Department of Physics

FORUM

Volume XV — College of Arts & Sciences Alumni Association — Fall 2003

Letter from the chair

Department proud of recent research, new faculty

Thanks for taking the time to learn more about some of the exciting events that have taken place in the IU Department of Physics over the last year. What a fantastic time to be chair of the IU physics department! I am blessed with an energetic, enthusiastic faculty that is constantly developing new ways of improving the learning environment for our students and providing the thriving research environment that is at the heart of our academic program. In this newsletter you'll find articles about a number of important new elements of our research program, such as our new low energy neutron scattering facility (LENS), which was approved for construction by the NSF this summer. We expect this $10 million facility to be a center for interdisciplinary research on the IUB campus, drawing users from biology and chemistry as well as physics. A second center for interdisciplinary research activity is provided by a major new program in biocomplexity, directed by new faculty member James Glazier.

One of our traditional areas of strength is our nationally ranked nuclear physics program. This group continues to do great work, as you'll see in articles describing an exciting new result on charge symmetry breaking and on progress in the construction of the STAR endcap calorimeter, which promises to provide groundbreaking measurements of a fundamental nature for the proton spin. The work of our theorists is also attracting national attention, as you'll learn in the article describing Alan Kostelecky's work on CPT and Lorentz violation.

The heart of any physics department is the faculty, and we are most fortunate to have added a number of young, energetic, and talented new faculty to the department over the last year. In this newsletter you will learn a little about the research activities of James Glazier, a senior biophysicist who joins us from Notre Dame; Mark Messier, an experimental high energy physicist from Harvard; and Rex Tayloe, who joined our nuclear group two years ago from Los Alamos National Laboratory. We will also be joined this fall by Sima Setayeshgar, a biophysicist from Princeton; Jon Urheim, an experimental high-energy physicist from the University of Minnesota; John Beggs, a biophysicist joining us from the National Institute of Health; and Robert de Ruyter van Steven, who joins us from Princeton. We will be highlighting the research activities of these four most recent additions to the faculty in our next newsletter.

It is a privilege and honor to serve the IU Department of Physics, and I am grateful for your support. I look forward to the opportunities ahead and wish each of you every success in the year ahead.

— *James Musser*

Biocomplexity research experiences growth

Since the beginning of a nascent biophysics program at Indiana University Bloomington when Jay Tang joined the physics department in 1999, there have been plans to increase research and add additional faculty in this field. A step in this direction was taken in the fall of 2002 with James Glazier moving to Bloomington from Notre Dame to become the first four-year director of the newly formed Institute for Biocomplexity in the Department of Physics and the director of the Indiana Biocomplexity Consortium, which, in addition to the institute, will link together the Indiana University Medical School, departments of science at Indiana University–Purdue University Indianapolis and the Interdisciplinary Center for the Study of Biocomplexity at the University of Notre Dame. The physics department is considering several further new hires in biophysics.

Biocomplexity is the study of the unique complex structures and behavior that arise from interactions between biological entities such as molecules, cells, or organisms. While physical and chemical processes produce a great variety of spatial and temporal structures, the complexity of even the simplest biological phenomena is infinitely richer. Until recently, scientific approaches to biological organisms have centered on genes, their protein products, discrete signaling pathways, and gene regulatory circuits. The success of these endeavours has brought a new era in biological research that is poised to take advantage of recent advances in molecular and computer-science-based technologies. Experimental and theoretical work in condensed-matter physics, mathematical, and computational approaches to the analysis and modeling of abstract networks representing metabolic and gene regulatory networks permit a reframing of problems in sub-cellular, cellular and developmental biology, e.g. structural networks, applied to the cytoskeleton, which determines cell shape and functional capacity, attempt to model the thousands of cytoskeletal fibers in any cell that simultaneously assemble and disassemble and interact with other proteins to generate forces

(*continued on page 3*)

$10 million research facility in developmental stages

Several researchers at IU are in the process of developing a pulsed cold (low energy) neutron facility at the Indiana University Cyclotron Facility. Those involved include David Baxter, John Cameron, Herman Nann, and Mike Snow of the physics department; Vladimir Derenchuk, Dennis Friesel, Mark Leuscher, and Thomas Rinckel of IUCF; and Josef Zwanziger of the chemistry department. The project has received a $6.4 million award from the National Science Foundation, with the first phase of building expected to be completed late next year and the second in 2006.

Neutrons are a unique probe of the structure and dynamics for a great variety of systems studied today in many scientific disciplines, including physics, chemistry, biology, and engineering. Although the technique was initially developed in North America (1994 Nobel Prize in Physics), the premier facilities have resided in Europe during the last two decades. This is expected to change in four years with the completion of the Spallation Neutron Source at the Oak Ridge National Laboratory, which will be the world's most intense pulsed neutron source. However, the existence of the SNS may not, in itself, be sufficient to ensure the expansion of neutron use into new areas of science nor to establish a large community of users in the United States. Major obstacles in expanding the neutron community are the current unfamiliarity of U.S. researchers with neutron scattering techniques, a diminishing number of facilities where novice users can be introduced to techniques, and a lack of flexible facilities for the pursual of new ideas.

The facility at IU of a Low Energy Neutron Source will help provide solutions to such problems. A combination of developments in proton accelerator technology, neutron optics, cold neutron moderators, computer technology, and small-angle neutron scattering instrumentation have made it possible and cost-effective to construct a pulsed cold neutron source suitable for use in a university setting. LENS will be the first attempt to demonstrate this. In addition to the source itself, the facility will have a number of instruments designed for the study of nanostructures in the fields of materials science, polymers, micro emulsions, and biology. The source will use (p,n) reactions in light nuclei induced by a pulsed proton beam of roughly 10MeV in energy. This primary source will be tightly coupled to a cold neutron moderator. This configuration will be ideal for the study of a number of technical issues that are essential for the development of neutron science, such as cold and perhaps ultracold neutron moderators, neutron optical devices, and neutron detector technology. Almost all of the required instrumentation and expertise to efficiently launch this first serious attempt to develop an intense pulsed cold neutron source at a research university currently exists at IUCF. We intend to exploit this resource to take a significant role in the future development of neutron science in this country. IU researchers propose to design, construct, and operate this source and an associated SANS spectrometer as a regional user facility for research and training of faculty and students. The facility will also be used to develop new neutron instrumentation for both scattering and radiography, and to develop new neutron moderators and detectors. This source is intended as a model to be duplicated at other research universities and used to develop a network of local pulsed cold neutron sources across the United States at reasonable cost. Such a network would provide invaluable support to major national facilities (such as the SNS) in much the same way a network of small reactors supports the community of users for Europe's major sources.

Rare symmetry violating reaction seen at IU

IU physicists have detected a rare reaction that demonstrates subtle differences between subatomic particles called quarks. In the IU cooler storage ring accelerator, an intense beam of heavy hydrogen collided with a heavy hydrogen target, occasionally producing pi zero meson particles. The symmetry of these different kinds of particles shows small differences between up- and down-type quarks.

Neutrons and protons, the building blocks of atomic nuclei, are made of quarks, with a neutron having an extra down quark and a proton having an extra up quark. The neutron is just 0.1 percent heavier than the proton. This tiny difference was enormously significant for reactions just after the Big Bang that determined the composition of the universe. The IU experiment may indicate how much of this crucial difference comes from mass differences between up and down quarks, and how much is from the electric forces between quarks.

The IU team is led by research scientist Ed Stephenson and Professor Andrew Bacher. Other IU physicists involved include Chris Allgower, Anders Gardestig, Chris Lavell, Herman Nann, John Olmsted, and Tom Rinckel. Implications of the experiment have been discussed at three workshops. The most recent was organized by Professor Charles Horowitz and was held in Bloomington Aug. 23–24, 2002.

The team was under pressure to finish before the closing of the accelerator. Hard work, good fortune, and the excellent performance of the machine allowed them to make the deadline. This result is a final achievement for the cooler storage ring, which was designed by Distinguished Professor Robert Pollock (now a professor emeritus). During more than a decade of operation, experimentalists using the cooler have produced significant results on storing particle beams, understanding meson production, manipulating the spin of particles, and on the forces between three nucleons.

Forum

This newsletter is published by the Indiana University Alumni Association, in cooperation with the Department of Physics and the College of Arts and Sciences Alumni Association, to encourage alumni interest in and support for Indiana University. For activities and membership information, call (800) 824-3044 or send e-mail to iualumni@indiana.edu.

Department of Physics

Chair .... James Musser
Editor .... Jordan Tillett

College of Arts & Sciences

Dean .... Kumble R. Subbaswamy
Executive Director of Development & Alumni Programs .... Tom Herbert

IU Alumni Association

President/CEO .... Ken Beckley
Director of Alumni Programs .... Nicki Bland
Editor for Constituent Periodicals .... Julie Dales
Editorial Assistant .... Jackie Corgan

THE COLLEGE

Scientists collaborate to probe origins of nuclear forces

Nuclear processes are the most powerful sources of energy known in nature. Together with the electromagnetic and weak interactions, they are described by the standard model of fundamental interactions. The nuclear forces are responsible for binding protons and neutrons together to form atomic nuclei whose binding energies are orders of magnitude bigger then contained in atomic or molecular bonds. At the most fundamental level, the strong force acts between quarks that are believed to be the basic building blocks of protons, neutrons, and other strongly interacting particles, also known as hadrons, including mesons and baryons.

Just like the electric charge is at the origin of electromagnetic interactions, the color charge carried by quarks is at the origin of the strong force. In electromagnetism the force carriers are the quanta of electromagnetic radiation known as photons. The corresponding carriers of the strong force are known as gluons. It is expected that gluons are also significant contributors to hadronic structure, including hadron mass and spin. In fact, more than 90 percent of a proton's mass should be attributed to gluons, implying that the bulk of the visible mass in the universe originates from gluons!

Gluons, however, are very mysterious particles. Except for the color charge, they do not interact with any other charge, like electric or weak. Thus, it is impossible to directly "poke" a gluon inside a hardon and determine its properties. Furthermore the nuclear interactions are so strong they prevent gluons from existing as free particles. Both quarks and gluons are permanently confined to distances of the order of 10^{-15}m, a typical size of a hadron. It is also the case that gluons carry the strong, color charges themselves (which is not the case in electromagnetism, where photons are neutral), and it is expected that the strong force between gluons may lead to gluon-rich matter. For example, matter can be made by gluons alone (glueballs) or a mixture of quark and gluon excitations (hybrid mesons). Thus, spectroscopy of glueballs and hybrids could provide the ultimate insight into the origins and dynamical nature of color confinement.

From a theoretical point of view, the challenges in strong nuclear interactions arise because they correspond to a strongly coupled, relativistic, field theory, thus containing an infinite number of degrees of freedom, with some of them being redundant due to the gauge symmetry. The first principle calculations in QCD are based on numerical simulations on discretized space-time lattices. Such calculations indicate, for example, that the gluon field in hadrons is collimated in so-called flux-tubes. As the separation between quarks increases, the flux-tube acts as a relativistic string that leads to a constant force between the quarks of the order of several tons and to a linearly rising potential.

When the flux-tube is excited, a new family of adiabatic quark potentials is generated that can be used to estimate the hybrid spectrum. At IU, the lattice effort is led by Steve Gottlieb; he and his collaborators from the MILC lattice group are responsible for the first direct lattice simulation of light hybrid meson spectra. At the Nuclear Theory Center, Adam Szczepaniak employs conventional many-body techniques to study the quark-gluon dynamics. Recently, in collaboration with Eric Swanson (University of Pittsburgh), they have shown that the linear confining potential arises due to gluon self-interactions in the mean-field approximation. This potential also leads to effective mass generation for quarks, which then can be identified as the valence constituents of hadrons.

A number of experiments have reported glueball and hybrid candidates, but so far, no unambiguous signature has been established. The complication with glueballs is that the low-lying states are expected to have the same quantum numbers as normal mesons. Thus an observed meson can be a mixture of a glueball and an ordinary, quark-antiquark meson.

The Crystal Barrel collaboration at CERN has shown that certain meson spectra are richer than expected from pure quark counting, which may indeed indicate presence of glueball states.

There is a class of hybrid mesons, called exotic hybrids, that have unique signatures. This is because they have quantum numbers that cannot be accounted for by a valence quark-antiquark pair. Thus, observation of an exotic meson would be a "smoking gun" signal of gluonic excitations. Three exotic mesons candidates have recently been reported from an experiment (E852) at Brookhaven National Lab. However, a new analysis of the E852 data, carried out at IU by Alex Dzierba, Scott Teige, Maciej Swat (graduate student), and Adam Szczepaniak, has demonstrated that out of the three exotic candidates, two cannot be explained as genuine guonic resonances. Instead, they are most likely an effect of meson rescattering. The third candidate originally identified via its decay to a r and p meson has properties, mass, and lifetime close to what is expected from theoretical considerations. The original analysis was based on a small fraction of the data. The full data sample is now being analyzed at IU. The analysis presents new theoretical and computational challenges having to do with the size of the data set, the

(*continued om page 6*)

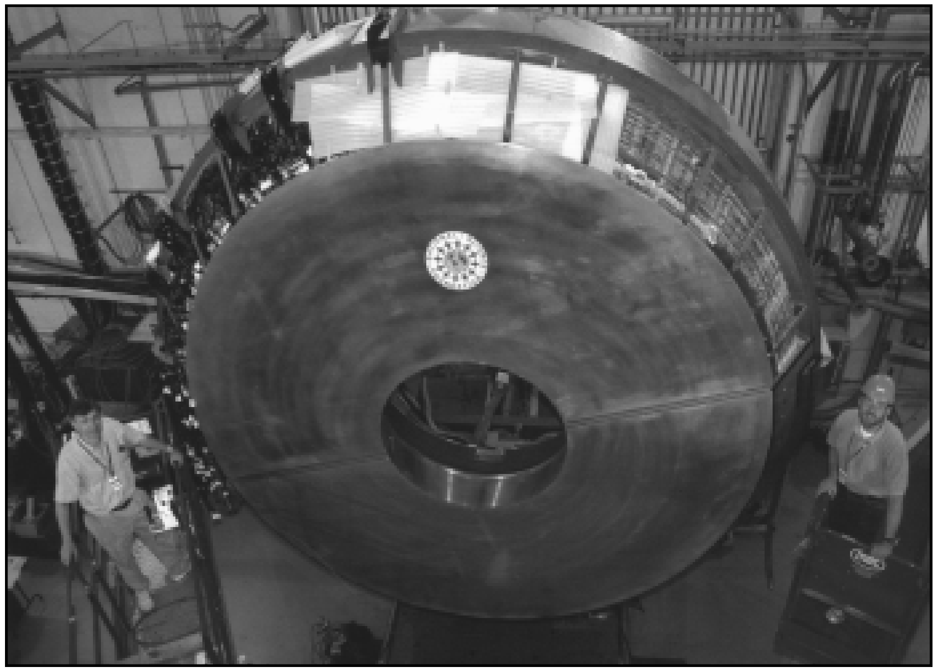
Biocomplexity

(*continued from page 1*)

determining the average and local dynamics determining cell mobility, behavior, and intercellular traffic. Multi-cellular aggregates, such as embryonic and mature tissues, often share the properties of "excitable media" and "soft matter" familiar to modern condensed-matter physics and dynamical systems. Mathematical and physical concepts with new discoveries about adhesive forces in cells and the molecular composition and rheology of cytoplasm and extracellular matrix are well suited to the analysis of changes in tissue shape and form during growth and repair.

Remodeling of Swain Hall West to provide facilities needed for biophysics research on this enlarged scale will shortly be under way for a cost of close to $1 million. Recent approval by the Indiana University board of trustees for construction of a new $55 million Multidisciplinary Science Building at IUB offers the opportunity for further space for biophysics research. The consortium will also install in Bloomington a Zeiss 510 multispectral two-photon confocal microscope for use in cell tracking. Geoffrey Fox (computer science and physics) is the associate director of the Consortium and Biocomplexity Institute and a liaison to the Pervasive Technology Laboratories at IUB for support and training for large-scale computation, parallel computing, image processing, visualization, and Internet and database development for consortium members. Research at IUB, particularly in the physics department, will provide extensive training for undergraduate and graduate students as well as postdoctoral and visiting researchers in the area of biophysics. The consortium also organizes twice annually intensive workshops for consortium members and the larger scientific community, focusing on biological problems that demand multi-scale and interdisciplinary solutions. The fourth official workshop, "Biocomplexity IV: Regeneration and Development," was held at IUB May 7–10, 2003.

Putting an IU Cyclotron Facility spin on STAR



Steve Vigdor and Jim Sowinski stand beside the STAR endcap electromagnetic calorimeter during its assembly on the STAR detector poletip at the relativistic heavy-ion collider in September 2003. The 30-ton detector, comprising a multi-layered sandwich (visible in the upper right) of lead and stainless steel radiators with plastic scintillator, has been constructed over the past four years by an international collaboration, under the leadership of a team from IUCF, with Will Jacobs as project manager. Light from the scintillators is transported by nearly 30,000 optical fibers — some of which are being connected to the detector in the upper left of the photograph — to some 1,300 photomultiplier tubes mounted on the rear side of the poletip. The EEMC is crucial to STAR's plans to utilize polarized proton-proton collisions at RHIC to measure the contributions of gluons and sea quarks to the spin of the proton, a research program in which IU is playing a leading role.

When the National Science Foundation announced in 1997 its plan to phase out operations of the Indiana University Cyclotron Facility, the nuclear physicists at IU began to make alternative plans for the future. They sought to exploit the extensive infrastructure that had been built up at IUCF to make leading technical, as well as intellectual, contributions to high-profile research projects at the major national laboratories for nuclear physics. The largest new project they undertook was to add an endcap electromagnetic calorimeter to the STAR (solenoidal tracker at RHIC) detector at the new relativistic heavy-ion collider situated at Brookhaven National Laboratory. The main goal of the RHIC facility is to enable ultra-relativistic collisions of heavy nuclei, in which matter could be heated to temperatures previously attained only in the earliest instants following the Big Bang birth of the universe. At such high temperatures, it is anticipated that neutrons and protons will "melt," leaving a plasma of quarks and gluons, a state of matter never before observed convincingly in the laboratory.

The IU physicists (led by professors Vigdor and Wissink and senior research scientists Jacobs and Sowinski) are bringing a complementary forefront research program to the STAR collaboration: utilizing high-energy collisions of spin-polarized proton beams to measure how the proton gets its intrinsic spin and magnetism. A series of experiments carried out with high-energy electron and muon beams have produced the surprising result that no more than a third of the proton's spin arises from the intrinsic spins of the quarks and antiquarks inside the proton. It is now very important to see whether the remainder comes from gluons — the mysterious, self-reproducing particles that transmit the strong force between quarks. Gluons are so abundant inside a proton that they dominate the proton's mass, so it is not too much of a stretch to imagine that they dominate the proton's spin as well. The preferential spin alignment of gluons in a proton is best probed by measuring reactions between spin-polarized proton beams that produce very high-energy photons. Such polarized beams are available at a collider for the first time at RHIC, thanks to technology (so-called Siberian Snakes) that was first demonstrated at the IUCF cooler ring and was adapted to use at RHIC, with important contributions from IU Professor S.Y. Lee and his students. The EEMC is now needed to allow STAR to detect the high-energy photon products in the region where they carry the most information about gluon spin contributions. The same calorimeter will also be used to detect electrons and positrons up to energies of 200 GeV, where they carry unique information about the spin orientation of antiquarks of different "flavor" inside the proton.

The endcap calorimeter consists of alternating layers of lead radiators, used to convert photons to a "shower" of electrons and positrons, and active plastic scintillators to measure the total energy contained in the shower. When completed, the detector will be 5 meters in diameter, will weigh 30 tons, and will have about 30,000 channels of electronic readout of output light transmitted by optical fibers to photomultiplier tubes. It also has a number of innovative design features in comparison to earlier detectors of similar type. Its construction is a $7 million project, with most of the funding provided by the National Science Foundation, beginning in fall 1999. Major milestones were achieved this fall when the lower half of the EEMC structure was installed on schedule in the STAR detector, including one-third of the planned active elements. Commissioning of the installed portion of the detector during RHIC running in 2003 will pave the way for efficient exploitation of the detector to probe the proton's spin as soon as the desired polarized beam properties are achieved in 2005–06.

In parallel with their extensive work on the calorimeter, the IU physicists are also playing other important roles at RHIC, with Vigdor serving as one of two deputy spokespersons for the 450-member STAR collaboration, and senior research scientist Stephenson heavily involved in plans for an experiment to provide an absolute calibration of the proton beam polarization in this previously unexplored energy regime.

For further stories on Homer Neal, Jack Childress, Vic Viola, and Riccardo Giancconi, visit us on the Web at www.physics.indiana.edu.

Lorentz group gathers in Williamsburg

At the back-to-back American Physical Society conferences held May–June 2002 by the Division of Particles and Fields and the Division of Atomic, Molecular, and Optical Physics in Williamsburg, Va., a number of former Indiana University students and postdocs actively investigating Lorentz and CPT violation attended the meetings to present recent results. This search for possible violations of Lorentz and CPT symmetry is a research program started about 15 years ago by Professor **Alan Kostelecky** of the Indiana University Department of Physics.

The conferences featured a special joint DPF/DAMOP session on fundamental symmetries that included invited talks on the Lorentz-violating standard-model extension by Kostelecky, experimental consequences by maser specialist Ron Walsworth of the Harvard–Smithsonian Center for Astrophysics, and a related talk by spectroscopy specialist Mike Romalis of Princeton University.

The IU graduates presenting work at the meeting included **Don Colladay**, PhD'98, now a physics faculty member at New College in Sarasota, Fla., who presented recent results in a talk titled "High-Energy Processes with Lorentz Violation." Colladay was instrumental in the two papers published in 1997 and 1998 with Kostelecky that defined the coefficients of the standard-model extension in their current form, and he has worked on theory aspects since then.

Ralf Lehnert, PhD'02, now a postdoc at the Algarve University in Faro, Portugal, presented work titled "Dispersion Relations and Lorentz Violation." Lehnert's work answered questions about microcausality and stability in the theory.

Austin Pickering, postdoc in the Department of Physics during 2000–02, has studied renormalization issues in this Lorentz-violating quantum field theory. He presented his findings in a talk titled "Lorentz Violation Beyond Tree Level."

Current graduate student **Matthew Mewes** was also at the meetings and presented work done with Kostelecky, "Searching for Lorentz Violation in Electrodynamics." This work, published recently, includes unprecedented bounds on a number of coefficients for Lorentz-violation, based on an analysis of polarization data for light from cosmologically distant sources.

Chuck Lane, PhD'01, now a faculty member at Berry College in Georgia, presented recent work, "Probing Noncommutative Geometry and Lorentz Violation with Atomic Tests." Recently, he has shown that realistic noncommutative quantum field theories, currently popular among high-energy particle theorists, are contained in the standard-model extension.

Lane has also worked on exploiting the high precisions of atomic clocks to search for Lorentz violation.

Neil Russell, PhD'99, now on the faculty at Northern Michigan University, gave a talk titled "Space-based Tests of Lorentz and CPT Symmetry." This work proposes using atomic clocks on the International Space Station and other satellites to test Lorentz and CPT symmetry. The work, published with former IU postdoc **Robert Bluhm** (now on the faculty at Colby College, Maine), Lane, and Kostelecky, received widespread media attention and was one of the most accessed stories on the CNN.com Web site in June 2002.

A number of other physicists have performed or are planning to perform experiments to investigate the effects predicted by the standard-model extension. These include Mike Romalis of Princeton University, who presented work on a self-compensated helium-potassium magnetometer for CPT and Lorentz tests in a session of the DAMOP conference, in addition to the invited talk at the joint DPF/DAMOP session. Ron Walsworth and collaborators from the Harvard–Smithsonian have performed various tests of Lorentz and CPT symmetry in their maser laboratory. In several talks, they presented results from hydrogen masers and a two-species helium-neon maser. They have plans to improve on this work using a helium-xenon maser.

In his invited talk, Kostelecky presented an overview of the standard-model extension. He discussed technical issues relating to the theory and listed a number of the areas in which it has been applied and tested. One active area is with the K, D, and B neutral mesons and includes analyses performed with data from KTeV and FOCUS at Fermilab, from OPAL and DELPHI at CERN, and from BELLE in Japan. Kostelecky also discussed results from a muonium experiment conducted by Yale experimentalist Vernon Hughes at Los Alamos and the Rutherford-Appleton Laboratory. Further muon results are expected from the BNL g-2 collaboration. Other experimental results have been obtained by Blayne Heckel and Eric Adelberger in Seattle with a spin-polarized torsion pendulum. These and related papers can be found on the Kostelecky Web site, www.physics.indiana.edu/~kostelec/faq.html. A collection of papers on the topic can be found in the proceedings of the second meeting on CPT and Lorentz symmetry, organized by Kostelecky and held in the IU Department of Physics in August 2001.

An abridged explanation of the symmetry ideas is as follows. Relativity is the notion that the physical laws look the same for all non-accelerating observers. It has never been violated in any experimental context, so it seems quite possible that nature does indeed have perfect Lorentz symmetry. The other apparently perfect symmetry in nature is CPT symmetry, the notion that observations in one experiment must be the same in a "mirror" experiment consisting of oppositely-charged (charge conjugated, C) antiparticles transposed on a straight line through a single point (parity transformed, P), with reversed velocities (time reversed, T). In conventional particle physics and the standard model, CPT symmetry follows as a result of Lorentz symmetry. This mathematical result is called the CPT theorem.

Kostelecky and collaborators have shown that a theory at the Planck scale, such as string theory, may produce small terms that violate Lorentz symmetry. Such terms are the key feature of the standard-model extension and create the possibility of CPT violation.

The theory encompasses all observer-invariant field theories with Lorentz violation, providing a general framework to study Lorentz- and CPT-violating effects.

Physics and the community

Midwest Proton Radiotheraphy Institute dedicated

On Dec. 12, 2002, a dedication ceremony was held at the IU Cyclotron Facility for the Midwest Proton Radiotherapy Institute housed within IUCF. This dedication was the culmination of several years' effort begun under the leadership of John Cameron, director of IUCF and professor of physics. MPRI will use protons accelerated by the IUCF cyclotron to treat cancer in human patients.

Proton beams offer distinct advantages over more conventional types of radiation, such as X-rays and electron beams, in the treatment of cancer. High-energy X-rays produce radiation damage, which quantitatively falls off exponentially along their path as they traverse the body. Electron beams also produce the most radiation damage near the entering surface rather than in the interior. By adjusting the energy, most protons can be made to stop within the target volume. As the maximum range of the protons is well defined, no radiation damage is produced beyond the target region. Furthermore, as the protons slow down, they produce the maximum amount of radiation damage just before they come to rest. This phenomenon is known as the Bragg peak. By modulating the beam energy (and thus the range) to spread this peak across the volume of interest, the physician can deliver a full, localized dose of energy to the target site. Because of their mass, most of the protons do not scatter laterally. Proton beams can be used wherever conventional radiation therapy is used, and with greater precision.

In 1996, a consortium of physicians and scientists collaborated to form MPRI. MPRI is an independent radiation therapy center that is operated as a regional facility in conjunction with Clarian Healthcare of Indianapolis for the benefit of people in the Midwest. The medical director of MPRI is Allan Thornton, who came to Bloomington from the Proton Center in Boston. At present, there are only two other proton radiation facilities in the United States. One is at the Loma Linda University Medical Center in California, and the other is the Northeast Proton Center located in Boston.

The cyclotron accelerator that is being used by IUCF to supply proton radiation to the MPRI clinical facility was constructed from a radically new design developed by the late Professor Martin Rickey of the IU Department of Physics. The work was completed in 1975 under the direction of Distinguished Professor Robert Pollock (now a professor emeritus). Professors Rickey and Pollock were presented with the Indiana University Presidential Research Award for their work in developing and constructing the IUCF cyclotron.

From 1975 to 1999, the cyclotron was used mainly for nuclear physics research, and it accelerated a wide range of particles at various energies. Many important research projects were run on the cyclotron during this period, and about 200 students received degrees. In 1983, Professor Charles Goodman won the Tom W. Bonner Prize of the American Physical Society, and in 1992 Professor Pollock won the same prize. In both cases, their prize-winning work was done largely on the cyclotron at IUCF. The IUCF cyclotron has had an illustrious career in nuclear physics. It is now being rededicated for a new use, in which it will continue to play an equally important role.

Medical companies purchase proton beams from IUCF. The IUCF cyclotron can deliver over 500 nA of protons at 205 MeV. The current and energy prescribed for a particular protocol can be selected at the individual treatment room.

The first treatment room for human patients was constructed in late 1997 for a clinical trial evaluating proton therapy for age-related macular degeneration. However, the first patient was treated at IUCF in 1993 (for cancer), prior to the formation of MPRI under an experimental protocol.

In preparation for setting up the treatment facilities for MPRI, the nuclear physics research stations were removed from the cyclotron experimental area in 1999, and in the following year, the interim AMD clinical trial facility was also removed, leaving the "high bay" and "low bay" areas completely empty and ready for construction.

Today, MPRI houses, in 21,000 square feet of converted space, three proton therapy treatment rooms and an outpatient clinic devoted to staff support and patient care.

For more information, visit the MPRI Web site at www.mpri.org.

Nuclear forces

(*continued from page 3*)

order of 10^8 events, and the complexity of reaction mechanisms. For this purpose, a partial wave analysis center is being developed at IU by a collaboration of the high energy (Alex Dzierba), nuclear (Adam Szczepaniak), and computer science experts (Geoffrey Fox).

Theoretical considerations indicate that the gluonic excitations should have masses in the range from about 1.5 to 2.5 proton masses, lifetimes of typical hadronic resonances and large production cross-sections in photon-induced reactions. Photons act as a virtual quark-antiquark source with quark spins aligned, just as expected for quarks in an exotic meson. A high energy peripheral photon scattering — which mainly conserves orientation of spins — of a meson cloud surrounding a proton by exciting the gluon field would result in an exotic mesons produced in the direction of the photon beam. The GlueX/HallD collaboration, lead by IU physicists from the High Energy Group and Nuclear Theory Center, has been developing a research program for studies of exotic meson, to be carried out at the Thomas Jefferson National Accelerator Facility in Newport News, Va. The experiment would use 12GeV electrons from the CEBAF electron accelerator to produce a linearly polarized photon beam via the coherent bremsstrahlung technique. Photons will be scattered off a liquid hydrogen target, and the produced hadrons will be analyzed in the Hall D detector, consisting of a solenoidal magnet instrumented with charged particle tracking and identification and neutral particle calorimetry. With a beam of 10^7 photons/second, the GlueX experiment will collect data at 1petabyte/year, which is comparable to LHC experiments, and in one year, it is expected to surpass the current exotic sample from the E852 experiment by four orders of magnitude.

More information on the Gluex/Hall D project and current theoretical developments can be found at www.gluex.org.

We want to hear from you!

Please fill out coupon on the back page and mail or fax it to us. We'll publish your news item in the next issue of *Forum*.

Honors & Awards

Faculty & staff

The Society of Graduate Physics Students gave their teaching award to John Challifour in 1999 and 2000, to Adam Szczepaniak in 2001, and to Brian Serot in 2002. Physics department Trustees' Teaching Awards were given to Ben Brabson, Rick van Kooten, and Alex Dzierba (at-large nominee) for 2001 and to Mike Snow, Adam Szczepaniak, and Steve Vigdor (at-large nominee) in 2002.

It is with pleasure that we announce that June Dizer received this year's Leo Solt Award from the University Graduate School. For many years, Dizer has worked in the Student Services Office SW 132, handling the many details connected with admission, financial support, and progress toward degrees for a large number of physics graduate students. Dizer was honored for her distinguished service to graduate education in physics over many years.

E. Konopinski Teaching Awards, 2000–03

- **2000:** Graduate student awards went to **Charles Lane** and **Sonali Tamhankar**. There was no faculty award.
- **2001:** The faculty award went to **Adam Szczepaniak**, with graduate student awards to **Joo Chul Yoon** and **Lawrence Lieu**.
- **2002:** The faculty award went to **Jay Tang**, with graduate student awards to **Daniel Bowman** and **Martine Kalke**.
- **2003:** The faculty award went to **Rex Tayloe**, with graduate student awards to **Mathew Mewes**, **Julia Scherschlight**, and **Brian Steinkamp**.

Students

Undergraduates, 2002

New members of Sigma Pi Sigma were **Keith Crawley** and **Michael Steinhilber**, and graduating members of Sigma Pi Sigma were **Michael Bates** and **Michael Mishkin**.

Students graduating with honors were **Michael Bates** and **Lee Tremblay**. The Outstanding Undergraduate Award was presented to **Michael Bates**. The Hugh Brown Memorial Scholarship was awarded to **Brock Sayre**. The Outstanding Undergraduate Associate Instructor Award was made to **Dan Duggan**.

Graduate students, 2002

Graduate physics majors also received numerous awards in 2002. Konopinski teaching awards were made to **Dan Bowman** and **Martine Kalke**. A College of Arts and Sciences Travel Grant was awarded to **Jorge Viamontes**. A McCormick Science Grant was made to **Michael Gericke**. The James H. Coon Sciences Prize was awarded to **Martin Ciofalo**. The Outstanding Graduate Student in Research awards were made to **Martin Ciofalo** for experimental research and to **Matthew Mewes** for theoretical research. The William Koss Memorial Award was presented to **Martin Ciofalo**.

Undergraduates, 2001

New members of Sigma Pi Sigma were **Michael Bates**, **Michael Moore**, **Daniel O'Neill**, **Michael Mishkin**, **Benjamin Neff**, **Jason Rieger**, and **Debra Spain**. Graduating members of Sigma Pi Sigma were **Matthew Cecil**, **Erica Raffauf**, **Kathleen Plinske**, and **Leah Welty**.

Students graduating with honors were **Matthew Cecil**, **Michael Moor**, **Kathleen Plinske**, **Michael Mishkin**, **Benjamin Neff**, **Erica Raffauf**, and **Debra Spain**.

Tracy Parker was awarded a Kent Exchange. New members of Phi Beta Kappa were **Matthew Cecil** and **Kathleen Plinske**. An Undergraduate Research Grant was made to **Wes Gohn**. The Outstanding Undergraduate Award was made to **Erica Raffauf**, and the Hugh Brown Memorial Scholarship was awarded to **Michael Bates**.

Graduate students, 2001

Konopinski teaching awards were made to **Lawrence Lieu** and **Joo Chul Yoon**. College of Arts and Sciences Travel Grants were made to **Karim Addas** and **Sonali Tamhankar**. A Department of Energy Lindau Award was made to **Dan Hussey**. The Outstanding Graduate Student in Research awards were made to **Rupert Lewis** for experimental research and to **Aditi Mitra** for theoretical research. The William Koss Memorial Award was presented to **Ralf Lehnert**.

PhDs awarded

In 2000–01: **Gong Li** (with Horowitz), **Zema Chowdhuri** (Snow), **Todd Peterson** (Vigdor), **Haichuan Yong**

(*continued on back page*)

Olmer named Woman of the Year

Professor Catherine Olmer was honored as the "2002 Bloomington Woman of the Year" at a Women's History Month luncheon at the Bloomington Convention Center on March 6, 2002. Jean Robinson, IU dean of the Office for Women's Affairs, wrote in her nomination letter, "Cathy Olmer has helped make profound changes in the lives of young girls in Monroe County." She added, "In her work for the Girl Scouts, her leadership at WonderLab, her efforts to expand IU's outreach in science, her contributions to the development of girls through the Eureka Project and Women in Science Program, she has opened the door for girls and young women to new opportunities and new careers."

WonderLab, located in Bloomington, is a children's museum of science, health, and technology. A founding member of WonderLab, Olmer has served as its executive director since 1998. In an interview, Olmer talked about the impact that the Boston Museum of Science had on her in her frequent visits there when she was a child. She said, "It was that museum (that) helped me want to establish a science museum like WonderLab."

WonderLab originated in 1995 as an outreach program that was housed in Swain West (home of the IU Department of Physics), and many physics personnel have volunteered their time and talents to help create new exhibits and activities, as well as to present these to the public. In 1998, the organization opened to the public at a small, interim site while developing plans for a new museum. At present, a new building to house the museum is nearing completion on West Fourth Street in downtown Bloomington. A grand opening took place on Saturday, March 29, 2003.

The new 15,000-square-foot museum will offer two floors of exciting hands-on exhibits, daily demonstrations, and various activities. The museum will also feature a 7,000-square-foot outdoor nature area. The development of WonderLab has been a community-wide initiative, with hundreds of people, from corporations to individuals, offering financial help, scientific expertise, and volunteer time.

More information about WonderLab can be found at the WonderLab Web site at www.wonderlab.org.

New faculty members welcomed to department

Recent faculty

James Glazier joined the department in fall 2002 as a professor of physics and director of the newly formed Interdisciplinary Center for the Study of Biocomplexity. He completed a BA degree in mathematics and physics at Harvard in 1984 and a PhD in physics at the University of Chicago in 1989.


James Glazier

Glazier held a postdoctoral position at AT&T Bell Research Laboratories from 1989 to 1991 and was in the physics department at the University of Notre Dame from 1992 to 2002. Glazier's research is involved with biocomplexity, which is described in an article on page 1.

Mark Messier joined IU as an assistant professor of physics in fall 2002 after having been a research associate at Harvard from 1999 to 2002. He earned a BS in physics at MIT in 1993 and received a PhD in physics in 1999 from Boston University. Messier works in the field of experimental particle physics. He is searching for evidence that neutrinos, the lightest of the fundamental particles, have non-zero mass. Messier works on both the Super-Kamiokande experiment located in Japan (which detects neutrinos produced in the sun and in the earth's atmosphere) and on the MINOS experiment (which will use the Fermilab proton accelerator located outside of Chicago to produce a neutrino beam directed toward a detector located at a distance of 735 kilometers in northern Minnesota).


Mark Messier

Rex Tayloe joined the department in fall 2000 as an assistant professor of physics. He received a BS in physics from Purdue University in 1986 and a PhD from the University of Illinois–Urbana in 1995. His postdoctoral appointments prior to IU were at Illinois and Los Alamos National Laboratory. Tayloe's field of research is the study of the properties and interactions of neutrinos. He is working on the MiniBooNE experiment (more information at www.boone.fnal.gov), which is searching for neutrino oscillations at Fermilab. Neutrino oscillations are where a neutrino of one type changes into a neutrino of another type. This is a phenomenon that was seen in a previous experiment at Los Alamos, and if verified, would have large implications in particle physics and cosmology. Tayloe is also working on measurements using neutrinos as a probe to investigate the structure of the proton.


Rex Tayloe

New faculty

John Beggs, assistant professor, received his PhD in 1998 from Yale University. Prior to joining our department, he was a postdoctoral fellow at the National Institute of Mental Health. His research interest is in the area of physical neuroscience.


John Beggs

Robert de Ruyter, professor and Gill Professor (this last a five-year appointment), received his PhD in 1986 from the

(*continued on page 10*)

Physics department salutes three retiring professors

Archibald Hendry

In January 2002, Professor Archibald "Archie" Hendry retired after serving for 33 years on the physics faculty. Archie was born in Scotland and received a PhD in 1962 from the University of Glasgow. He did postdoctoral work and research at the University of California at San Diego, at Oxford University and the Rutherford Laboratory, at the University of Heidelberg, and at the University of Illinois for seven years before coming to IU.

Archie is an elementary particle theorist who has succeeded in increasing our understanding of the way quarks behave inside protons, neutrons, and other subnuclear particles. From his analysis of experimental data, he found evidence for the existence of a number of baryon resonances. His results have stood the test of time and continue to be included in the international tables of particle data.

In recent years, Archie became interested in properties of the sun and the neutrinos that are emitted by the sun as byproducts of the energy-producing nuclear reactions in the core. Experiments have indicated that the number of neutrinos arriving at Earth is less than half the number expected. To investigate this puzzle, Archie developed an interesting class of solar models that enabled him to calculate in a simple fashion the number of neutrinos emitted from the sun for each model.


Archibald Hendry

Archie has also been an outstanding teacher. In 1992 he received a faculty award for excellence in teaching, followed in 1993 by an IU President's Award for distinguished teaching. In 1995, the physics graduate students presented him with their annual award for outstanding contributions to teaching.

Archie also contributed valuable service to the physics department and to the university. A partial list of his activities include the following: He was an associate dean for the budget in the College of Arts and Sciences for three years. Prior to that, he was a member of the College's elected Policy Committee, chairing it for one year. He was elected to the Bloomington Faculty Council several times, serving on and chairing its Budgetary Affairs and Nominations committees.

Information for this article was taken from the IU retirement biography of Archie Hendry written by Don Lichtenberg.

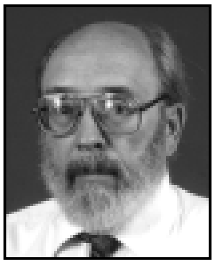
(*continued on page 9*)

Retirements

(*continued from page 8*)

Robert E. Pollock

Bob Pollock is a born tinkerer. He is a distinguished professor of physics; a prize-winning and innovative designer of particle accelerators that have helped fuel a generation of experimental research in nuclear physics; a proven and inspirational manager of complex technical projects with substantial support staff; a sage and much-sought-after adviser to the worldwide community of nuclear physicists; and a superb experimental physicist.



Robert Pollock

But he derives his greatest pleasure from sitting in his office or small laboratory, *tinkering* — building and testing with his own hands, perhaps with an undergraduate or graduate student at his side, tabletop scale devices that have the potential to change the way we think about the range of instrumentation possibilities — and reveling in the unexpected particle behavior he gets to observe.

Indiana University has been benefiting from Bob Pollock's tinkering for 30 years. Bob received a PhD in experimental nuclear physics from Princeton in 1963. After a couple of years spent doing experiments at the Rutherford Laboratory in England, he returned to Princeton in 1970, for the express purpose of overseeing the translation of Martin Rickey's brainchild — the Indiana University Cyclotron Facility — into an operating national user facility in the new field of intermediated-energy nuclear physics. The National Science Foundation, inexperienced itself in bankrolling such a large facility, was growing impatient to see the realization of the novel design in which they had invested substantial funding. Bob got it built and made it work, establishing along the way a premier laboratory that attracted researchers from around the world and a first-rate international reputation for the nuclear physics research group at IU. He directed that laboratory from 1972 until 1979. On the side, he also carried out some of the most elegant early experiments with the new accelerator, setting forth an intellectual theme, the study of particle production near threshold that has been central to the lab's development over since.

By 1979, Bob was getting antsy for a new challenge. He had learned of a new technique, electron cooling, being developed in Siberia to improve dramatically the quality and staying power of particle beams stored in a ring accelerator, and he began to ponder the advantages of a storage ring for research in intermediate-energy physics. He inspired the IU nuclear physics group to work out these advantages and write a proposal to the National Science Foundation for the first nuclear physics accelerator that exploited this new technique. The IUCF cooler was proposed in 1980 and approved shortly thereafter. Bob managed the construction project that brought this innovative technology to a successful commissioning and first use for experiments in 1988. In the years since, the IUCF cooler has not only supported a program of novel nuclear physics experiments, but also has spawned a generation of similar machines in laboratories around the world. For his development of the cooler and his central role in the refinement of cyclotron technology, Bob was awarded the 1992 Tom W. Bonner Prize, the highest honor bestowed by the Division of Nuclear Physics of the American Physical Society.

While continuing to utilize the cooler for experiments in both nuclear physics and the physics of beams, Bob came up with another novel idea in the mid-1990s. A fundamental limitation on the quality and intensity of the beams that could be stored in the cooler came from the interactions of the electrically charged particles in the beam with atomic electrons bound to the nuclei of interest in the targets used for experiments. So why not create electron-free nuclear targets? This challenge led Bob into a new field, non-neutral plasma physics, to perfect techniques utilizing electromagnetic fields to trap a high density of charged ions in a small region of space, where they would be forced to expose themselves to the onslaught of the incoming beam. He has already advanced the state of the art in this new field and will undoubtedly continue to do so well after he formally retires from the IU faculty.

Bob is a man of few words, but those few words, and even changes of facial expression, merit attention. Those of us who have worked extensively with Bob learned long ago to interpret the silent answers to our questions by counting the number of furrows that would appear on his brow.

When the U.S. nuclear physics community decided in 1977 that it had to bring some order to funding-agency decisions about what new projects to support, it chose Bob as a charter member of the new Nuclear Science Advisory Committee, which establishes priorities for the field with the Department of Energy and the National Science Foundation. Other charter members of the committee have told me that they, too, learned to pay very close attention whenever Bob considered an issue sufficiently important to share his wisdom about it. He has long and often been sought as a member of national and international advisory committees and review panels. His insights have greatly enriched the field.

Bob had received a number of honors in the course of his years at IU. In addition to the Bonner Prize, he was awarded a Humboldt Senior U.S. Scientist Prize in 1986–89 and was named an IU Distinguished Professor in 1984. There are also unclaimed honors. For example, I am certain that for many years Bob was the Fastest Slide Rule in the West; no one I know could ever do an involved, multistep numerical calculation on calculators or computers faster than Bob could produce the answer on his slide rule, with the furrows on his brow multiplying at every step. (I came to think of the furrows as data-storage devices.) But I hope that among the honors Bob cherishes most during his retirement will be the eternal gratitude of his research and faculty colleagues and students. For us, he was the initiator of a legacy that lives on in the reputation of the IU nuclear physics group: a legacy of intellectual integrity, innovation, attention to detail, and ability to deliver on ambitious promises.

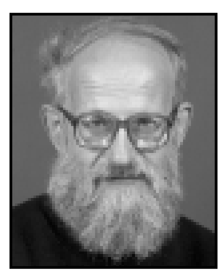
— Steve Vidgor

David Rust

In January 2003, senior scientist David Rust retired after 31 years of service with the experimental high energy groups at IU.

Dave received a PhD in physics from Cornell University in 1967. He then worked at Argonne National Laboratory until 1972, when he came to IU.

While at IU, Dave worked on high-energy experiments at the following accelerators: Argonne National Lab, Fermilab, SLAC, CERN, Brookhaven National Lab, and the Jefferson National Accelerator. He also worked on a project for the SSC. Dave was the builder of the first plastic straw drift chamber, which was then part of a detector used on the HRS experiment at SLAC.



David Rust

In addition to his research, Dave served on a number of committees in the IU Department of Physics, most notably the Faculty, Student, and Staff Relations Committee, and the picnic group.

Department mourns loss of professors Bron, Singh

Walter Bron

We recently learned that Professor Emeritus Walter Bron, 72, of the Department of Physics at the University of California at Irvine, died on Nov. 16, 2002. Bron had been a faculty member of the IU Department of Physics for 20 years, from 1966 until he left for Irvine in 1986. His research work was in the area of experimental condensed matter physics, specializing in the optical properties of solids.

While he was at IU, he was awarded a Guggenheim Fellowship, was elected Fellow of the American Physical Society, and received a Senior Scientist Award from the Alexander Von Humboldt Foundation. Also during this time, a number of graduate students and postdocs did their research work under his direction.

Prithe Paul Singh

Prithe Paul Singh, professor emeritus of physics at IU and former co-director of the IU Cyclotron Facility, died of Alzheimer's disease on Aug. 17, 2003, at his home in Bloomington.

Paul was born on Sept. 10, 1930, in Hawalian, India, in what is now Pakistan, the son of a railway ticket collector. He grew up during the tumultuous period of the struggle for independence and the partitioning of India, and he and his family became homeless refugees in the newly born India. Faced with these enormous challenges, he focused on what would become his life's mission: science and education.

After receiving BS and MS degrees from Agra University in India in 1951 and 1953, he worked as a research assistant for the Indian Atomic Energy Commission for a year. He then won a scholarship to do a PhD in nuclear physics at the University of British Columbia in Vancouver, Canada. His time in Vancouver formed him to become a scientist. There he also met and married in 1959 his loving and devoted wife, Sudarshan, with whom he had two sons. Paul received a PhD in 1960 and remained in Canada as a National Research Council postdoctoral fellow at the Chalk River Laboratory. In 1962, he came to the United States, joining the Argonne National Laboratory as a research associate. He moved in 1964 to IU as an assistant professor, one year before design work began on the innovative cyclotron configurations, and in time to actively participate in shaping the future of what was to become IUCF, a major international center for medium-energy nuclear physics research.

Prior to completion of the cyclotron complex in 1975, Paul carried out a significant and wide-ranging nuclear physics research program at other laboratories (ANL and Naval Research Lab) and universities (at Groningen in the Netherlands and at Paris/Orsay). He did seminal work on the properties of giant resonances in nuclei, alpha-particle interactions with nuclei, and heavy-ion physics at medium energies. Specifically, he studied the Giant Dipole Resonance by radiative proton and alpha capture in the mid-1960s, and the excitation of isoscalar multipole strengths by inelastic alpha scattering in the mid-1970s. In the same period, Paul was involved in determination of the alpha-nucleus optical-model potential using both phenomenological and nucleon-nucleus folding-model approaches. In the late 1960s and early 1970s, Paul also participated in systematic studies of heavy-ion scattering at ANL, investigating the interplay between shape resonances, intermediate structure and quasi-molecular states. Great scientific curiosity, intuition, and imaginative approaches characterized his research.

Promoted to full professor at IU in 1971, Paul became associate director of IUCF in 1978, and then served as co-director from 1979 to 1986. This was a time of great accomplishment and growth at IUCF. Despite his significant administrative effort, Paul continued his research program at IUCF involving a substantial number of PhD students, IU colleagues, and foreign visitors. While seeking a better understanding of the effective nucleon-nucleus interaction and its energy dependence over the low-to-medium energy regime, Paul's research remained focused on nuclear structure and nuclear reaction mechanism studies. His work ranged from inclusive (p,x) and quasi-free (p,2p) continuum reactions, through giant resonance excitations by medium-energy polarized protons, 3He, and 4He ions, to Li-induced cluster-transfer reactions, fusion processes and fast-particle production.

A thorough and inspiring teacher, Paul was very successful in training graduate students. His own life experience confirmed his belief that education empowers people and transforms lives. He supervised a total of 14 doctoral students in 20 years, and his mentoring had a profound effect on his students.

Paul persistently sought ways to promote understanding by the general public of the nature and importance of basic research in science. In 1987, he and his son Pradeep got the idea of starting a two-minute radio program on general science, similar to the *Star Date* series on National Public Radio. With participation from key staff of the IU radio station WFIU, Paul provided the scientific guidance and sought out funds to initiate the program, which went on the air in 1988. This program, *A Moment of Science*, is now heard on public radio stations across the country.

In 1991, Paul was diagnosed with Alzheimer's disease, which eventually took his life but could not deprive him of his

(*continued on page 11*)

New faculty

(*continued from page 8*)

University of Groningen in the Netherlands. Prior to coming to IU, he was a senior research scientist at the NEC Research Institute in Princeton. His research area is the study of estimation, coding, and decision strategies used by the sensory nervous system.

Sima Setayeshgar, assistant professor, received a PhD in 1998 from MIT. Prior to joining the IU Department of Physics, she was a postdoctoral fellow at the Council on Science and Technology at Princeton University. Her research interests are in the areas of pattern formation in non-equilibrium systems and in the study of physically realistic systems.

Jon Urheim, assistant professor, received a PhD in 1990 from the University of Pennsylvania. Before coming to IU, he was an assistant professor at the University of Minnesota. Currently, he is a member of both the CLEO and MINOS collaborations. The research he intends to pursue at IU will focus on the emerging area of neutrino oscillation physics with accelerator-based experiments.

Robert de Ruyter

Sima Setayeshgar

Jon Urheim

Alumni news

Before 1990

Edwin H. Strain, BS'61, is retired but continues to sing in his church choir in Tucson, Ariz. His first year as a Singing Hoosier was 1953.

Kirby W. Kemper, MS'64, PhD'68, currently chair and distinguished research professor of physics at Florida State University in Tallahassee, was the winner of the Jesse W. Beams Medal of the Southeastern Section of the American Physics Society in 2000 for his experimental studies of nuclear structure and dynamics through collisions between light nuclei, especially lithium, and for developing a facilty for high quality beams of polarized lithium ions.

1990s and 2000s

Jae-Sung Kim, MS'89, PhD'91, is a member of the physics faculty of Sook Myung Women's University in Seoul, Korea.

Thomas Wolenski, MS'94, who later received a PhD from the University of Hamburg, is employed in customer information systems at Siemens PSE GmbH & Co. KG, Harburger Schloßstr. 18, 21079 Hamburg,Germany. He wrote the following about his current work: "Unfortunately, I don't have too much time to keep up with physics, but I enjoy my job. I am still doing project management at Siemens, developing software for public transport companies. Our product does CCTV, PA, telephony, customer information and SCADA (monitoring of remote equipment) functionality for use in subway/ railway stations and the corresponding operational control centers. We are still trying to win a major project in New York City, and although the process is very slow (our proposal was originally submitted just over a year ago), we are still very optimistic. I therefore also got to travel to NYC three times this year. Since for our unit the headquarters are in Vienna and part of my project team is located in Slovakia, I get around a lot. Also, technically it is a quite complex system with many interfaces, so it never gets boring." Wolenski's e-mail address is Thomas.Wolenski@siemens.com.

Darius Torchinsky, BS'99, is currently working on a PhD at MIT. He's doing "shock" (high-pressure) physics and spends much of his time in the high-pressure laboratory at Washington State University.

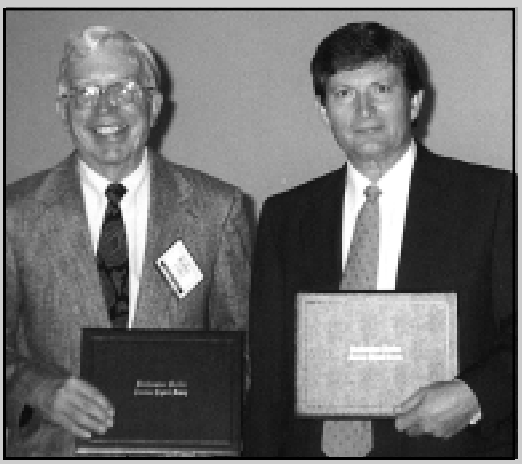
Eric Goff, MS'93, PhD'99, is an assistant professor of physics at Lynchburg College in Virginia. Sadly, we learned from him of Ray Gilbert's untimely death in Indianapolis this past February. Gilbert began graduate study in physics in fall 1992 but had to leave graduate school due to health problems.

Stephen Ichiriu, BS'99, is currently working on a PhD at Caltech.

John Clancy, MS'95, PhD'99, is currently with Lockheed-Martin Corp., Fort Worth, Texas.

(*continued on back page*)

Alumnus named doctor honoris causa



Kirby W. Kemper, Ms'64, PhD'68, left, and Joseph H. Hamilton, PhD'58, received Jesse W. Beams medals of the Southeastern Section of the American Physics Society in 2000.

In May 2001, St. Petersburg State University named **Joseph H. Hamilton**, PhD'58, doctor honoris causa in recognition of his achievements as a world leader in nuclear structure research. In the series of experimental works concluded in the mid-1970s, Hamilton discovered significant properties of nuclei from the transition region between regions of spherical and deformed nuclei. His results led to the experimental discovery of the coexistence of spherical and deformed shapes of nuclei which had major significance for the theory of nuclear structure. Later he undertook a series of investigations that lead to a change from the view of stable nuclei having fixed shapes (spherical or deformed) to understanding the shape as a significant dynamical variable describing the structure of the nucleus. He was the first to discover the existence of a new region of deformed shapes in A=80 nuclei and established the significance of reinforcing protons and neutron clouds, which for large deformations leads to the existence of super deformed states of nuclei.

Hamilton was the first to use germanium detectors for g–g correlation measurements and first performed measurements of life times of the excited states of nuclei using the method of Doppler broadening of gamma lines for products of heavy-ion reactions. He was a creator of both exceptional high-efficiency significant experimental devices and scientific organizations, which had given large, inestimable contributions to contemporary nuclear physics. Hamilton is also involved as an organizer in science education as well as national and international conferences on nuclear physics. He was a member of 37 organizational committees of such conferences. He was the founder of two unique educational-scientific organizations: UNISOR, unifying 12 universities, and the Joint Institute for Heavy-Ion Research. This institute has been visited by about 1,000 foreign scholars, who work there as invited employees, including Russian scholars from St. Petersburg State University.

Hamilton received a PhD from IU in 1958 and joined Vanderbilt University. In 1966, he became a full professor at Vanderbilt. He has been chair of the Vanderbilt physics department and has received many scientific awards and distinguished titles.

Department mourns

(*continued from page 10*)

love for his family or the pleasure he took in walking in the beautiful forests of southern Indiana. He was a dedicated scientist, an inspiring teacher of graduate students, an innovative administrator noted for his ability to promote new directions, and a promoter of the understanding of science in less-developed countries and of global peace. He was a very warm and likeable person whom his many friends around the world sadly miss.

— Timothy Londergan, Dan Miller, and Peter Schwandt, IUB, and Rolf Siemssen, KVI, University of Groningen, Groningen, the Netherlands

Alumni news

(*continued from page 11*)

Todd Peterson, MS'94, PhD'00, was one of eight winners of a prestigious Career Award at the Scientific Interface, given by the Burroughs-Wellcome Fund in 2002. This new award provides $500,000 over five years to each recipient in a national competition. It is intended to support research at the postdoctoral and then beginning faculty levels in biomedical sciences, carried out by scientists who received rigorous doctoral training in the physical or computational sciences. Candidates are expected to draw from their training in a scientific field other than biology to propose innovative approaches to answer important questions in the biological sciences. Peterson's proposal centers on the development of small gamma-ray imaging systems based on semiconductor radiation detectors, and their application to in vivo biomedical imaging experiments in small animals. This represents a new application of technology Peterson also developed for his PhD research at the IU Cyclotron Facility, where he employed state-of-the-art double-sided silicon microstrip detectors and custom-made application-specific integrated circuit electronic readout as the centerpiece of a tagged neutron facility at the IUCF cooler ring. Peterson has continued development of this technology during his current postdoctoral appointment with a highly regarded biomedical imaging group in the radiology department at the University of Arizona. He was previously a Rhodes Scholar, one of the first three awardees of a McCormick Science Grant at Indiana University, and recipient of the IU physics department's Outstanding Graduate Student in Experimental Research award. He is currently beginning to apply for faculty positions in both physics and biomedical engineering departments around the country.

Honors & awards

(*continued from page 7*)

(Wissink), **Charles Lane** (Kostelecky), **Andrea Manara** (Ogren), **Rupert Lewis** (Carini), and **Ning Ma** (Girvin). In 2001–02: **Yogesh Joglekar** (MacDonald), **Robert Cruise** (Macfarlane), **Christopher Blessinger** (Snow), **Craig Steffen** (Dzierba), **Byounghak Lee** (MacDonald), **Kuiru Li** (Girvin), **Anton Burkov** (MacDonald), **Si Yeon Kim** (Berger), **Ralf Lehnert** (Kostelecky), **Joo Chul Yoon** (Kostelecky), **Martine Kalke** (Baxter), **Aditi Mitra** (Girvin), **Sonali Tamhankar** (Gottlieb), and **Martin Ciofalo** (Carini).

INDIANA UNIVERSITY ALUMNI ASSOCIATION
Virgil T. DeVault Alumni Center
1000 East 17th Street
Bloomington, Indiana 47408-1521

Nonprofit Org.
Postage
PAID
Indiana University
Alumni Association

Printed on recycled paper in U.S.A.

Physics Alumni: What's new with you?

The IU Alumni Association is charged with maintaining records for all IU alumni. Please print as much of the following information as you wish. Its purpose, in addition to providing us with your class note, is to keep IU's alumni records accurate and up to date. To verify and update your information online, visit our online alumni directory at www.alumni.indiana.edu/directory.

Name ______________________ Date ____________

Preferred name ______________________

Last name while at IU ______________________

IU Degree(s)/Yr(s) ______________________

Soc. Sec. # or Student ID # ______________________

Home address ______________________

Home phone ______________________

City ______________ State ______ Zip ____________

Business title ______________________

Company/Institution ______________________

Company address ______________________

Work phone ______________________

City ______________ State ______ Zip ____________

* E-mail ______________________

* Home page URL ______________________

* *Please indicate clearly upper and lower case.*

Mailing address preference: ❍ Home ❍ Business

Spouse name ______________________

Last name while at IU ______________________

IU Degree(s)/Yr(s) ______________________

Your news: ______________________

❍ Please send information about IUAA programs, services, and communications.

Attach additional pages if necessary. Mail to the address above, or fax to (812) 855-8266.