PURDUE UNIVERSITY

# Physics INTERACTIONS

A NEWSLETTER HIGHLIGHTING THE DEPARTMENT OF PHYSICS AT PURDUE UNIVERSITY

2005-2006

Grande Finale Symposium April 16, 2005

# Centennial Year Recap

A major milestone was passed this year as Physics reached the 100th anniversary of its establishment at Purdue as a department. Our centennial celebration began with a look back into our history and ended with a look forward into the future of the field. We wish to share with you some of the highlights of this year.

Physics alum David Cassidy (Ph. D. '76), currently Professor at Hofstra University in the Natural Science Program, kicked off our retrospective by presenting a fascinating colloquium on the "Founding of the Modern Physics Department." One of the most remarkable facts reported by David was the cost of the new physics building, begun in 1904. Department head, Erwin Sidney Ferry made the case to President Stone for a new building to accommodate the growing number of engineering and physics students. President Stone successfully persuaded the legislature to appropriate $60,000 for the new facility. In today's dollars, this is more than $1M!

David's presentation was followed by a "Centennial Banquet" at which many of our guests, including former students and emeritus professors, were "treated" to photographs of themselves as they appeared in yesteryear. Professor Durbin's presentation can be found at: http://www.physics.purdue.edu/100_years_of_physics/centennial_colloquium/index.shtml.

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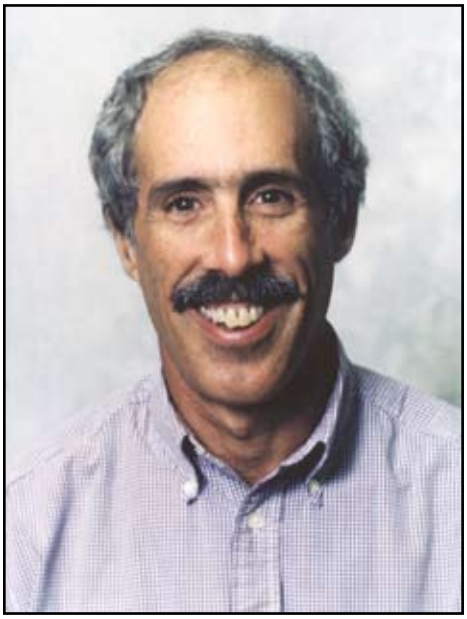
## Inside



# From the Head

I am pleased to introduce our new annual publication, ***Physics Interactions***. In the time since you last heard from me, we have made tremendous progress in reaching the goals set in our departmental strategic plan. We have not only looked ahead, but have also spent some time celebrating where we've been. We recently held a yearlong celebration, commemorating the founding of the department in 1905. You can read a recap of our Centennial in this issue.

For example, we have increased the number of Physics faculty from the low point of about 38 in 2001 to 50 in 2006. From the period 1990-1999, the department made only eight hires; only five of those remain on the faculty today. Since 2000, however, we have made 20 hires! Of course, this did not occur without a lot of effort on the part of our faculty and staff and the support of our Dean, Jeffrey Vitter.

Ten years ago, hiring new faculty, especially those in the experimental fields, did not require the level of startup funds that are needed today. It is not atypical to offer an assistant professor in experimental nanophysics up to $1M in order to set up a state-of-art laboratory and staff it. This is the market price of someone in a "hot" area that requires the very best equipment in order to do forefront science and to be competitive for major grants from funding agencies such as the National Science Foundation. What is the source of such funds? In part, the funds come from the upper administration (Provost, Dean) and the department. To be candid, it is always a challenge to fully meet startup needs and to refurbish space where this research can be conducted.

A goal we had set for ourselves was to increase our level of interdisciplinary activities in areas that meshed well with our core research activities. We have done so both through natural evolution, as researchers have taken advantage of opportunities to collaborate with colleagues in other disciplines and by hiring in areas such as biological physics (see article about Ken Ritchie on p11).

I am pleased to report that our undergraduate program is thriving with about 185 Physics majors in the program. Recent graduates have selected graduate schools such as Cal Tech, MIT, IU School of Medicine, and industries/government agencies such as Loral Space Systems and the CIA.

Concurrent with the growth in our faculty, our graduate program and funding base have increased as well. It is our hope that the funding for both fundamental and applied physics will continue to improve from the recent era of tight National Science Foundation and Department of Energy budgets.

As always, I encourage you to communicate with us, either via email (hirsch@purdue.edu) or via the traditional route!

Andrew S. Hirsch


## *Credits*

This newsletter is published periodically by the Department of Physics at Purdue University.Please address any quesitions to our department at the phone number below.

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www.physics.purdue.edu/interactions

# New Faculty

**Lynn Bryan**, Associate Professor of Science Education, focuses on research in science education. She uses the tools of qualitative research to study: 1) Sociocultural influences on teaching and learning, particularly in international and/or rural contexts; 2) Evidence-based inquiry and reflection in teacher education; 3) Teacher knowledge and beliefs; and 4) Science teacher education. Lynn received a bachelor's degree from the Georgia Institute of Technology, her M.S degree from Indiana University, and her Ph.D. from Purdue University.

**Gabor Csathy**, Assistant Professor of Physics, is a condensed matter physicist. His research focuses on low dimensional electronic systems. His interests include: 1) New Physics in 2D Electrons at low density and low temperature; 2) BCS-like Pairing of Composite Fermions; 3) Non-Abelian Statistics and Possible Applications for Quantum Computing; 4) Spin Physics in Low Dimensional Semiconductors; 5) Spectrally Enhanced Chemical Detection with Nanotube Transistors. Gabor received a bachelor's degree and an M.S. from the University of Bucharest and his Ph.D. from The Pennsylvania State University.

**Jiangping Hu**, Assistant Professor of Physics, is a condensed matter physicist. His research interests include: 1) Spintronics and Transport in Nano-Devices; 2) High Temperature Superconductors; 3) Higher Dimensional Quantum Hall Effects; 4) Atoms in Optical Lattice. Jiangping received a bachelor's degree from Peking University, an M.S. from the Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing, and his Ph.D. from Stanford University.

**Martin Kruczenski**, Assistant Professor of Physics, is a theoretical physicist. His research specializes in string theory and looks at how strings emerge from gauge theory in the large N limit. The particular application is to study connections to quantum chromodynamics (QCD). He also explores string descriptions of confining gauge theories. His interests extend to string theory and its description of blackhole physics, e.g. supergravity. Martin received an M.S. and his Ph.D. from the University of Buenos Aires.

**Yuli Lyanda-Geller,** Associate Professor of Physics, is a theoretical condensed matter physicist. His research investigates mesoscopic physics and interference phenomena (e.g. spin polarizations and nuclear electric resonance). He is also interested in transport and optical phenomena in nanostructures (optically oriented carriers in quantum wells). His interests extend to the field of quantum information, which includes such topics as quantum computing and quantum cryptography. Yuli received his bachelor's degree from the Leningrad Electrical Engineering Institute and his Ph.D. from the Ioffe Physico-Technical Institute, St. Petersburg, Russia.

# New Faculty

**Maxim Lyutikov**, Assistant Professor of Physics, is an astrophysicist. His areas of study include high energy, extragalactic, and plasma astrophysics. These studies explore the emissions of compact astronomical objects (pulsars, magnetars, neutron stars). His models explore the origins of gamma ray bursts and study the structure of relativistic jets from these objects. Maxim received his M.S. degree from the Moscow Engineering Physics Institute and Ph.D. from the California Institute of Technology.

**Denés Molnár**, Assistant Professor of Physics, is an astrophysicist. His research encompasses studies of the properties of nuclear matter at extreme energy densities, the physics of relativistic heavy-ion collisions and the quark-gluon plasma, and transport theory. The primary focus is understanding the new phases of matter that exist at extremely high temperatures and/or densities. For example, one of these phases is the hot dense plasma of quarks and gluons that existed shortly after the Big Bang. Denés received his M.S. degree from the University of Bergen and Ph.D. from Columbia University.

**Norbert Neumeister**, Assistant Professor of Physics, is an experimental particle physicist. His main areas of interest include the phenomenon of electro-weak symmetry breaking, the origin of the matter anti-matter asymmetry in the Universe, and the search for new physics beyond the established Standard Model of particle physics. Norbert is a member of the Compact Muon Solenoid (CMS) collaboration, where he is active in the fields of event selection and reconstruction, computing, software development and data analysis. The CMS experiment at the LHC at CERN will study proton-proton collisions at a centre-of-mass energy of 14 TeV (see article on pg 12). Norbert received his M.S. and Ph.D degrees from the University of Technology, Vienna.

**John Peterson**, Assistant Professor of Physics, is an astrophysicist whose research addresses questions about the large-scale structure of our universe. To pursue these questions, John uses of a variety of observational techniques such as X-ray spectroscopy of clusters of galaxies and weak gravitational lensing. John received a bachelor's degree from the University of Chicago and M.S. and Ph.D. degrees from Columbia University.

**Ken Ritchie**, Associate Professor of Physics, is a biophysicist. His research focuses on membrane physics and single molecule biophysics. The physics at the membrane layers of cells plays a key role in the functioning of cells. His studies include the dynamics of the formation of signaling complexes in the plasma membrane of cells and the process of diffusion in lipid bilayer membranes with embedded mobile and immobile obstacles. He develops and utilizes ultra-fast imaging techniques for observing individual molecules in living cells. Ken received his bachelor's and M.S. degree from the University of Waterloo, and Ph.D. from the University of British Columbia.

# Milestones

## Wei Cui
## University Faculty Scholar

Associate Professor of Physics, Wei Cui, joins a select group of Purdue mid-career faculty in being recognized as a University Faculty Scholar. Wei is the Physics Department's fifth UFS, joining Daniela Bortoletto, Sergei Khlebnikov, David Nolte, and Laura Pyrak-Nolte.

Wei's research focuses on the physics of complex astrophysical objects, black holes, neutron stars, active galactic nuclei, and the cosmological impact these objects have. You can learn more about Wei and his research program at: http://www.physics.purdue.edu/people/faculty/cui.shtml.

## Erica Carlson
## Cottrell Scholar Award

Assistant Professor of Physics, Erica Carlson, received a Cottrell Scholar Award. These highly competitive awards are targeted for faculty who wish to excel at both teaching and research. Erica has recently won both the Ruth and Joel Spira award for undergraduate teaching in the Department of Physics and a new College of Science recognition for outstanding contributions to undergraduate teaching. Erica is a condensed matter theorist who studies strongly correlated electronic systems. You can read more about Erica's research at: http://www.physics.purdue.edu/people/faculty/carlson.shtml.

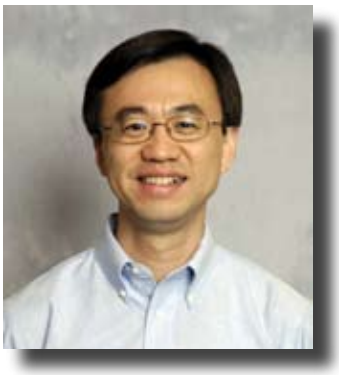
## Norbert Neumeister
## Department of Energy Outstanding Junior Investigator Award

Assistant Professor Norbert Neumeister was one of eight recipients of the DoE OJI award this year. This award is specifically for the purpose of assisting and facilitating the development of the research programs of outstanding untenured high energy physicists. Norbert's main areas of interest include the phenomenon of electro-weak symmetry breaking, the origin of the matter anti-matter asymmetry in the Universe, and the search for new physics beyond the established Standard Model of particle physics. More information regarding his research program can be found at: http://www.physics.purdue.edu/people/faculty/neumeister.shtml.

# Promotions

**Mark Caffee**
**Full Professor**

**Jorge H. Rodríguez**
**Associate Professor**



**Wei Cui**
**Associate Professor**

**Fuqiang Wang**
**Associate Professor**

# Retired

**Albert W. Overhauser**
Years of service:
1974 to 2004

**Sergio Rodriguez**
Years of service:
1960-2004

**Ed Shibata**
Years of service:
1974-2002

# Doctor of Science Honorary Degree Recipient

## Distinguished Professor Emeritus of Physics Albert W. Overhauser, Doctor of Science, Purdue University 2005

Albert W. Overhauser has distinguished himself as an internationally renowned scientist who has made many original and profound contributions to physics across a wide range of fields.

In particular, his discovery of the phenomenon of dynamic nuclear polarization, known as the Overhauser effect, has revolutionized the field of nuclear magnetic resonance and has led to far-reaching applications in biology and medicine.

Born in San Diego and raised in San Francisco, he earned his bachelor's degree, magna cum laude, in physics and mathematics from the University of California, Berkeley, in 1948. In 1951, he also received his doctorate there. Overhauser began his formal research and teaching career at the University of Illinois in 1951. From 1953 to 1958, he carried on his work at Cornell University. For the majority of his career, he served in various research capacities at Ford Motor Company.

In 1973, he departed Ford for Purdue University to become professor of physics, leaving behind the post of Director of the Physical Sciences Laboratory. Throughout his career, Overhauser has maintained a high level of world-class productivity. He served Purdue as the Stuart Distinguished Professor of Physics from 1974 to 2004 and is now Distinguished Professor Emeritus.

Overhauser is a member in the National Academy of Science and a fellow in the American Academy of Arts and Sciences. He also was awarded the National Medal of Science. Other significant honors include an Honorary Doctor of Science from the University of Chicago, an Honorary Doctor of Laws from Simon Fraser University and the Oliver E. Buckley Solid State Physics Prize.

Overhauser has held membership and posts with numerous distinguished professional societies, boards and committees. As a teacher and mentor, many of his graduate students and associates have gone on to distinguished careers of their own. Purdue took pride in recognizing Overhauser's scientific achievements by awarding him the Sigma Xi Faculty Research Prize and the Herbert Newby McCoy Research Award in 1977 and 1978, respectively.

## Faculty Honors

| | | |
|---|---|---|
| 2006 | Erica Carlson | Oustanding Contributions to Undergraduate Teaching, College of Science |
| | Erica Carlson | Cottrell Scholar Award |
| | Wei Cui | Purdue University Faculty Scholar |
| | Gabriele Giuliani | Ruth and Joel Spira Award for excellence in graduate teaching |
| | Mark Haugan | Ruth and Joel Spira Award for excellence in undergraduate teaching |
| | Norbert Neumeister | Outstanding Junior Investigator Awards in High Energy Physics |
| | Ian Shipsey | Chair of the American Physical Society W.K.H. Panofsky Prize Committee |
| 2005 | Daniela Bortoletto | Elected to the Particle Physics Projects Prioritization Panel |
| | Erica Carlson | Ruth and Joel Spira Award for excellence in undergraduate teaching |
| | Sherwin Love | Ruth and Joel Spira Award for excellence in graduate teaching |
| | Sherwin Love | Fermilab Frontier Fellow |
| | David D. Nolte | Herbert Newby McCoy Award, Purdue University |
| | Albert W. Overhauser | Doctor of Science (Honorary), Purdue University |
| | Ian Shipsey | Vice Chair of the American Physical Society Panofsky Prize Committee |

# In Memorium - Ralph Bray (1921-2006)

## Ralph Bray, Professor Emeritus of Physics at Purdue and a resident of West Lafayette since 1942, died Sept. 28, 2006 at the age of 85. His research as a graduate student at Purdue in the late 1940s contributed to the development of the transistor, which became a key foundation for the computer revolution

Although he had been treated for multiple myeloma for several years, he died after a brief illness from complications of the disease.

Bray was born on Sept. 11, 1921, in the town of Moghilev in Russia, the son of Harry and Pauline Brachkovsky. His father worked in the theater and later as a beautician. He immigrated with his parents to the United States in 1922 and grew up in Brooklyn, N.Y. The family changed its name to Bray in the 1930s. After graduating from Brooklyn College in 1942, he came to Purdue as a graduate student in physics and earned his Ph.D. in 1949. He was a member of the faculty until his retirement in 1989.

Dr. Bray devoted his research to the field of solid state physics and presented papers at numerous national

Ralph Bray in 1944

and international conferences. During his career at Purdue, he spent sabbaticals at General Atomic in San Diego, CA (1960-61), as a Guggenheim Fellow at Oxford College in England (1969-70), at the Hebrew University in Jerusalem, Israel (1978), as a Von Humboldt Senior Scientist at the Max Planck Institute in Stuttgart, Germany, (1985-86), and as a Visiting Professor at the University of Osaka in Japan (1990). In addition to his dozens of scholarly publications, he also wrote on the history of semiconductors and the history of physics at Purdue. As a teacher, Bray supervised the dissertations of numerous graduate students.

Ralph Bray in the early 1980's

Bray married Felice Tannenbaum on Feb. 1, 1948, in Brooklyn, N.Y., before settling in West Lafayette. Together, they loved their house, which they had designed and had lived in since 1955, and also loved to travel, recalling in vivid detail all of the memorable meals they ever shared around the world. Bray was an avid tennis player, loved to engage verbally with his family and friends, relished discussing politics and cosmology, and was inspired by his successive models of Mac computers. In recent years he enjoyed his visits with his grandchildren, and the topical discussions of his men's club.

Despite his extended battle with his cancer and the impact of macular degeneration which interfered with his reading, he remained passionate about his intellectual interests and never lost hope in his personal medical struggles or in the possibility of a more progressive and peaceful world. He was committed to the rationality and mysteries of science, but also revealed an un-common sense of humor with a well-known propensity for relatively "Paine"-less puns.

*-Journal & Courier - Lafayette & West Lafayette, October 1st, 2006*

## Particles of Information

# Centennial Year Recap

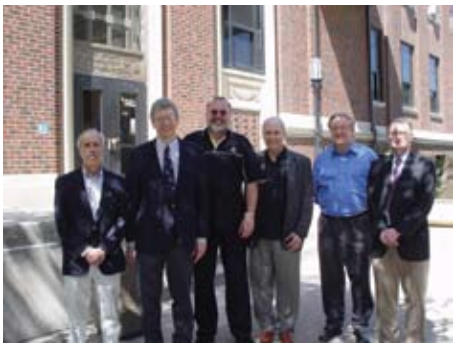
**Continued from front page...**

Over the course of 100 years, it is easy for a department to acquire large collections of photographs and memorabilia. It is typical that such items are put into notebooks or files, only to be soon forgotten. We used our centennial as motivation to digitize and assemble our history that had been so-captured and produced a truly outstanding volume entitled "A Century of Science." Some excerpts can be found at the above URL under the "Yearbook" designation. (You may obtain a copy of the yearbook by sending a check for $60 made payable to "Purdue Foundation"). Many thanks to Steve Durbin for compiling and editing this memoir.

Our yearlong celebration concluded on April 16 with a forward-looking "Grand Finale Symposium." Four outstanding scientists were invited to talk about the future of their respective fields: Condensed Matter Physics (Prof. Steve Girvin, Yale University); Biological Physics (Prof. Klaus Schulten, University of Illinois, Urbana-Champaign); Astrophysics (Professor Michael Turner, Assistant Director of the Mathematical & Physical Science Division of the National Science Foundation and University of Chicago); Particle Physics (Prof. Michael Witherell, Fermilab and University of California – Santa Barbara). Among the many interesting and exciting insights shared with the audience were:

- Caution urged on the possibilities of quantum computing (due mainly to issues pertaining to decoherence).
- The fact that quantum mechanics is relevant in biological systems, particularly those performing photosynthesis.
- What is the origin of mass and what is the dimensionality of space-time?
- The Universe is energetically dominated by a mysterious component, Dark Energy, which we know little about.

Physics Building Dedication 1943
Left to Right: Lark-Horovitz, Pauli, Hansen, Kerst (rear), Schwinger, Condon, Becker.



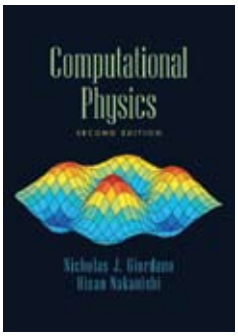
From left: Andrew Hirsch, Steve Girvin, Greg Boebinger (Distinguished Science Alumni Award winner, 2005), Michael Turner, Klaus Schulten and Michael Witherell
photo taken by Jane Einstein

Conference on Problems of Modern Physics - June 19 and 20, 1942
This photograph was recreated at the Grand Finale Symposium April 16, 2005 (see front cover)

At the break between the morning and afternoon talks, all attendees were invited to gather on the steps outside the entrance of the old wing of the Physics Building known as the Charles Benedict Stuart Laboratory of Applied Physics (front cover) in order to recreate an assembly of physicists attending the Conference on Problems of Modern Physics (left), June 19-20, 1942. The following year, this building was dedicated. A photograph of that occasion was also recreated with the four invited speakers for our Grand Finale Symposium (above).

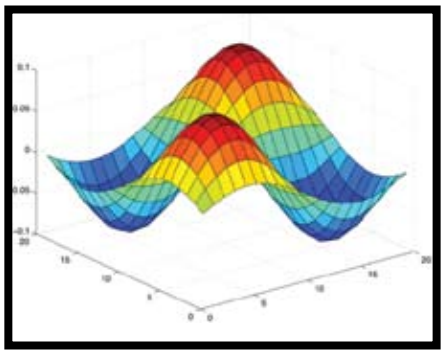
We believe that our Centennial was a great success. It has given us the opportunity to re-establish ties to many of our friends and alums who have been an integral part of our history, and provided the impetus to document the remarkable past achievements of Physics at Purdue University. We all look forward to our next centennial!

# *Computational Physics 2nd Edition (Prentice-Hall)*



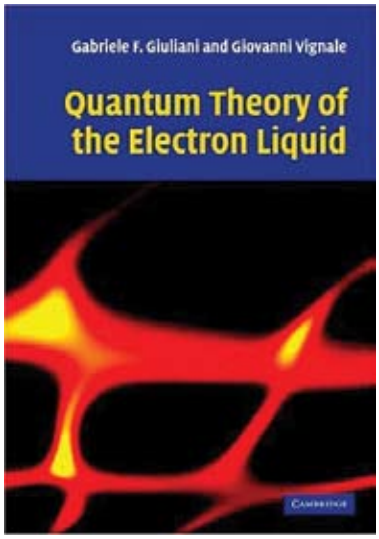

The second edition of Computational Physics, by Nicholas Giordano and Hisao Nakanishi was published by Prentice Hall in 2005. This text is designed to give an introduction to a wide variety of problems that can only be attacked using computational methods.

Written for graduate students and advanced undergraduates, problems ranging from solar system mechanics to chaotic systems to molecular dynamics to critical phenomena to quantum mechanics are covered. A range of interdisciplinary topics including protein folding, neural networks, and musical instruments are also discussed.



**Read more on the web:** http://www.physics.purdue.edu/~hisao/book/

# *Quantum Theory of the Electron Liquid (Cambridge University Press)*




Professor Gabriele F. Giuliani is one of the two coauthors of "Quantum Theory of the Electron Liquid." The work presents the modern theory of the fundamental electron processes that are at the core of condensed matter physics.

First published in 2005 within the prestigious Physics collection of Cambridge University Press, the book represents a state of the art monograph on the subject and has established itself as a well received resource for scholars in the field. On the other hand the wealth of material covered in its 777 pages and an emphasis on providing the necessary details, make it a very useful textbook for Physics, Chemistry and Electrical Engineering graduate courses.

The book has been very positively reviewed by several distinguished international scientific Journals including Physics Today and is already close to its first reprinting. Notably its attractive cover image has been selected for the cover page of the Cambridge University Press Physics catalogue as well as for the background of the "Year of Physics" poster of the oldest press in the world.

**Read more on the web:** http://www.missouri.edu/~physvign/qtel.htm

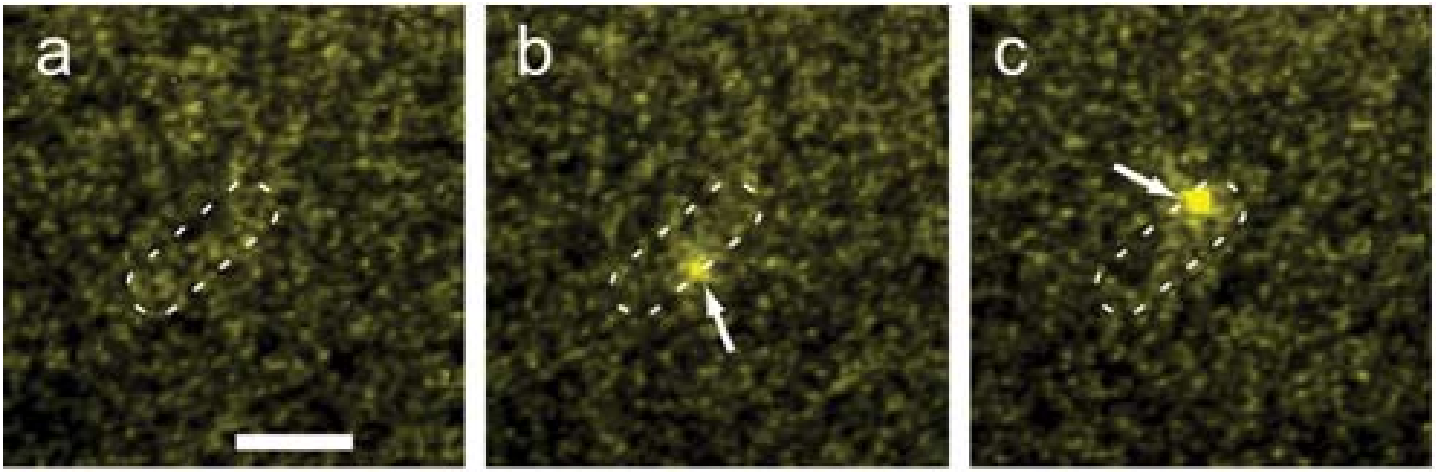
# Biological Physics

BY KEN RITCHIE
Associate Professor of Physics

Our research centers on trying to understand the dynamic organization of the membranes of cells, specifically bacterial cells, by directly imaging the motion of individual cell surface molecules. Unlike mammalian cells, bacterial cells have a complicated double membrane sandwiching a cell wall that gives the bacteria resistance to applied pressure. These membranes are two dimensional fluids, yet they maintain polarized distributions of many of the molecules embedded within them. For example, in Escherichia coli, many of the chemoreceptor proteins required for sensing nearby chemicals (food) reside only in the ends of the cigar-shaped cell.

To attack this problem we use the latest state-of-the-art low light level cameras coupled to a home-built total internal reflection fluorescence microscope. Using laser illumination, we can observe the faint signal produced by individual fluorescent dyes attached to the molecules of interest on/in the cell.

Recent results are shedding light (pun intended) on the mechanisms through which E. coli maintain heterogeneous distributions of essential chemoreceptor protein molecules in their fluid inner membrane. By directly observing serine receptor proteins just after they are transcribed, we find preliminary evidence that the molecules are inserted near one end of the cell and a fraction of these molecules are then actively transported by an unknown mechanism to the distal end. In collaboration with Profs. Barry Wanner and Daisuke Kihara in Purdue's Department of Biological Sciences, we are combining biophysical, genetic and bioinformatic techniques to investigate this mechanism.

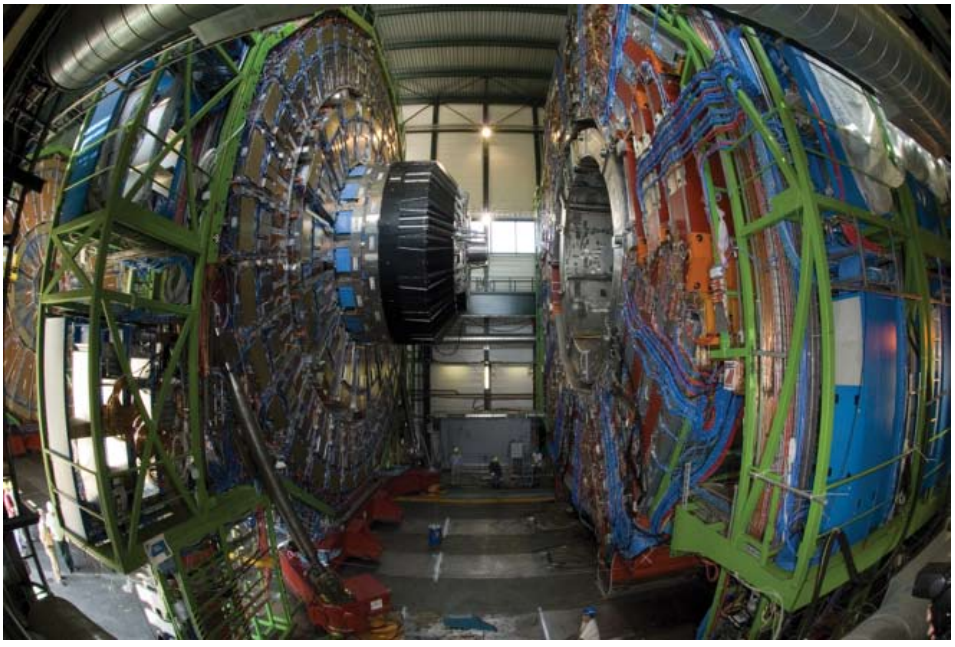



Appearance and transport of a single Tsr protein molecule in E. coli. a) Prior to the transcription of a new protein there is no signal within the cell, whose location is shown by the dotted line. b) and c) A newly produced, single Tsr molecule (arrow) is being transported towards the far end of the cell. The time difference between images b) and c) is 0.53 s. Scale bar is 2 micrometers.

# The CMS Tier-2 center at Purdue

The Large Hadron Collider (LHC), currently under construction at the European Organization for Nuclear Research (CERN), which is located near Geneva, Switzerland, is the largest scientific instrument on the planet. When it begins operations in 2007, it will produce PetaBytes of data per year, which thousands of scientists around the world will access and analyze. The Compact Muon Solenoid (CMS) experiment is one of two major experiments at the LHC which will study the properties of the elementary constituents of matter and their interactions at the most fundamental level. It is being constructed by a global collaboration of over two thousand physicists and engineers and will commence operation in 2007 with a scientific program that will continue for decades. The Purdue experimental particle physics group plays a major role in the design, construction and operations of the CMS experiment.

The LHC will open a new window into the physics of the Universe, providing nearly a ten-fold increase in collision energy over any existing particle accelerator. It is believed that the unprecedented energy range combined with the special capabilities of the CMS experiment will lead to a breakthrough in our understanding of nature. At these extreme energies our understanding of the microscopic sub-atomic world is expected to break down, yielding new discoveries about the underlying structure of matter. By colliding protons at very high energies, physicists hope to learn more about the postulated Higgs particle, which has been called the holy grail of particle physics. The Higgs particle is the only unobserved particle predicted by the Standard Model of particle physics, which is the current theory of fundamental particles that make up matter.



The Large Hadron Collider at CERN

In order to establish the existence of new physics, new particles must be produced in the particle beam collisions that occur at the center of the CMS detector. These events are sufficiently improbable compared to standard particle interactions that huge numbers of collisions must be created and examined to establish evidence of new physics. At the LHC, the beams will collide every 25 ns, and the beams are so dense that up to 25 peripheral interactions will occur each time the beams cross. The data acquisition and filtering system is designed to select the information for 100 collisions

## On the world wide web: http://cms.cern.ch/

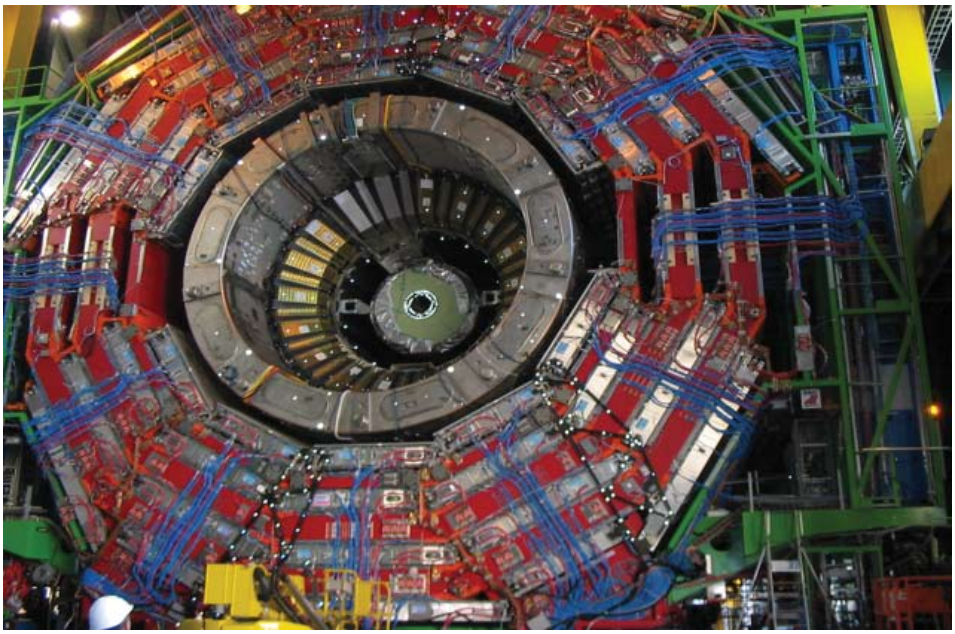
**The CMS (Compact Muon Solenoid) experiment at the LHC at CERN will study proton-proton collisions at a centre-of-mass energy of 14 TeV.**

BY NORBERT NEUMEISTER
Assistant Professor of Physics

per second as "interesting enough" for permanent storage, filling disks at 100 MegaBytes per second. Total data volumes will easily exceed 3 PetaBytes per year. The analysis of this data in a manner that will allow us to extract signatures of new physics provides a major challenge.

To handle the large amount of data that will be produced by the experiment, an international effort is underway to establish a global research-computing grid that can use resources at the world's premiere science institutions. All data from the CMS detector will be distributed for further processing and analysis to various centers in many nations. The CMS computing model assumes a hierarchical tier structure of facilities with CERN being a Tier-0 center. In addition there will be seven Tier-1 centers across the world, one per major country, and about 30 regional Tier-2 centers, all connected by an international Grid-infrastructure.

To provide the necessary computing infrastructure for physics analysis and simulation within the US, the CMS collaboration will operate one Tier-1 center at Fermilab and seven Tier-2 analysis centers at US universities. Tier-2 centers are at the core of empowering US universities to perform physics analysis at the LHC by providing computing services. In January 2005 the Purdue Physics Department in partnership with Purdue's Central Computing and Telecommunications Organization (ITaP) has been selected to build and operate a Tier-2 analysis center. The Tier-2 center at Purdue is a facility designed to provide the computational needs of scientific and academic communities in the region and across the globe. The facility consists of computational clusters, disk storage arrays and a variety of other service nodes. By 2007 it will provide CPU resources of about 1000k SI2000, about 250TB of disk storage and a high bandwidth network connection (~10 Gigabit/s). The US-CMS Tier-2 program will support about 250 physicists in the country. It will profit from opportunistic resource use and sharing with other computing infrastructures. The Open Science Grid is the framework that enables sharing and provision of these resources.



The complete CMS detector will be about 21m long, with a diameter of about 16m and will weigh in excess of 12500 tonnes (=14,000 tons).

Purdue's participation as a CMS Tier-2 center is part of an on-going effort to integrate high performance computing facilities with top-level research. This is a unique approach that helps to advance science and education. The Tier-2 facility at Purdue also participates in computer science and engineering projects engaged in researching grid computing on a regional and world-wide scale. In addition to providing computing resources, Tier-2 centers will act as competence centers for selected physics analyses. Hence, the Tier-2 center at Purdue complements the ongoing CMS efforts within the experimental particle physics group and provides a regional resource to become a key player in physics analysis and to produce the first physics from the LHC.

# Student Awards

| | | |
|---|---|---|
| **Awards to the Undergraduate Students** | | |
| 2006 | Richard W. King Award | Maggie Stewart<br>Anna Treaster |
| | Outstanding Freshman and Sophomore Award | Zohar Aliya - Freshman<br>Kevin O'Brien - Sophomore |
| | Lijuan Wang Memorial Award | Anna Treaster |
| 2005 | Richard W. King Award | Paris Miles Brenden |
| **Awards to the Graduate Students** | | |
| 2006 | Edward S. Akeley Award | Stefano Chesi |
| | Akeley-Mandler Awards for Teaching Excellence Award | John Buncher |
| | Teaching Assistant Award | Jacob Hale<br>George Simion |
| | Karl Lark-Horovitz Award | George Simion |
| | George W. Tautfest Award | Anadi Canepa |
| | Grodzins Summer Research Award | Stefano Chesi |
| | Lijuan Wang Memorial Award | Valeria Starovoitova |
| 2005 | Edward S. Akeley Award | George Simion |
| | Akeley-Mandler Awards for Teaching Excellence Award | John Millis |
| | Teaching Assistant Award | Glynn Bricker |
| | H. Y. Fan Award | Leilei Peng |
| | Karl Lark-Horovitz Award | Manoj Varma |
| | George W. Tautfest Award | Kim Giolo<br>Amitava Roy |
| | Grodzins Summer Research Award | Naranbaatar Dashdorj<br>Xiangshun Lu<br>Joshua Matties |
| **Other Prizes and Awards Given to Physics Students** | | |
| 2006 | Barry M. Goldwater Scholarship | Katherine Wooley |
| | College of Science Outstanding Achievement | Shakeel Dalal, Freshmen<br>Amber Meyerratken, Junior<br>Justin Troyer, Sophomore<br>Katherine Wooley, Junior |
| | Bilsland Dissertation Fellowships | Trinanjan Datta |
| | Outstanding Physics Senior | Anna Treaster |
| | Spira Undergraduate Summer Research Award | Amber Meyerratken |
| | Undergraduate Research And Poster Symposium | Matt Marziale<br>Julia Novak<br>Maggie Stewart<br>Chris Wolfe |
| 2005 | Barry M. Goldwater Scholarship | Anna Treaster |
| | Bilsland Dissertation Fellowships | Mary Yang |
| | College of Science Distinguished Scholar | Scott Burdick |
| | | |

# Student Awards

| Other Prizes and Awards Given to Physics Students (cont.) | | |
|---|---|---|
| 2005 | College of Science Outstanding Achievement | Scott Burdick<br>Cameron McKinney<br>Amber Meyerratken<br>Kevin O'Brien<br>Margaret Stewart<br>Anna Treaster |
| | Edmond R. and Mary L. Henelt Scholarship<br>given by the College of Science | Scott Burdick |
| | Edward and Annette Shapiro Scholarship<br>given by the College of Science | Anna Treaster |
| | Ellen Aldag Sawyer Memorial Scholarship<br>given by the College of Science | Amber Meyerratken |
| | Graduate School Excellence in Teaching Award<br>Given by Purdue University | Jacob Millspaw<br>Ricardo Vasquez |
| | Merit Scholarship<br>given by the College of Science | Kevin O'Brien |
| | Outstanding New Researcher<br>given by the College of Science | Nicholas Mellott |
| | Outstanding Physics Senior | Krystal Tyler |
| | Phi Beta Kappa | Scott Burdick<br>Kyle English<br>Paris Miles-Brenden<br>Anna Treaster |
| | Purdue University Excellence in Science and Engineering Fellowship<br>Sponsored by Sandia National Laboratory | Laura Biedermann |
| | Science Alumni Outstanding Achievement<br>given by the College of Science | Scott Burdick<br>Cameron McKinney<br>Amber Meyerratken<br>Paris Miles-Brenden<br>Margaret Stewart<br>Anna Treaster |
| | Science Scholarships | Paris Miles-Brenden |
| | Undergraduate Research And Poster Symposium | Nicholas Mellott<br>Paris Miles-Brenden<br>Margaret Stewart |
| | Violet B. Haas Memorial Scholarship<br>given by the College of Science | Anna Treaster |

## Alumni News

# 2005 Distinguished Science Alumni Award

## Gregory S. Boebinger

- B.S. Physics; B.S. Electrical Engineering; B.A. Philosophy, 1981, Purdue University
- Certificate of Postgraduate Study in Physics, Churchill College Cambridge University
- Ph.D Physics, 1986, Massachusetts Institute of Technology

Greg Boebinger received a truly rounded education at Purdue, earning Bachelor's degrees in physics, electrical engineering, and philosophy, all with a final grade point index of 5.96 on a 6.0 scale. He spent a year at Cambridge University's Churchill College, earning a certificate of postgraduate study in physics before entering MIT to pursue the Ph.D in physics. He spent a year of postdoctoral research with the Groupe de Physique des Solides of the Ecole Normale Superieure in Paris, and then joined Bell Laboratories as a member of the technical staff in the Physical Research Laboratory.

Greg joined the Los Alamos National Laboratory in 1998 as director of the Uulsed Magnetic Field Laboratory. In 2003 he was named deputy division leader for Science Programs at the Los Alamos Lab's Materials Science and Technology Division. In 2004, he became the director of the National High Magnetic Field Laboratory, a joint operation of Florida State University, the University of Florida, and Los Alamos National Laboratory. He also holds appointments on the faculties of both Florida State and the University of Florida. Greg has authored more than 100 publications with a total of over 2,200 citations. He counts among his honors his election as Fellow of the American Physical Society, a NATO postdoctoral fellowship, fellowships from the Fannie and John Hertz Foundation, the Karl Taylor Compton Foundation, and the Winston Churchill Foundation. He was the speaker at his Purdue commencement ceremony in 1981 and at his graduation from North Central High School in 1977. He is proud of his achievement award in writing from the National Council of Teachers of English, and his Eagle Scout award from the Boy Scouts of America in 1974. Greg is active in his church, the United Church of Los Alamos.

### *Career Highlights*

| | |
|---|---|
| 2004 | Director, National High Magnetic Field Laboratory |
| 2002 | Deputy Director for Science Programs, Los Alamos Division of Material Science and Technology |
| 1998 | Director, National High Magnetic Field Laboratory, Los Alamos National Laboratory |
| 1996 | Fellow, American Physical Society |
| 1987 | Member, Technical Staff, Physical Research Laboratory, Bell Laboratories |
| 1986 | NATO Postdoctoral Fellowship, Ecole Normale Superieure |

# 2006 Distinguished Science Alumni Award

**Victor L. Hunter**
B.S. 1969, Physics,
Purdue University
MBA 1971,
Harvard Business School

Vic Hunter is founder and president of Hunter Business Group LLC. He is nationally known for his expertise in business-to-business direct marketing and service to the nation's leading companies. Founded in 1981, Hunter is the first consulting and service company dedicated solely to increasing the productivity of businesses by assisting them to sell products and services to other businesses, institutions, and professionals.

Prior to starting his consulting business, Vic was president of Business and Institutional Furniture, a direct mail business furniture and equipment distributor in Milwaukee. Before that, Vic was Director of Marketing for a manufacturing company in Green Bay, Wisconsin. He currently serves on the Board of Directors for Wm. K. Walthers Inc., as well as the Wisconsin Presidents Organization.

He is a much-sought-after guest lecturer to business school students and is a frequent speaker at Direct Marketing to Business Conferences. Vic is a member of the DMA Business-to-Business Segment Advisory Council and serves on the Board of Directors for SAMA (Strategic Account Management Association). He serves the College of Science as a member of the Dean's Leadership Council.

Vic is the author of Business to Business Marketing: Creating a Community of Customers, which provides a comprehensive model for doing business in the new customer-focused environment and the practical guidance for implementing profitable, customer-driven marketing programs.

Vic and his wife Linda have four children and live in Fox Point, Wisconsin.

**Marcos H. Grimsditch**
M.S. 1973; Ph.D 1976, Physics,
Purdue University

Marcos Grimsditch grew up in Buenos Aires , Argentina and came to Purdue Physics as a Fulbright exchange student in 1972. He earned his doctorate under the guidance of Prof. Anant Ramdas, Lark-Horovitz Distinguished Professor of Physics, a world-class expert in the spectroscopy of crystals.

Marcos joined Argonne National Laboratory in 1980, rising to the position of Senior Scientist in the Materials Science Division in 1998. The division's materials scientists, physicists, and chemists carry out collaborative research on a variety of problems, bringing fundamental research to improve the performance of old materials or to design new materials.

Marcos is an internationally recognized expert in inelastic light scattering techniques as applied to solids. Prof. Ramdas cites Marcos' "superb experimental skills, his appreciation of the scientific opportunities involving fundamental issues in semiconductors, insulators, superconductors, and amorphous materials." He has authored more than 300 articles, and in 1996 was elected a Fellow of the American Physical Society, an honor reserved for a very select group of APS members.

# Physics Outstanding Alumni Award 2006

## On October 26 & 27, 2006, three physics alumni were honored for their contributions and leadership within their professions.

From left: Dr. John Parker, Dr. Andrew Hirsch, Dr. Virginia Ayres, Dr. James Vickers, and Dean Jeff Vitter, College of Science

### Dr. Virginia Ayres (Ph.D., 1985)

Dr. Virginia M. Ayres is an Associate Professor in the Department of Electrical & Computer Engineering at Michigan State University. She earned her Ph.D. in physics from Purdue and two B.A.s in physics and biophysics from Johns Hopkins University. Her research interests are in nanobiology, nanoelectronics, and scanning probe microscopies.

Dr. Ayres has received two NASA Faculty Fellowship Awards, two NSF Outstanding Performance Awards, and two international awards from the Japan Society for Promotion of Science and from Tokyo Institute of Technology for research and education in Japan.

### Dr. John Parker (Ph.D., 1988)

Dr. John Parker is Vice President of Cabot Microelectronics. He earned his B.S. in Physics at Northeastern Illinois University in 1983.

John has spent his career contributing to the commercialization of emerging technologies, predominantly focused in nanotechnology and entrepreneurial development. He was formerly employed at Argonne National Laboratory as a research associate before joining Nanophase Technologies Corp., where he served as co-founder and chief scientist, and finally then as CTO/VP Technology and Manufacturing.

In 1999, John was the Director of Engineering at Cirqon Technologies Corp., before joining Cabot in 2002. He holds nine U.S. and international patents, has authored over forty technical and scientific publications, and contributed to two textbooks on nanotechnology. He organized and edited five Materials Research Society symposia on nanotechnology.

John received the 1998 Entrepreneur of the Year award from the Research Directors Association and the 1995 R&D 100 Award presented by R&D Magazine (Cahners Publications).

### Dr. James Vickers (BS, 1986)

Dr. James Vickers of San Jose, Calif., is Chief Technology Officer and founder of T-Metrics. He studied semiconductor surface physics and atmospheric physics, and worked on the design and launch of a satellite, as well as launching four sounding rockets. He worked for AT&T Bell Laboratories before co-founding Optonics, a company that designed and produced a picosecond-timing diagnostic tool used to debug complex integrated circuits. He is currently pursuing a second startup company with a fellow Purdue physics graduate. He holds a Ph.D. in physics from the University of California at Berkeley. and earned his bachelor's degree in physics from Purdue in 1986.

# Alumni News

**Mario Paniccia** (Ph.D. 1994, Ron Reifenberger, major professor), who is the Director of the Photonics Technology Laboratory at Intel Corporation, has led a successful effort to develop a silicon-based optical switch, capable of operating with a bandwidth of more than 1 Gigahertz. Previously, the best performance achieved was in the range of 20 MHz. The marriage of photonics and silicon technology will allow manufacturers to build optical communication systems inexpensively by eliminating costly materials such as gallium arsenide. This breakthrough development was reported in the February 12, 2004 edition of the journal *Nature*.

**Qun Shen** (Distinguished Alumni Award from College of Science, 2004) recently moved from the Cornell High Energy Synchrotron Source (CHESS) to Argonne National Laboratory where he works as Senior Scientist and Group Leader at the Advanced Photon Source.

**Have news to share? Send it to us! Have a question?**

Contact Tony Vidmar, Director of Development, at 765-494-0669 or tvidmar@purdue.edu.

# Your Donation Can Make a Difference!

If you are interested in supporting the Department of Physics rememer that donations are tax deductible. Even small amounts are helpful and add up when combined with gifts from others. Gifts to the department's Discretionary Fund provides the greatest flexibility, allowing the department to allocate the funds where it is needed most. For further information contact Tony Vidmar, Director of Development.

# Recognizing Our Donors

**We recognize and thank our donors who made gifts to the department between Jan. 1st - Sept. 30 2006**

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