.

Our team's model is that the explosion occurred in a denser than normal part of the interstellar medium (about 6 times average density), where the density had a fairly substantial gradient (a factor of 3 from one side of the remnant to the other). Including thermal conduction (a process often ignored out of misguided prejudice), the density of the center is high enough at present to generate the x-rays seen, the temperature of the dense outer part is too low to make x-rays, and all the other emissions arise naturally from the very dense shell of already cooled material on the outermost surface of the denser half of the remnant. Voila! Or darn near anyway. The list of authors includes three UW alumni: Robin Shelton, Randall Smith (who is off in England getting married), and Andrew Pawl who just finished his BS and is soon headed to Michigan for grad school.

OK, so Andy isn't headed to Michigan all that soon. He stayed here this summer to finish up his senior honors thesis project — we are trying to see whether radiation pressure of Lyman alpha escaping from quasars and young galaxies will create structures in intergalactic space that will contribute appreciably to the neutral hydrogen wisps seen in absorption against distant quasars. The structures are so common along the long sight lines that the spectrum of a quasar looks like a forest of lines. Andy refers to his project as making the trees. It would have been done long ago but he, like I, got (happily) buried by the W44 project this year. ❑

Instructional News

Computing Integration Continues

by Ugo Camerini, Professor of Physics

As we move with astounding speed toward the 21st century, we are working to develop opportunities for a variety of interactive computing experiences for students in our introductory labs. As we have told you in previous newsletters, several faculty have been dedicated to making this change over happen in a timely manner by writing Instructional Lab Proposals, receiving funding, integrating developed software programs from Pasco and Lab View into our regular lab experiments, and working on creating new laboratory manuals. Needless to say, this is a major task.

We would like to take this opportunity to report on the status of our work thus far. Introductory physics laboratories in 103 are now running. In addition, I have begun the work of computerizing laboratories in 104 and will continue to work on this project through the fall 1998–99 semester. When completed, these laboratories will serve a total of about 1,600 students during an academic year.

Computerized Physics 109 labs, involving the physics of music and color, will be available to students in the fall 1998–99 semester. We currently run 15 laboratories in 109, with a standing waiting list of up to 200 students.

This past year, we wrote a proposal for the upgrading of physics 201 laboratories. We were extremely pleased

when the College considered that proposal as the top priority for lab modernization. Professor Don Reeder is working on the computerization of these 201 labs.

Physics 207 and 208 remain somewhat in the development stage, with beginnings of a new Web-based lab manual, from Professor Michael Winokur.

We maintain a very strong departmental philosophy relative to our instructional laboratory development. It is our goal to offer both traditional experiences and to take advantage of innovative computing in areas which enable students to deepen their learning opportunities. ❑

NSF-Sponsored Collaborative Learning Experiment to Include Physics

Wes Smith has agreed to act as physics facilitator and developer of a new learning experience for engineering students in Physics 201/202 (General Physics for Engineers). He will join with college faculty at six other partner institutions across the country in an effort to bring a new approach to teaching through the National Science Foundation's Engineering Education Coalitions Program.

There will be four primary thrusts to this program including integration of subject matter within the curriculum, cooperative and active learning, technology-enabled learning, and continuous improvement through assessment and evaluation.

This new learning approach uses a variety of names — collaborative learning, cooperative learning, active learning, small group learning, and problem-based learning. Cooperative learning actively engages students in their own learning process, encourages critical thinking and helps students retain what they've learned. It introduces true scientific practice, creates cultural and gender diversity through supportive learning environments and promotes lifelong science literacy.

UW-Madison is one of two new campuses (the other is UMass-Dartmouth) joining the program at this time. Under a new five-year NSF grant, several departments, including Chemistry, Math, Engineering and Physics, will be teaming up to enable inclusive Learning Communities of students, faculty and employers with common interests who will work as partners to improve the engineering educational experience.

For further information on this new approach to teaching go to **http://www.wcer.wisc.edu/nise/CL1** ❑

• Editor's footnote: If you are interested in learning more about collaborative learning, I might suggest three new publications from faculty who were invited speakers at the NSF-sponsored Engineering Education Scholars Program held in Madison this summer: Lillian McDermott, Professor of Physics, University of Washington and Karl Smith, Professor of Civil Engineering, University of Minnesota.

K. Smith has published "New Paradigms for College Teaching," by Campbell & Smith, ISBN: 0-0939603-26-8. McDermott is the author of "Tutorials in Introductory Physics," (Prentice Hall) for college-level instruction and "Physics by Inquiry," (John Wiley & Sons) a set of laboratory-based instructional modules for elementary through high school teachers to improve science teaching.

Undergraduate Peer Mentor Tutor Program Aids "At-Risk" Students

During the past two semesters, Physics, in cooperation with the Chemistry Learning Center staff, has participated in a Peer Mentor Tutor Program in which senior undergraduates have the opportunity to act as mentors and tutors for at-risk students in Physics 103 (fall semester) and Physics 104 (spring semester). Tony Jacobs of the Chemistry Learning Center has been working with Physics PMT's to create an effective continuing program. The Physics portion of this program is housed in 1416 Sterling Hall during the 1998–99 academic year, with post doc Susan Nossal acting as part-time director.

Although the size of the program is small, the participants perceived a large difference in getting through their physics course requirements. A survey completed at the end of the second semester showed a "larger than usual" inhibiting factor for "at-risk" students in approaching a TA or faculty member for extra help when they didn't understand a physics concept. On the other hand, having a one-on-one undergraduate mentor-tutor to talk to provided them with a comfortable opportunity to ask questions and better grasp the idea.

In addition to approachability, "at-risk" students liked Peer Mentor Tutors because they helped them learn how to think faster about problem solving, they explained the

concepts in plain English, they helped them clarify the problems and focus on important topics. They also liked having additional ways of viewing the ideas presented in class. . ❑

Disney Hosts Physics Wonders

The Wonders of Physics program, aimed at generating interest in physics among the public, celebrated its fifteenth anniversary this year. Over that period, **Professor Clint Sprott** has presented the program 127 times to a total audience of about 35,000. In addition, a traveling show, staffed by graduate students and others has been taken to over 300 schools and other settings.

The presentations have gained a national reputation, and have been taken to Illinois, Iowa, North Dakota, Colorado, Connecticut, Pennsylvania, and Florida, as well as throughout Wisconsin. A highlight this year was a week-long series of presentations made by Roger Feeley at the Disney Epcot Center in Florida. Thousands of people from around the world were entertained and enlightened by this important outreach program of the Physics Department.

Hour-long videos of the yearly public presentations are available from the Physics Department for $25 and would make an excellent gift for a youngster. Call (608) 262-2927 to request a listing of available videos and instructions for ordering. Since the program is entirely supported though donations, perhaps you would like to include it in your charitable contributions. ❑

•Mark your calendars now!

Madison Physics Symposium

(A special event for alumni, faculty, students and staff.)

In connection with the UW Sesquicentenial and the 100th anniversary of the first Ph.D. in Physics, the Department will sponsor a two day symposium on "Physics in the 21st Century." The event will be held at the Wisconsin Center on October 8 & 9, 1999 (Friday and Saturday). Speakers will be giving talks on the future of physics research in the various subfields represented in the department. There will also be a lecture by Professor Bob March on the history of the UW Physics Department and a report by Lee Pondrom on current departmental activities and plans for the future. Several social events are also planned with the symposium. You will receive a direct mailing with details in 1999.

(from Alumni and Corporate Relations Committee)

Graduate Student Report

by Barb Schutz, Graduate Secretary

Last year, we talked with you about the many changes in the Graduate Program. We are continuing with recruiting initiatives (i.e., visit reimbursement, Van Vleck Welcome Fellowships of $2,000, etc.) and have now seen our second very successful year in a row for incoming graduate students.

Here is the 1998 recruiting year tally. A total of 99 offers (65 domestic, 34 international) were made to 228 applicants (88 domestic, 140 international). We will have 30 new students this fall (19 domestic, 11 international), including 5 women. This is the largest segment of new women graduate students since fall of 1992 when we had an incoming class of 44 (also a record!), including 6 women.

Meanwhile, let's look at who is going out the door. In 1996–97, the Physics Department awarded 20 Ph.D. and 15 MS/MA (5 terminal masters's) degrees. This is compared to 21 Ph.D. and 5 MS/MA (1 terminal master's) degrees in 1997–98. [The 1997–98 figures include only December 1997 and May 1998 degrees, whereas the 1996–97 figures include all three semesters (December 1996, May 1997, and August 1997)].

What's new? Our Web site (www.physics.wisc.edu) was entirely revamped this past year, and we are currently in the process of revising the Graduate Program brochure. We invite you to visit the Web site and provide us with any feedback you wish. This is an ever-changing project, and we welcome your comments. Many of you have already expressed your wish to have a "hot" button linking our Web site to your homepage by checking "Yes" on the recent alumni directory survey which was mailed during late May and June. We thank the more than half of our survey recipients who have already responded, and urge the others to take a few minutes to complete and return the form. Our intent is to print a Ph.D. Directory based on the information you provide.

We look forward to another good year and encourage you to continue your efforts in helping us to attract the very best students to our Physics Graduate Program. You can really make a difference! ❑

Graduate Student Honors

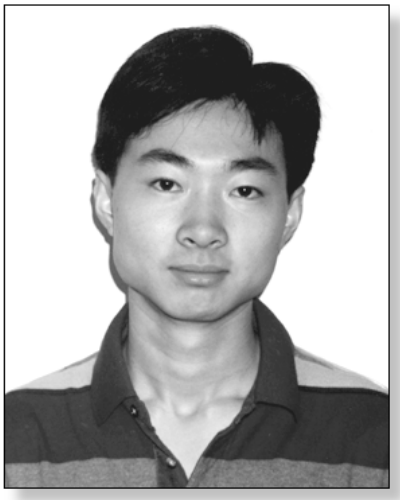
Rellen Hardtke has won a four-year fellowship from Department of Energy Computational Science Graduate Fellowship. Rellen is working with Professor Francis Halzen.

Chris O'Dell (Peter Timbie) and **Amy Lesser** (Dan McCammon) are each recipients of a NASA Graduate Research Program Fellowship. ❑

Piore Prize Winners

Two outstanding physics graduate students, Kun Qian and Xiaowei Wu, were awarded the Piore Prize on May 1, 1998 for excellence in their first year of graduate study.

Kun Qian received his B.S. degree in Physics from Peking University in Beijing in 1997. As an undergraduate, he won prizes for excellent student scholarship and an excellent senior thesis. In Madison, Kun likes the idea that the whole class is struggling with homework at the same time in core courses like Jackson's Electrodynamics. Kun was also a teaching assistant in Physics 202 during his first year.



Kun Qian

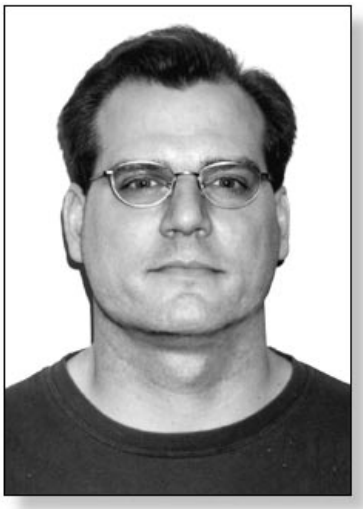
Outside of physics, Kun is interested in reading and sports. He plays soccer in a top team called the Eagles in UW-Madison tournaments, as well as Madison City League.

Xiaowei Wu received her BS in Physics from Nanjing University in 1994. She received an MA in Physics from Johns Hopkins University in Baltimore in 1997. Her research interest is in solid state physics, and she is currently working with Professor Mark Rzchowski. ❑

Dillinger Awards

This year's Dillinger Award was presented to two outstanding teaching assistants in the department, Kevin Mirus and Tae-Ogg Yoo. Many thanks to the Dillinger Family for making this award available!

Kevin Mirus began his outstanding teaching career in 1990, an incoming graduate student in physics. Because of his dedication to teaching, Kevin donated his time over many semesters to assisting new graduate students in learning the basics of becoming good teaching assistants.



Kevin Mirus

He has also served as a member of the teaching assistant review committee for many years.

As Kevin neared the end of his graduate career, he returned for one more semester of teaching in fall 1997. At that time he received an "excellent" ranking among the department's TAs. Upon further investigation, we found that Kevin had received only "excellent" ratings during all of the semesters he taught! Kevin's research work has been with Professor Clint Sprott.

Tae-Ogg Yoo's teaching career centered around Physics 307, 308 (intermediate labs) and 321 (electric circuits and electronics). Faculty teaching these courses were most grateful for Yoo's excellent teaching assistant skills. His students expressed much satisfaction with his technical assistance. His major professor has been Charles Goebel.

Congratulations to **Chuang Ren** upon becoming a member of Sigma Xi and to **Matthew Callaway** for being selected as an alternate in the 1998 L&S Teaching Fellows competition.

John Fons

A big thank you and "good bye" to **John Fons**, who, by himself for many years and along with **Kevin Mirus**, served as graduate student teaching assistant trainers. John and his family left Madison in July to take a job as Laboratory Supervisor at Case Western Reserve University, Lyndhurst, OH. ❑

Masters' Degree Recipients

Recent Masters' Degree recipients include Robert Oeckl, Jay Anderson, Amihan Huesmann, Amy Lesser and Dmitri Petrovykh. ❑

New Physics Ph.D.'s

Fall 1997

Bhattacharya, Arnab
"High power near resonant 1.55 μm InGaAsP/InP antiguided diode laser arrays" (Winokur/Botez) Guest Scientist, Ferdinand Braun Inst. Rudower Chaussee, Berlin, Germany

Borumand, Majid
"Topics in astrophysics of compact objects" (Kluzniak), Graduate Student, UW-Madison, School of Business

Chapman, Brett
"Fluctuation reduction and enhanced confinement in the MST reversed field pinch" (Prager) Postdoc, UW-Madison, Dept. of Physics

Mao, Guomin
"Structural studies of alkali metal intercalculated poly (paraphenylenevinylene)" (Winokur) Postdoc, Argonne National Lab, Argonne, IL

Nachtman, Jane
"Search for charginos at square root s=161 and 172 GeV with the ALEPH detector" (Wu) Postdoc, UCLA Physics/Astronomy Dept., Los Angeles, CA

Zhang, Liqun
"Search for w pairs in pp collisions at square root of s = 1.8 TeV" (Carlsmith), MS Candidate, UW-Madison Computer Sciences Dept.

Spring 1998

Grahl, James
"Z lineshape measurement with the ALEPH detector" (Wu), Postdoctoral Associate, CERN, Geneva, Switzerland

Jaloviar, Steven
"Sources of optical anisotropy from the Si(001) surface" (Lagally), Senior Processing Engineer, Intel, Hillsboro, OR

Kinnel, Timothy
"Hadronic energy flow in charged current neutrino scattering" (Smith)

Lee Alardin, William
"Hydrodynamics of the coalescence of a black hole with a neutron star" (Kluzniak), Associate Investigator, UNAM, Mexico, DF, Mexico

Mullman, Krista
"Absolute oscillator strengths in the ultraviolet and vacuum ultraviolet" (Lawler), NRC/NIST, Postdoctoral Research Associate, NIST, Gaithersburg, MD

Rebei, Adnan
"Beyond RPA: An effective action approach" (Goebel), Graduate Student, UW-Madison, Computer Sciences Dept.

Zhou, Yong
"Measurements of differential cross section and various spin observables for deuteron helium3 elastic scattering at 6 MeV" (Knutson), Research Associate, UW-Madison, Medical Physics Dept.

Summer 1998

Boffard, John
"Experimental measurement of electronimpact excitation cross sections out of rare gasmetastable levels" (Lin), Postdoctoral Research Assistant, UW-Madison, Physics Dept.

Fons, John
"Determination of xenon emission cross sections and the origin of their anomalous pressure dependence" (Lin), Laboratory Supervisor, Case Western Reserve University, Lyndhurst, OH

Lorentz, Bernd
"Measurement of pp elastic scattering at 197 MeV with longitudinal polarized beam and target" (Haeberli), Postdoctoral Research Assistant, UW-Madison, Physics Dept.

Milbrandt, Rodney
"Phantoms add materials for performance testing of H magnetic resonance spectroscopy of brain" (DeLuca/Madsen), Visiting Assistant Professor, Loras College, Dubuque, IA

Mirus, Kevin
"Control of nonlinear systems via periodic parametric drive" (Sprott), Consultant, Corporate Technology Solutions, Wauwatosa, WI

Ren, Chuang
"Studying tearing modes via electron cyclotron emission in tokamaks" (Callen), Postdoc, UW-Madison, on assignment with General Atomics, San Diego, CA

Zhang, Haibo
"Measurement of the positron proton neutral current deep inelastic scattering double differential cross section at high Q2" (Smith), Research Assistant, METRO Information Services, Altamonte Springs, FL ❑

UNDERGRADS

Undergraduate Report

by Don Cox, Professor of Physics & 1997–98 Coordinator of Undergrad Programs

Hello again ye noble alums and cheers from a truly beautiful Wisconsin summer.

So, what about the undergrad program? Lately I think the best part by far is the chance we have to do research together. (Please see my research article on page 10.) Undergrads who get involved with good projects have an enormously valuable experience.

But we still have classes and a curriculum. As usual, there isn't much changed from what you remember, but the department is involved in a huge evaluation at present, kicked off by our spending an enormous amount of time evaluating ourselves this past year. Naturally we find ourselves to be quite wonderful, with, OK, room for improvement here and there. Having done much of the writing on the undergrad program self study, I could regale you with text galore, but I won't. The bottom line is that we need an oversight committee that is a good deal more responsible (and powerful) than me to marshal our hopes into actions. And that committee has recently been appointed and begun some of its work.

We also conducted exit interviews of graduating seniors and got some very good and occasionally pointed suggestions about things that could be altered to the good. I've shared some of these remarks with you in the past; again I'll spare you this time.

Many of our relatively few graduating seniors had extremely high academic marks and have been recipients of awards over the last couple of years. I assume this year's crop will appear elsewhere in this publication. Others didn't get into the awards finals but still did very well. It's been a pleasure to know such folks.

We're interested in expanding the numbers of our majors — it's rather remarkable how few we have for a university of this size. Every year I read in a supplement to the Wisconsin State Journal about the graduating high school students from the state who have been selected for special mention, maybe National Merit finalists. And every year I notice that a fair number mention that they plan to study physics, many not at UW but many here. And I know, not having been a National Merit finalist myself, that there are others out there with similar intentions (although I personally always intended to become an engineer, and did, before switching to physics in grad school). So, there seem to be people headed our way who are somehow finding themselves diverted. Maybe they get captured somewhere else in the huge manifold of interesting intellectual pursuits that open up before them when they reach the university, or maybe we fail to excite them all that much in our earliest courses, or maybe we just don't act interested enough in them personally to warrant their continued allegiance.

I've previously reported on a couple of things we've tried, perhaps the most useful being our annual Find Our People Meeting during which we introduce many of ourselves and insert into the eager hands of those who come, our Physics Majors Handbook (for which now graduated and heading to Columbus, Ohio, Jennifer Tate deserves an enormous amount of credit, along with, as always, Jean Buehlman who tends to make things go in the right direction around here).

If we could not only collect their E-mail addresses and interest them in early involvement in the Physics Club, but also get the proto majors set up with meaningful mentors in the department, maybe we'd get somewhere. I guess we need to do a better job making SOAR aware of the needs of our people too.

As usual, suggestions are welcome.

For three years now I have participated in a program called Creating a Collaborative Learning Environment, learning about learning. I think I've finally gotten far enough along to quit for a year and try to see what to do with what I've learned.

Being out of time, I'll close with one small thing from my 207 class this year. I was trying to make the point that part of doing physics for real involves forcing the physical world around you to make sense, and to involve yourself in measuring when you want to know something. The students brought in burned out light bulbs and we addressed the question of how dangerous, or not, that it is to break one. What is the pressure like inside? Do they implode violently when shattered? How far do the fragments fly? We broke a lot of bulbs. Even veteran physicists were surprised at the answers. That includes me. Try wrapping one in plastic wrap before mashing it lightly, for example.

Time to run — nice chatting with you,

Don ❑

Undergraduate Majors Stats

Yes, determining the number of undergraduates who are really majoring or planning to major in physics is always just an uneducated guess. Why? Our undergraduate population has a tendency to declare on their way out the door, often as seniors.

The spring 1998 snapshot looks like this: a total of 45 physics majors, of which seven were women and 38 were men. Of this group, 35 were seniors, six were juniors and four were sophomores. This is compared to spring one year ago when there were 31 declared physics majors (24 seniors, six juniors, one sophomore). Note that six junior majors grew to 35 seniors the next year.

In AMEP, there were 22 majors compared to 16 one year ago. ❑

Undergraduate Awards

Radtke Award Winners

Stefan Gerhardt, Sandy Eng, Shashank Misra and Russell Hart were all recognized for their outstanding efforts as physics undergraduates in our departmental Awards Day ceremony held on May 1, 1998. This year the Physics Department was able to provide four awards of $1,000 to each of these outstanding undergraduates.

The Radtke Award was established by a bequest to the University of Wisconsin by the late Mrs. Elizabeth S. Radtke in honor of her husband, August A. Radtke. The Radtke Award is given during the spring semester to outstanding junior or senior students majoring in Physics or Applied Mathematics, Engineering and Physics (AMEP).

Sandy Eng

Each of the winners was asked to provide us with a glimpse of their personal passion. Below are the results:

Here's **Sandy Eng**…in a nutshell. She came to Madison from tiny Hartland, Wisconsin to study physics and is now a junior on her way to being a senior. When she's not studying, she enjoys reading and running, though not at the same time. When she has the money, she can be found flying lightweight planes as well as jumping out of them. Her career goal is to teach physics to anyone who wants to learn. (Sandy has started practicing for this job as a Peer Mentor Tutor during the past year. In the PMT program, physics undergraduate majors are teamed up with four to five "at risk" students from Physics 103 or 104. She provided small group support and tutoring for these students and helped them "survive" introductory physics.)

Shashank Misra is the son of Devendra Kumar and Ila Misra of Milwaukee, Wisconsin. He and his parents emigrated from India in 1980 so his father could pursue his graduate studies in electrical engineering. Ten years later his mother has also earned a Ph.D. in biochemistry. Shashank is planning to begin his graduate work at the University of Illinois, Urbana/Champaign in experimental condensed matter physics. Over the last three years he has worked in Professor Duncan Carlsmith's high energy lab and, most recently, in Professor Marshall Onellion's solid state lab. He found that because he also took classes in many of the other sub-fields, he became interested in physics in general. Corny as it might sound, he feels he actually got to experience "sifting and winnowing" opportunities during his educational experiences.

Stefan Gerhardt is from Wichita, Kansas, and majored in Applied Math, Engineering, and Physics. During the summer of his sophomore year, he won the National Undergraduate Fellowship in Fusion Science and worked at the MST group for Dan Den Hartog. He will attend Electrical Engineering graduate school in the fall, and work for the HSX Stellerator group.

Stefan Gerhardt

Russell Hart has always been interested in the study of physics. Here at the University of Wisconsin, he has majored in physics and math and has been involved in physics research. He has worked in plasma physics for Dan Den Hartog. His research involved building some of the instruments and electronics used to gather data on impurities in the plasma generated in the Madison Symmetric Torus. He has written a computer program to compile data on the characteristics of the plasma so he could correlate the appearance of certain impurities with different plasma conditions.

Russell Hart

Russell has also worked in atomic physics for Professor Thad Walker. He designed and built a Fabry-Perot spectrum analyzer to be used as a diagnostic of lasers in the lab, and he helped with the building and testing of an atomic funnel, a funnel to hold an atom trap. He is currently working on a thesis project, the study of stimulated Raman spectroscopy of ultra-cold Rubidium atoms. He plans on going to graduate school in physics and hopes to eventually conduct his own research.

As you can see, we have very diversified and interesting undergraduate majors. We are pleased to have the opportunity to recognize them for their excellence. ❑

Fay Ajzenberg-Selove Award

You could just feel the excitement in the air when the Department of Physics called a young woman named Jennifer Covington to tell her she was the 1998 winner of the Fay Ajzenberg-Selove Award.

This was the second time the department has had the honor of making this special undergraduate award. This award was first initiated in 1997 by Fay Ajzenberg-Selove for the purpose of encouraging young undergraduate women in physics.

Jennifer Covington

Jennifer is a most interesting winner. She indicated that she first realized that she should be a physics major during a faculty concert she was attending at Beloit College. When she recognized that she was thinking about how much force it would require to tip over the piano instead of listening to the beautiful music, she was a little disturbed, but she smiled to herself.

"Physics," she says, " is not just a discipline, it is a way of approaching the world."

She sees cause-and-effect relationships in almost everything, and when she is not thinking about those, she keeps wanting to take things apart in order to explain them. Luckily, she knows she's not the only one. Peeking in rooms around Sterling and Chamberlin, she sees professors doing all kinds of manipulations to all sorts of matter when they are not helping out students like her. She still marvels at how the natural phenomena they are studying can be explained with equations, and she is so excited to be studying in a place where so much research and discovery is going on!

She sounds like a future woman scientist.

Fay Ajzenberg-Selove would like her! ❑

College Awards

Two female physics undergraduate students have been recipients of 1998 Sophomore Summer Honors Grants. **Alexandra Pettet** is working on "The Josephson Effect in High Temperature Super Conductors" with Associate Professor Mark Rzchowski. **Jodi Supanich** is working on "The Perfect Window" with Assoc. Professor Peter Timbie. ❑

Campus Awards

Once again, several physics undergraduate students who are interested in research experiences were successful in obtaining Hilldale Undergraduate Research Awards for 1998–99.

The following advisers and their students will participate in projects in the upcoming school year:

Andrey Chubukov — Nathan Gemelke

Cary Forest — Jonathan Goldwin

Marshall Onellion — Scott Christensen

Frank Scherb — Andrew Steffl

Thad Walker — Russell Hart

The faculty adviser of each student will receive $1,000 for expenses related to the undergraduate research project. ❑

University Physical Society

by Karen Lewis, President

The first item of news is that Jennifer Tate, the physics club president for the past three years has graduated. (We couldn't convince her to stay!) However, at the spring picnic five new officers were elected; myself, Beth Petrus, Angel Klohs, Lisa Weltzer and Nate Gemelke.

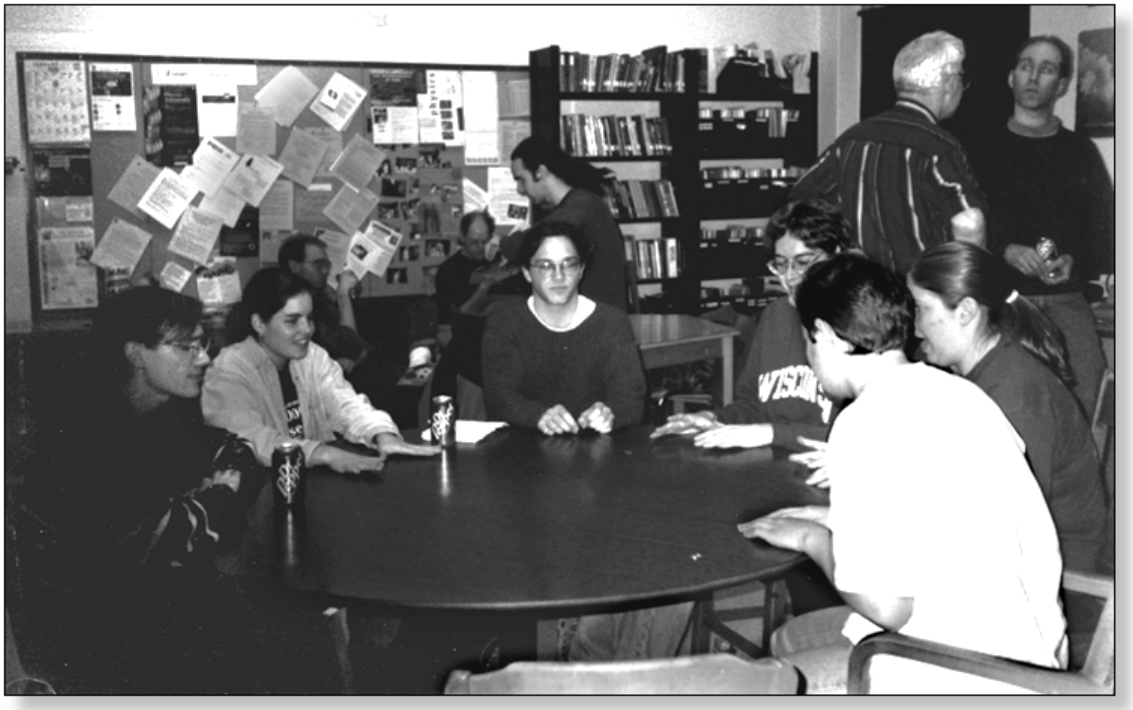
We had an extremely busy year with a full calendar of events both in and out of the club room. The year kicked off with the traditional liquid nitrogen ice cream party. We developed some interesting new ice cream flavors and colors that will never be recreated (thankfully!). The club's advisor, Peter Timbie, demonstrated his ability to "drink" liquid nitrogen. We also had several pizza parties throughout the year that were open to all students, faculty, staff and their families. We were pleased with the faculty and staff turnout at these events.

This year the physics undergrads were given the golden opportunity to meet with the weekly colloquium speaker. We discussed the colloquium topic in a relaxed "question and answer" setting. The speaker also shared his/her thoughts on physics, graduate school, and life in general. There was a group of a dozen UPS members who came every week; we all found this experience to be spectacular. This type of interaction complemented our course work by applying what we learned, along with some new concepts, to a real research project. A main achievement of this weekly event is a rather sizable undergrad attendance at the colloquium, which is quite impressive for a Friday afternoon event. Although few of us understood the entire talk, the exposure to so many ground-breaking ideas has been truly inspiring. After sitting in a classroom all week, this Friday event is an excellent reminder of why we study physics. The physics club sincerely hopes that the department will continue this event in future years.

At the end of the semester, the department received several high quality telescopes from Nicolet. The department has given the physics club "first picks" of the equipment which we plan to use in a research project. We are currently in the brainstorming stage. From what we can tell from the drawings, we have terrestrial infrared telescopes with a magnification of three. If you know of any exciting projects that could be done with these telescopes, please contact me at lewis@cmb.physics.wisc.edu.

As usual, the physics club provided drop-in tutoring hours which seem to be well populated this year. We had several donut/coffee sales at the end of the year which turned out extremely well. It seems we have found a weakness for donuts in the department which we plan to exploit several times next year! On the lighter side of things, we have had many club outings and parties. There was a Halloween party as well as a few Saturday night movie marathons in the spring. We began playing volleyball fairly regularly in the spring and there is talk of a co-ed soccer team in the fall.

In general, it's been a great year and we look forward to more great times next year! ❑



UPS students gather to discuss weekly colloquium topic.

PHYSICS FUND DRIVE

THANK YOU! THANK YOU! THANK YOU! THANK YOU!

The following alumni, faculty, and friends contributed to the Physics Graduate Student Recruiting Fund and Physics General fund between July 1, 1996 through July 15, 1998. To find out more about all physics funds, please read the information on the following pages. Please continue your generosity. We greatly appreciate your financial help!

Physics Graduate Student Recruiting Fund Donors

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Graduate Fellowships

Lily Chen
Jeff Chen

❑

Physics Student Endowment Fund

A super big "thank you" to every faculty, alumni and alumnae, and friends who responded to our Physics Student Endowment Fund Drive this past year. As of the current date, we had received gifts amounting to $8,825 as a result of our personalized mailing campaign last November. **The need continues**. Your gifts have enabled us to remain more competitive with other research universities to continue to attract the best students from a dwindling student pool. (The 1997 incoming graduate class numbered 28 students, while the incoming 1998 fall class has 30 new graduate students.)

In addition, as you may remember from your own University days, the State of Wisconsin did not allow us to provide students with full tuition remission. Students that had a minimum of a 33⅓% appointment were able to get out-of-state tuition waived, but still had to pay substantial in-state fees. During the past academic year, as a result of actions by the Teaching Assistant Association, the Wisconsin Legislature passed a bill changing that policy for teaching assistants initially, and later for research assistants. Now students with a minimum of 33⅓% appointments get full remission…but their pay rate has been lowered. Students can now more easily compare our support across the board with other educational institutions who adopted this policy long ago. The ultimate results remain to be seen. Meanwhile, we must keep recruiting the best students — and as it currently appears, still continue to supplement the offers with gift funding. Your help would be greatly appreciated.

In addition to the Student Endowment Fund and the General Fund, we continue to receive support for the following major funds established over the past four years:

- ***NEW*** **— Raymond G. & Anne W. Herb Fund —** established to promote advances in materials science. This fund was created by the will of the late Ray Herb, who had a distinguished career as a member of the Physics Department faculty. It will be used for graduate fellowships to attract the best students to our condensed matter research program.
- **Fay Ajzenberg-Selove Scholarship Fund for Undergraduate Women**
- **Jeff and Lily Chen Graduate Fellowship Fund**
- **The Elizabeth S. Hirschfelder Fund for Graduate Women in Mathematics, Chemistry & Physics**
- **Joseph Dillinger Teaching Assistant Award Fund** — to be awarded each year to the outstanding teaching assistant.
- **Hallett Germond Annuity Fund** for physics and math graduate student support.
- **Cornelius P. and Cynthia C. Browne Endowed Fellowship Fund** for physics graduates interested in Experimental Nuclear Physics.

In addition, the department wishes to thank others for their gifts of stock, including **John and Lavonda Cameron**.

We share the above information in grateful acknowledgment of the above people who went the extra mile in helping our undergraduate and graduate students in the department. We also want to share with you some of the many possible ways people have chosen to donate. We have also found corporate matches provide an excellent opportunity to double your donation.

If you have any interest in establishing a named fellowship, we can offer you that opportunity. ❑

Double Your Money

It may be of interest to alumni to know that Virginia Hinshaw, Dean of the Graduate School, is getting closer to attaining one of her goals — insuring a steady stream of funds available for graduate fellowships. A new initiative entitled **Wisconsin Distinguished Graduate Fellowship Program**, should help to attract the best and brightest graduate students to UW-Madison. This program is a partnership with the Graduate School, the Wisconsin Alumni Research Foundation (WARF), and the University of Wisconsin Foundation, in conjunction with all schools/colleges.

The goal of this program is to raise $100 million in private donations between 1998 and 2008. This is one of the largest and most ambitious projects of its kind among any of the nation's major publicly-assisted research institutions.

The Wisconsin Distinguished Graduate Fellowship Program will provide selected graduate fellows, in both master's and doctoral programs, with stipends and professional development funds derived from sources independent of traditional government funding. Annual support for one graduate student (12 months) currently requires approximately $24,000, including a stipend and fringe benefits of $22,000 and professional development funds of $2,000. Full fellows will also be eligible for remission of the nonresident portion of fees and tuition. To attain this level of annual support, an endowment of $500,000 is necessary for each fellowship.

A $250,000 gift, with the matching supplement from WARF, provides a full fellowship and enables the donor to name and designate the fellowship. This means that the effect of gift dollars will be doubled and those dollars will be available immediately for fellowships. A $125,000 gift, with the supplement would provide a 50% fellowship. This is the minimum level at which the Graduate School will assign the matching supplement.

Interested in learning more? E-mail the UW Foundation at uwf@uwfound.wisc.edu, check the web page at **http://info.gradsch.wisc.edu/fellowship/wdgf.htm** or call (608) 263-4545. ❑

Department & Campus Tidbits

A Wisconsin Week for You?

Always wished you could be more connected to campus? You can! Subscribe to "Wisconsin Week," the newspaper of record for the University of Wisconsin-Madison. Eighteen issues are published yearly on a biweekly basis when classes are in session. Subscriptions are $18 for a year or $9 for six months. Make checks payable to "Wisconsin Week" and mail to Wis. Week, 19 Bascom Hall, 500 Lincoln Drive, Madison, WI 53706.

Honorary Degree

Dr. Raymond Damadian, who was nominated by Wilmer Anderson, received an Honorary degree at the 1998 Spring Commencement ceremonies at the new Kohl Center.

Damadian was the inventor of magnetic resonance imaging. He is the founder, president, and chair of the board of FONAR Corporation. Damadian has distinguished himself both as a business leader and a medical researcher.

New Associate Dean Named in L&S

Professor Herbert F. Wang , Geology & Geophysics, has been named as the new Letters & Science Associate Dean for the Natural Sciences, succeeding Alex Nagel, Mathematics.

Physics Department Staff News

1998 marked the retirement of three long-term classified staff members in the department: Jerome Glowacki, Marian Schmidt, and Norbert Meier.

Jerry Glowacki, an Electronics Technician, retired on May 5, 1998, after 21 years of service with the Department of Physics. Jerry worked in the Department's electronic shop since 1977.

Marian Schmidt worked for the University of Wisconsin 25+ years. You'll remember her as one of the technical typist secretaries in Atomic and Solid State (Condensed Matter). She retired on July 20, 1998.

Norbert Meier, Instrument Maker, retired from the Physics Department's Instrument Shop in January, 1998. Norbert began working in Physics in 1989. ❑

Alumni Corner

Brett Chapman (Ph.D. 1997) was recently awarded a Department of Energy Fusion Energy Postdoctoral Fellowship. He is currently working with the MST Group.

Alan DeWeerd (Ph.D. 1996) has joined the University of Redlands (near Los Angeles, CA) as a tenure-track assistant professor. He has previously been at Creighton University as a nontenured track assistant professor.

Jonathan Bennett (Ph.D. 1994) joined the Science Charter School of the University of North Carolina in a career position as physics instructor.

Fernando Cabral (Ph.D. 1979) is a Mechanical Engineering professor at the Universidade Federal de Santa Catarina-Campus Trindade in Florinspolis, Santa Catarina, Brazil.

David Allen (B.A. Physics & Math, 1988) says while completing his undergraduate physics major at Wisconsin, he became interested in the earth sciences and took several classes from in geology and geophysics. After graduating, he received an M.S. and Ph.D. at Purdue (1994) in exploration geophysics. He lives in Kingwood, TX and works for Exxon Exploration Company as a potential fields geophysicist.

David Mantik (Ph.D. 1967) is an assistant professor at Loma Linda University in Radiation Sciences, Loma Linda, CA. He was a major contributor to "Assassination Science: Experts Speak Out on the Death of JFK," edited by James Fetzer, Cat Feet Press, Chicago.

Mark Raphaelian (B.S. 1982) of Micrion Corporation, Peabody, MA writes that he would like us to do a newsletter publication on physics in industry. He thinks physics students should learn to program in C, C++ & GUIs. He also thinks they should take more engineering courses to better prepare them to work in industry.

Tim Dowty (B.S. 1997) wrote to tell us that he is employed with Raytheon Corp., a major defense contractor in the Boston area. His email is njdowty@aol.com.

Rod Milbrandt (Ph.D. 1997) is currently a visiting assistant Professor in the Department of Physics and Engineering Science at Loras College, Dubuque, Iowa. His email is milbran@loras.edu

Ken Fischer (B.S. 1965) sent a check as a token of appreciation for all the benefits he received as a UW undergrad during 1960–65. He worked part time in Ray Herb's Ultra-High Vacuum Lab. He comments, "It is quite amazing how many practical things I learned and how much Prof. Herb shaped my life and encouraged me during those years." He also worked at National Electrostatics Corp. after graduating. He now lives in Johnson City, Tennessee.

Gilbert Plain (Ph.D. 1941) passed away at age 86 on November 21, 1997 at Ridgecrest, CA. After receiving his Ph.D., Plain joined the staff of the radiation lab at MIT. He then went to work for the Naval Ordnance Test Station at China Lake. For five years he taught UCLA extension and graduate courses and served as the area's thesis advisor for both the UCLA master's program and the University of Utah Ph.D. program.

Nicolle Zellner (B.S. 1993) is now working at Rensselaer Polytechnic Institute in Troy, NY.

Ron Kalich (B.S. 1987) wrote to say that he received an MBA in 1989 at the University of Pittsburgh and is now employed as a supervisor in Capital Accounting at the Pacific Gas & Electric Company.

Phillip Rudoff (Ph.D., 1969) asked to be included in the alumni data base. He is currently employed as a lawyer.

John Lohr (Ph.D. 1972) is a principal scientist at General Atomics. His advice to physics graduate students is to learn to sail, ski and think at Madison. He says these skills will come in handier than you may think.

Ralph Muehleisen (B.S. 1990) wrote to say that he has moved from the Naval Postgraduate School to the University of Colorado.

Michael Rathsack (B.S. 1969) sent us a check from his law office in Chicago. Thanks, Mike!

David Newman (Ph.D. 1994) was the recipient of a Presidential Young Investigator Award in a ceremony at the White House in fall of 1997.

Roger Stuewer (Ph.D. 1968) is Chair-Elect of the Forum for History of Physics of the American Physical Society. He also was named as a Sigma Xi Distinguished Lecturer for 1997–98. ❑

Stay Connected

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A Look at History — Physics Professors at the University of Wisconsin 1849–1950

1849 John W. Sterling, professor of math, natural philosophy and astronomy began teaching physics at UW-Madison

1868 John E. Davies, appointed. Ph.D. 1868, Chicago Medical College. Beginning of the study of modern physics.

1892 Benjamin W. Snow appointed. Ph.D. University of Berlin, Germany. Developed a reputation as a very interesting lecturer.

1895 Louis Winslow August joins staff.

1897 Robert William Wood joins staff.

1900 John Davies dies.

1901 August Trowbridge & Charles Elwood Mendenhall join staff.

1903 Albert Hoyt Tayler appointed to staff. Continues until 1909.

1905 Leonard Rose Ingersoll, Ph.D. Wisconsin, 1905, appointed to teaching staff.

1907 Otis Amaden Gage, Cornell University, joins faculty, making for a total of four.

John Ransom Roebuck joined department.

1909 William Frederick Steve appointed to staff of Physics Department.

1910 Earle Melvin Terry was made assistant professor.

1915 The professorial staff consisted of Gage, Ingersoll, Mason, Mendenhall, Roebuck, Snow, Steve, and Terry.

1916 Gordon Scott Fulcher joins staff for two years.

1923 R. C. Williamson joins faculty.

1925 H. B. Wahlin comes to Wisconsin Physics.

1926 Professor Snow becomes Emeritus due to illness. Dies on September 20, 1928.

1927 Professor Terry passes away.

1928 John Hasbrouck Van Vleck appointed as Professor of mathematical physics.

1935 Professor Mendenhall dies.

1945 After nearly 100 years of attempts, the first Wisconsin physics professor succeeded in reaching retirement age. Professor William F. Steve became Emeritus Professor.

1948 Professor J. R. Roebuck reaches Emeritus status.

1950 Professor L. R. Ingersoll retires.

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Physics Department picnic in the park 19??

Important Addresses:

*The University of Wisconsin Home Page is available at (**http://www.wisc.edu**). Please check it out and encourage prospective students and their parents to look at the information there. A new admissions button makes it easier for prospective students to learn about appropriate UW resources. The button links to admissions resources for undergraduate, graduate, professional and continuing education students, as well as financial services, university housing and information about visiting the campus.*

*The Department of Physics Home Page has been undergoing reorganization and is available at (**http://www.physics.wisc.edu**).*

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