PURDUE UNIVERSITY

Physics INTERACTIONS

A NEWSLETTER HIGHLIGHTING THE DEPARTMENT OF PHYSICS AT PURDUE UNIVERSITY

2009

High Energy Nuclear Physics Group Investigates "Perfect Liquid"

The Relativistic Heavy Ion Collider (RHIC) complex at Brookhaven National Laboratory. The Purdue High Energy Nuclear Physics Group's research at RHIC provides an in-principle means to measure the equation of state of the quark-gluon plasma (QGP), a "perfect liquid" that may have existed shortly after the Big Bang. (Photo Courtesy of NSLS, Brookhaven National Laboratory)

(page 8)

Inside

Credits

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

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www.physics.purdue.edu/interactions

From the Head

Welcome to the latest edition of *Interactions*, the annual newsletter from the Purdue Department of Physics. It has been quite a busy year, in many ways. The difficult economic times have, of course, been a formidable challenge for the University and for the Department. Nevertheless, we are firmly focused on the future, and you will see from this newsletter that the future of Physics at Purdue looks very bright. Our students and faculty have received an impressive number of awards and recognitions during the past year. Graduate students Abraham Olson and Sannah Ziama have won prestigious National Science Foundation Fellowships – and Abraham also was awarded a National Defense Science and Engineering Graduate Fellowship (it has been quite a good year for Abraham!). The National Science Foundation has also given Early CAREER awards to three of our faculty, Yong Chen, Matthew Jones, and Chen Yang. These are special grants to recognize and support young faculty to develop innovative ways to combine their research and educational work. Another of our young faculty, Martin Kruczenski, won a fellowship from the Alfred P. Sloan Foundation, another very nice recognition of his accomplishments and his promise. We are very proud of these recognitions, and the other awards our students and faculty have received during the past year (more of which are mentioned on pp. 4 & 7).

Many folks in the Department of Physics have worked hard during the past year to develop a strategic plan. A faculty retreat, numerous committee meetings, and several faculty meetings were devoted to this effort, and the Department approved a new five-year plan in April. This plan has been approved by the Dean, and we are now working to implement the various initiatives outlined in the plan. One major effort is a review of our graduate program with the goal of increasing the graduate student success rate and decreasing the average time needed to obtain a Ph.D. We are also continuing the implementation of our new undergraduate curriculum (which was approved in 2008), including the expansion of options in our Applied Physics program. Earlier this year we welcomed a new outreach coordinator, Keith Adams, to the department, and we are now working to refocus and enhance our outreach activities to have a greater impact on K-12 physics education throughout the state. The past year has also seen a significant increase in our sponsored research funding, and we are now working on ways to give better support to faculty as their research programs grow.

It has thus been a very busy and productive year for the Department. Much work remains, but the success we are now seeing gives us all great optimism for the future. It is my great pleasure to share all the good news with you – and I encourage you to stay in touch with the Department!

- Nicholas J. Giordano (‘73)
Hubert James Distinguished Professor of Physics and Department Head.

New Faculty

Jay Melosh , Distinguished Professor of Physics, specializes in planetary physics. His specific research interests are in the ramifications of impact cratering, planetary tectonics, and the physics of earthquakes and landslides. Prof. Melosh is a member of the National Academy of Sciences and comes to Purdue from the University of Arizona where he was a Regents Professor. He holds an A.B. from Princeton University and a Ph.D. from Cal Tech.

New Dean of the College of Science

Jeffrey Roberts was named Frederick L. Hovde Dean of the College of Science in June. Dean Roberts comes to Purdue from the University of Minnesota where he was Chair of the Department of Chemistry.

Retired Faculty

Prof. Solomon Gartenhaus
Years of Service:
1958-2009

Retired Staff

Roger Boyce
Physics on the Road
Years of Service:
1969-2009

Sangita Handa
Academic Advisor
Years of Service:
1993-2009
(Physics 2004-2009)

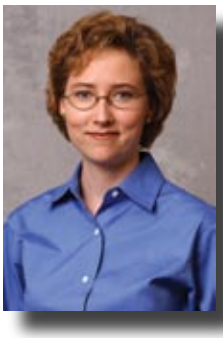
Research expenditures in the Physics Department were up 11% in 2008-09.

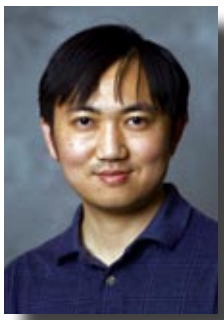
In Memorium

Prof. Alexander Gerritsen
29 November 1913 – 18 May 2009
Years of Service: 1956 – 1979

Faculty Honors

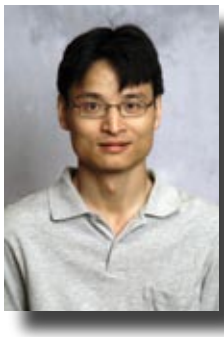
Professor Erica Carlson was promoted to Associate Professor and received the Ruth and Joel Spira Award for Outstanding Graduate Teaching.





Professor Yong Chen received a National Science Foundation CAREER Award.

Professor Wei Cui was promoted to Professor.



Professor Jiangping Hu was promoted to Associate Professor.

Professor Matthew Jones was promoted to Associate Professor and received a National Science Foundation CAREER Award.

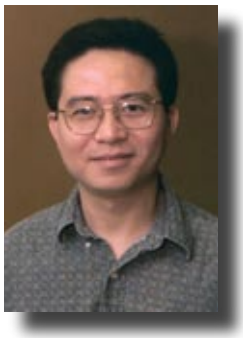
Professor Martin Kruczenski received an Alfred P. Sloan Fellowship.

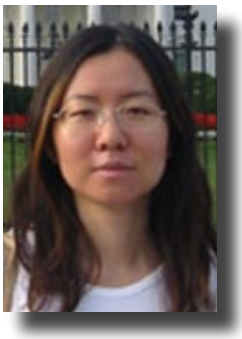
Professor Matthew Lister was promoted to Associate Professor.

Professor Emeritus Albert Overhauser received the Russell Varian Prize and was named a Fellow of the International Society of Magnetic Resonance.

Professor Anant Ramdas received the Ruth and Joel Spira Award for Excellence in Undergraduate Teaching.

Professor Fuqiang Wang was promoted to Professor.





Professor Chen Yang received a National Science Foundation CAREER Award.

Staff Honors

Carol Buuck received the Professional Achievement Award from the College of Science.

Michael Focosi received the Professional Achievement Award from the College of Science.

Sandy Formica received the Customer Service Award from the College of Science.

Andrzej Lewicki received the Leadership Award from the College of Science.

Particles of Information - Graduate Research

Optical Picometrology for Ultra-thin Dielectric Film Detection

Xuefeng Wang

Ultra-thin dielectric films (with a thickness on the order of one nanometer or less) are not rare. Water in air spontaneously forms a sub-nanometer film on silica surfaces. Graphene, a single flake of a graphite crystal, is as thin as 0.335 nm. Oil can spread into a monolayer (single molecule thin) on the surface of water. Other than these naturally occuring examples, one finds more cases of man-made ultra-thin films as nanotechnology advances, especially in the areas of gene and protein chips, chemical vapor deposition (CVD), nano-electro-mechanical systems (NEMS), and so on.

As the study and applications of ultra-thin films evolve rapidly, traditional film characterization tools such as ellipsometry may fail in extreme situations. A more versatile method is demanded for the facile measurement of thickness, complex refractive index or dielectric constant of films with limited size, extremely low thickness, or optical anisotropy. Picometrology was thus developed in response to this need in the research group under the direction of Prof. David Nolte.

Picometrology studies thin films on a solid substrate. It suppresses the background noise by spinning the sample (Fig. 1), and therefore detects in the frequency domain away from the dominant 1/f (pink) noise. Moreover, local interferometry (optical interference occurs among the interfaces of a thin film and the coatings of the substrate) is exploited to further improve sensitivity. The detection limit for a protein layer is down to 10 pm (0.01 nm) by tuning the coatings of the substrate to an optimized condition to amplify the signal. Picometrology acquires both an intensity drop and a phase delay of the probe light caused by the film by combining the reflectance and phase contrast detections (Fig. 1). As a result, the complex refractive index of the thin film can be measured accurately. Picometrology can also be operated at arbitrary incidence angles and under high resolution (around 1 micron) which makes it highly adaptable. We have applied Picometrology to studies of cancer marker detection based on a protein array (Fig. 2), water adsorption on silica, optical dispersion of graphene (Fig. 3), and the dielectric evolution of ultra-thin gold films.

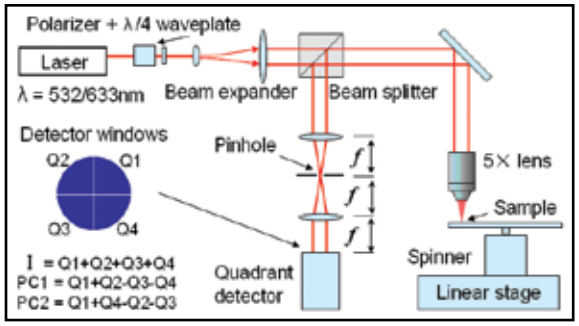


Fig. 1. Schematics of Picometrology using laser scanning of a spinning disk and interferometric detection.

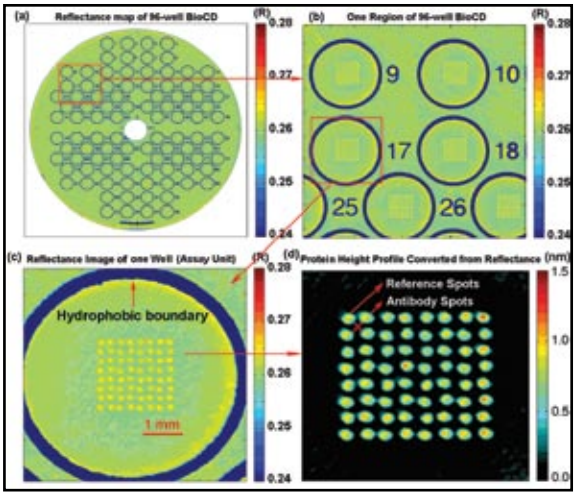


Fig. 2. Picometrology monitors PSA (prostate specific antigen) immunoassays in a 96-well BioCD. A 4 ng/ml PSA detection limit was achieved in patient sera without the aid of fluorescence. That is the clinical threshold of PSA levels that may indicate the abnormal function of the prostate gland.

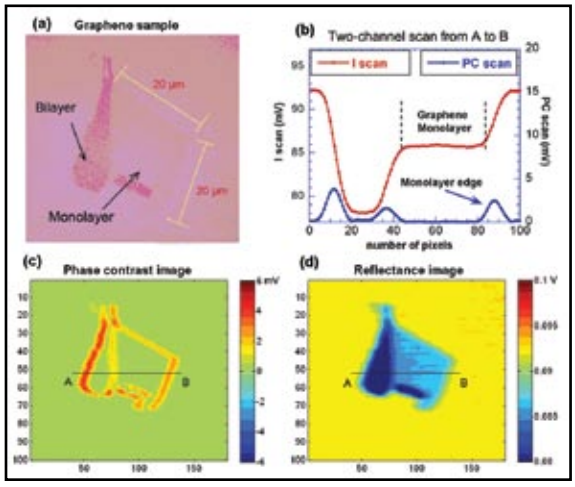


Fig. 3. By measuring the refractive index of graphene, we found a strong dispersion of graphene in the visible light domain.

Student Awards

Undergraduate Awards

Richard W. King Award
Outstanding Physics Junior and Senior
- Zachary Sylvan (Sr.)
- Andrew Bohn (Jr.)

Lijuan Wang Award – Women in Physics
- Kristen Ziegler

Spira Award for Summer Research
- Alex Krzywda

College of Science Outstanding Student Award
- David Runyan (Fr.)
- Christopher Bairnsfather (So.)
- Andrew Bohn (Jr.)
- Zachary Sylvan (Sr.)

David G. Seiler Physics Scholarship
- Emily Grace

Kenneth S. and Paula D. Krane Physics Scholarship
- Christopher Bairnsfather
- Robert Gustafson
- Jhan Harp
- Philip Hebda
- Jenna Walrath
- Kristen Ziegler

Graduate student Yu Zheng (major Professor Ian Shipsey) received the Research Poster Award at the 1st US Large Hadron Collider Users Meeting

Graduate Awards

Karl Lark-Horovitz Award – Outstanding Research
- Artur Apreseyan
- Ming Zhao

H.Y. Fan Award – Outstanding Research in Condensed Matter
- Mason Overby
- Xuefeng Wang

Grodzins Summer Research Award
- Eric Clausen-Brown
- Yihong Liu

George W. Tautfest Award – Outstanding Research in High Energy Physics
- Bo Xin

Lijuan Wang Award – Women in Physics
- Alyssa Garrelts
- Cristina Moody

Edward S. Akeley Award – Outstanding Research in Theoretical Physics
- Chen Fang

Akeley-Mandler Award for Teaching Excellence
- Jacob Hale

Outstanding Graduate Student Teacher
- Deepak Pandey
- John Buncher

Fellowships Awarded

Bilsland Dissertation Fellowship
- Riei Ishizeki
- Xuefeng Wang

Gary L. Wright Memorial Fellowship
- Kari Frank

National Science Foundation Graduate Research Fellowship
- Abraham Olson
- Sannah Ziama

Sandia Laboratories Purdue University Excellence in Science and Engineering Fellowship
- John Watson

National Defense Science and Engineering Graduate Fellowship
- Abraham Olson

Physics INTERACTIONS

Indications of Supersonic Mach Cone Shock Waves in Subatomic Media

by Fuqiang Wang
Department of Physics
Purdue University

Figure 1. (Above) An F/A-18 Hornet at transonic speed and displaying the condensation vapor cone just before reaching the speed of sound. Picture taken from http://en.wikipedia.org/wiki/Mach_number.

The universe started with the Big Bang. The early universe contained all the energy we have today but in a much smaller volume. The energy density was so enormous that protons and neutrons could not exist. It was in the state of deconfined quarks and gluons, the quark-gluon plasma (QGP). An international team of physicists have now recreated the QGP state by colliding heavy nuclei at relativistic energies.

The research was conducted at the Relativistic Heavy-Ion Collider (RHIC) (http://www.bnl.gov/rhic) on the campus of Brookhaven National Laboratory on Long Island, New York (Figure 2). Gold nuclei (ions) are accelerated to 99.995% of the speed of light, or an energy of 100 GeV per nucleon, 100 times the nucleon's rest mass. Two beams of gold nuclei are circulated in opposite directions by superconducting magnets in the 2.4-mile two-lane RHIC rings. At six intersections, the lanes are made to cross, leading to collisions between gold nuclei.

At this high energy, the collision melts the protons and neutrons and, for a brief instant, liberates their constituent quarks and gluons to form a QGP. The QGP is found not to be a gas of free particles as initially anticipated from the phenomenon known as asymptotic freedom, but a liquid of strongly interacting matter. Its viscosity to entropy density ratio is orders of magnitude lower than that of ordinary liquids such as water and milk. In fact, the QGP created at RHIC is a perfect liquid, as perfect as it can get, limited by quantum physics. The behavior of the QGP can be described by "almost" ideal hydrodynamics. The QGP is formed by the "stopped" energy from the colliding gold nuclei. (The spectator nucleons from the initial colliding nuclei have long receded from the created plasma.) Most quarks and gluons in the plasma are thermal (low energy) particles. However, energetic particles are sometimes generated in the collision by hard-scatterings between quarks and gluons from the initial colliding nucleons of the gold nuclei. Such hard-scatterings also happen in high energy proton-proton collisions, and the scattered energetic quarks and gluons are observed as collimated jets of particles. The jets are back-to-back in azimuth because there was no net transverse momentum before the collision (see Fig.3 left panel). In gold-gold collisions, however, only a single jet is observed; the back-to-back jet at 180° azimuth from the observed jet has disappeared (see Fig.3 right panel). The interpretation is that the observed single jet comes from the surface of the collision zone, directed outward, and the back-side partner jet has interacted with the QGP while traversing it and is lost. (Those back-to-back jets that originated from the interior of the QGP are both lost.)

The natural question is: Where did the jet energy go? It is found

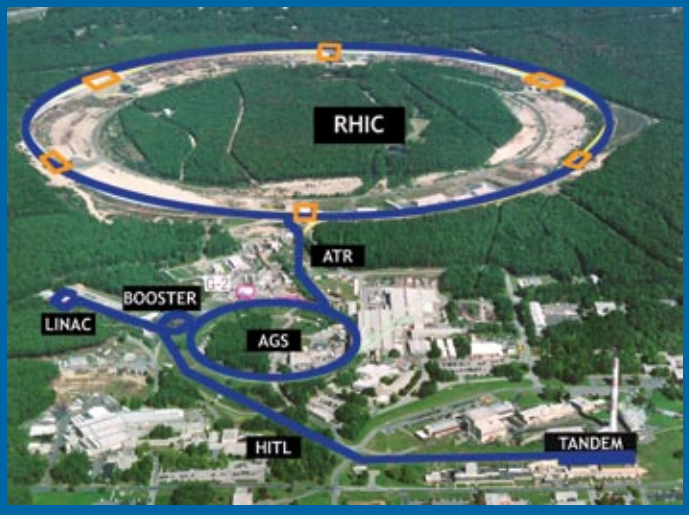


Figure 2. Aerial view of the RHIC complex. Electrons are stripped off gold atoms, and the gold nuclei (ions) are first accelerated in the Tandem Van de Graaff facility. Beams of gold ions are then sent through the Heavy Ion Transfer Line (HITL) to the Booster where they are pre-accelerated before entering the Alternating Gradient Synchrotron (AGS). The beams are accelerated to about 10 GeV per nucleon in the AGS, and are delivered via the AGS-to-RHIC (ATR) line to RHIC, where they are accelerated to the full energy of 100 GeV per nucleon. (Photo source: Brookhaven National Laboratory)

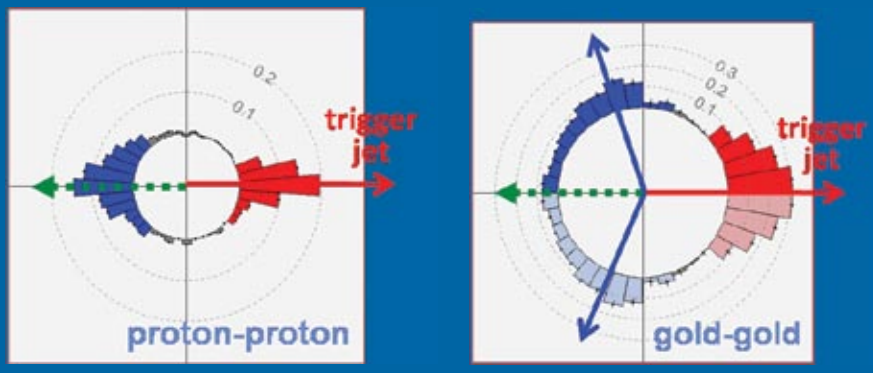


Figure 3. The left panel depicts a pair of back-to-back jets in proton-proton collisions. The right panel depicts a single jet and a back-side broad distribution in gold-gold collisions.

that the energy has dissipated into production of low energy particles, similar to those thermal particles in the QGP. Those back-side particles in coincidence with the surface jet (observed via an energetic particle) are found to be broadly distributed (Fig.3 right panel). In some kinematic region, they are even double peaked, at both sides of the 180° direction from the observed energetic particle. This work was led by Purdue physicists and was published in Phys. Rev. Lett. 95, 152301 (2005).

How can one explain the double-peak distribution? Since the QGP is a liquid, it is natural to expect excitations of sound waves. The speed of sound is a fundamental property of a medium. An object moving at supersonic speed in a medium may interact with it to generate a supersonic shock wave. The wave front forms a Mach cone, a phenomenon most recognizable when an airplane breaks the sound barrier (see Fig.1). The back-side energetic quark or gluon deposits a large amount of energy over a short time, produces a pressure disturbance and generates a shock wave. Since the quark or gluon moves at the speed of light, the Mach cone angle is determined only by the speed of sound of the medium. A Mach cone shock wave produces a collective emission of particles normal to the wave front, along a well-defined azimuth at both sides of 180° (see Fig.4 left panel). The double-peaked distribution can, therefore, be explained by Mach cone formation.

On the other hand, the broad distribution can be also produced by other physics mechanisms. For example the back-side jet may be deflected to the sides by the collective expansion of the quark-gluon plasma (see Fig.4 right panel). The deflecting angle and which side it is deflected to vary from collision to collision; when all the collision data are summed together, broad and even double-peak distribution may result.

In order to identify which mechanism is responsible, one has to measure at least two particles in coincidence with the triggered surface jet. If the two particles on the back side are always relatively close to each other, then it is due to deflected jets. If, on the other hand, the two particles are sometimes on the opposite sides of 180° from the triggered surface jet, then it is the evidence of conical emission. To this end, the STAR (Solenoidal Tracker At RHIC) experiment, led by the Purdue High Energy Nuclear Physics Group, has carried out an analysis of three-particle correlation. Indeed, it is found that particles in coincidence with a triggered energetic particle are present on both sides of its backward direction. This provides unambiguous evidence of conical emission of particles on the back-side of the triggered surface jet. This conical emission pattern is a strong indication of supersonic Mach cone shock waves. The work is published in Phys. Rev. Lett. 102, 052302 (2009).

The conical emission angle is measured to be $\theta = 78° \pm 4°$. In the ideal case, the emission angle is related to the speed of sound via $\cos(\theta) = c_s/c$, which results in the speed of sound (c_s) 20% of the speed of light (c). In relativistic heavy-ion collisions, however, the relationship is complicated by collision dynamics. Studies show that the Mach cone angle can be distorted by the hydrodynamic expansion of the QGP. However, the measured conical emission of subatomic particles at RHIC is a major step forward, providing an in-principle means to measure the speed of sound and thereby the equation of state of the QGP.

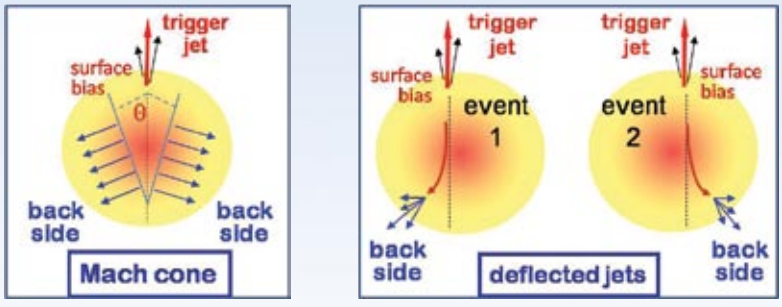


Figure 4. Energetic particles (jets) are preferentially emitted from the surface due to energy loss in the QGP. The back-side jet partner has to traverse the entire medium. The left panel depicts the physics scenario of Mach Cone shock wave. The right panel depicts the physics scenario of deflected jets where the back-side jet in each event is deflected to side by medium expansion.

Purdue Physicists working on RHIC

Professors:

- Andrew Hirsch
- Denes Molnar
- Rolf Scharenberg
- Brijesh Srivastava
- Fuqiang Wang
- Wei Xie

For more information, visit:
www.physics.purdue.edu/henp or
www.star.bnl.gov

Alumni News

Where Are They Now?

Dr. Greg Fiete with his wife, Ila and daughter Mayuri

Greg Fiete joined Purdue University in 1993 as a freshman physics major. Like many physics undergraduates, his inspiration to study physics came from his high school physics teacher, Mr. James McPhee, who still teaches at Penn High School in Mishawaka, Indiana. In fact, it was Mr. McPhee, himself a Boilermaker, that helped Greg make the decision to study physics at Purdue. "Mr. McPhee is one of those truly rare individuals that can touch a young student's life at a critical time and set him or her on the right course for the bigger challenges ahead, both academic and personal", says Fiete.

With a solid foundation in high school physics, Greg entered the Purdue Honors Program hoping to hold his own. He graduated in 1997 with Highest Honors as the Outstanding Senior in Physics. "My education at Purdue was blessed with superior and supportive faculty at every stage. I gained not only a solid education in physics, but was actively encouraged by my professors to seek out research experience in national programs such as the National Science Foundation's Research Experience for Undergraduates (REU) program."

Prof. Nick Giordano and Greg Fiete (1997)

Greg spent two summers in REU programs at other universities as well as one summer working at Purdue in Professor Nick Giordano's lab, where he did work for his senior project on fluid flow in nanoscale structures. "I am especially grateful to Prof. Giordano for the opportunity to work in his lab where I had a chance to see first hand how a world-class physicist guides his research", says Fiete.

After Purdue, Greg joined the PhD program in physics at Harvard University. He made the switch from experimental work to theoretical work before beginning his thesis research in condensed matter physics. Greg's doctoral work was concerned with the quantum properties of electrons in nanostructures and disordered magnetic systems, and quantum decoherence.

After receiving his PhD in 2003, Greg took up a postdoctoral position at the Kavli Institute for Theoretical Physics (KITP) on the campus of the University of California Santa Barbara and then later moved to Caltech as a Lee A. DuBridge Prize Fellow in Theoretical Physics. Since August 2008, Greg has been an Assistant Professor of Physics at the University of Texas at Austin. His current research focuses on emergent quantum phenomena in many-body systems, especially those that exhibit something known as "topological order", a subtle quantum property with implications for applications in high-precision electronic devices and quantum computing.

In 2009, Greg received the Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honored bestowed by the US government on scientists and engineers at the beginning of their independent careers. The award will be conferred by President Barack Obama at a White House reception held in the fall of 2009. A certified open water SCUBA diver and former national caliber triathlete, Greg lives with his wife Ila (a physics-trained Assistant Professor of Neuroscience at UT Austin who Greg started dating in his first REU) and their daughter Mayuri in Austin, Texas.

Where are YOU now?

Send us a note at interactions@physics.purdue.edu and tell us about it!

2009 Outstanding Alumni Award

The Physics Department hosted its Outstanding Alumni for 2009 on September 25, 2009. David Brown, Katherine Harkay, and Christopher Tong were honored for their contributions and leadership within their professions.

Dr. David Brown – Outstanding Alumni Award 2009

Dr. Brown is professor and chairman of the Department of Physics & Astronomy at the University of Louisville. He earned a B.S. in Mathematics and Physics from Eastern Michigan University in 1987 and completed Ph.D. at Purdue University in 1992 under the direction of Prof. Ed Shibata. He joined the University of Louisville in 1996 following positions at the University of Pittsburgh and Boston College.

Dr. Katherine Harkay – Outstanding Alumni Award 2009

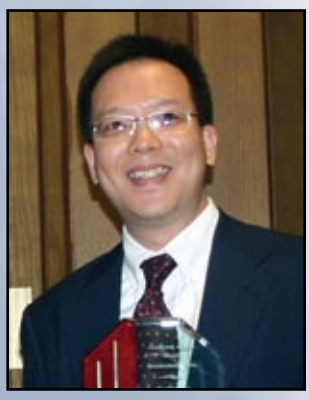
Dr. Katherine Harkay received her PhD from Purdue University in 1993, supported through the Fermilab Doctoral Program in Accelerator Physics and under the direction of Prof. Lazslo Gutay. She joined the Advanced Photon Source at Argonne National Laboratory that same year and served as Group Leader for Accelerator Physics from 2003-2008. Since 1999, she has played a lead role in the use of retarding field analyzers to measure the electron cloud distribution in a high-energy storage ring. She is presently collaborating on characterizing the electron cloud at the CESR Test Accelerator, a proposed test bed for the ILC Damping Ring. Dr. Harkay serves on various committees, including the Fermilab Accelerator Advisory Committee and the U.S. Particle Accelerator School Program Committee.

Dr. Christopher Tong – Outstanding Alumni Award 2009

Dr. Christopher Tong recently completed a career as a statistical consultant at Merck Research Laboratories, working primarily with basic research (drug discovery). He was involved in a wide range of collaborations, including molecular modeling, drug metabolism, medical imaging, cardiovascular diseases, and more. As a member of one such collaboration (ultrasound imaging), he received a 2008 Merck Animal Alternatives Award. During his Purdue years, he was involved in fluid dynamics research with Alexander Gluhovsky and Ernest Agee in the Dept. of Earth & Atmospheric Sciences, as well as research on cochlear mechanics with Arnold Tubis (Physics) and Glenis Long (Audiology & Speech Sciences). Chris received his Ph.D. from Purdue in 2001.

Dr. David Brown (Ph.D. 1992)

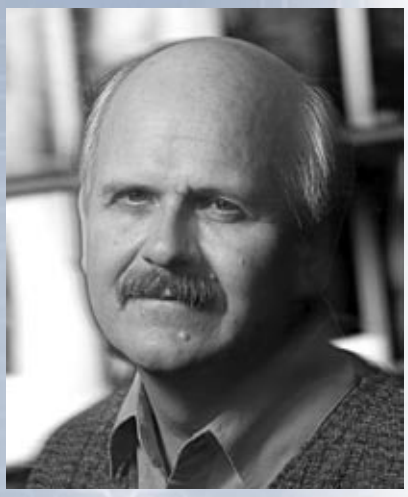
Dr. Katherine Harkay (Ph.D. 1993)



Dr. Christopher Tong (Ph.D. 2001)

Alumni News

2009 Distinguished Science Alumni Award



L. Dean Chapman

BS '75, Southwestern Oklahoma State University

PhD '81, Purdue University (Prof. Roberto Colella, advisor)

Dean Chapman is a Professor of Anatomy and Cell Biology at the University of Saskatchewan where he holds a Tier I Canada Research Chair in X-ray Imaging and is the scientific lead for the Biomedical Imaging and Therapy Beamline Projects at the Canadian Light Source Synchrotron. Before joining the University of Saskatchewan, Chapman was a member of the Physics faculty and Director of the Center for Synchrotron Radiation Research and Instrumentation at the Illinois Institute of Technology in Chicago, IL. As a researcher, he has authored over 70 articles in the area of x-ray optics and Diffraction Enhanced Imaging and has received over $23 million in funding since 2003. In addition, he holds 6 patents and serves as Chief Scientific Officer for Nesch, LLC, located in the Purdue Research Park in Merrillville, IN, and Vice-President of Quercus X-ray Technologies in Oak Park, IL.

Career Highlights

2003 Named Professor and Canada Research Chari in X-ray Imaging, Anatomy and Cell Biology Department, University of Saskatchewan

2002 Appointed Professor, Biological, Chemical and Physical Sciences, Illinois Institute of Technology

1995 Named Director of Synchrotron Radiation Research and Instrumentation, Illinois Institute of Technology

Professor H.Y. Fan Remembered with Conference Room and Graduate Fellowship

Thanks to generous contributions from the family of Professor Hsu Yun "Bill" Fan, the Physics Department is pleased to announce a new graduate research fellowship for condensed matter physics and the renovation of the Department Seminar Room. The Fan Fellowship will be awarded in the 2010-2011 academic year and is the second departmental fellowship to be created in the past five years. The Department's seminar room (PHYS 242) has been the central gathering place for members of the Department since the "new" part of the Physics building opened in 1970. Renovations to the room began in November 2009 with a planned completion date of January 2010.

Professor Emeritus H.Y. Fan

Prof. Fan began his distinguished career at Purdue University in 1949, following positions at National Tsing Hua University in China and at the Massachusetts Institute of Technology. Professor Fan was a pioneer in condensed matter physics, especially in the area of infrared studies of semiconductors. Along with Prof. Karl Lark-Horovitz, he played a key role in the development of the Purdue Department of Physics into a large research oriented department. In 1963 he became the Duncan Distinguished Professor, a position he occupied until he retired in 1978. During his tenure at Purdue, he served as advisor for 19 Ph.D. students, all of whom went on to have distinguished careers as physicists. In 1987, the Department of Physics established the H.Y. Fan Award for outstanding graduate research in condensed matter physics. Purdue conferred an Honorary Doctor of Science on Prof. Fan in 1990.

To contribute to either the Fan Fellowship or the Fan Conference Room, contact Javier Magallanes, Director of Development at 765-494-0669 or jmagalla@purdue.edu.

(From l to r) Bob Collins, Manya Fan, H. Y. Fan, and Milton Becker (Ph.D. 1950) at Prof. Fan's Retirement Symposium in 1979.

Alumni News

From the Director of Development

Greetings from the Purdue Physics Department!

In just a little over a year as the Director of Development for the Physics Department, it's truly been an honor to personally meet many of our alumni and friends from across the country and to learn about what they have done since leaving campus. Purdue University is a preeminent institution because of the achievements and support from dedicated alumni and friends like yourself. Thanks for representing your alma mater so well!

Higher education is not immune to the current economy. Now more than ever, it is vital that our alumni and friends step up to show their support for the Physics Department as we continue to prepare our students for fulfilling careers in a diverse array of fields. It is your support that will create the leverage needed to reach new levels of excellence, provide scholarships, enhance our programs, and attract world-class faculty to the Physics Department.

I welcome the opportunity to personally talk to you and discuss how you can make a lasting impact in the Physics Department at Purdue University. Please do not hesitate to contact me if you have questions or need any assistance regarding your philanthropy to our Physics Department.

Hail Purdue!

Javier Magallanes
Director of Development

Alumni Notes

- **Zindel Herbert Heller (MS 1949)** received a patent for a home testing method for measuring glucose.

- **Mario Paniccia (MS 1990, PhD 1994)** received an honorary doctorate degree from Binghamton University.

- **Elton Graugnaurd (MS 1998, PhD 2000)** has been hired as a research assistant professor at Boise State University.

- **David Moehring (BS 2001)** received the 2008 American Physical Society DAMOP (Division of Atomic Molecular and Optical Physics) Doctoral Thesis Award and was named an Alexander von Humboldt postdoctoral fellow at the Max Planck Institute for Quantum Optics near Munich, Germany.

- **Kristl Adams (PhD 2006)** accepted a full-time Physicist position at Lawrence Livermore National Laboratory (LLNL) in the Chemical Sciences Division within the Physical and Life Sciences Directorate.

In Memorium

- **Peter Eklund (PhD 1974)** passed away August 15, 2009.

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

Contact Javier Magallanes, Director of Development, at 765.494.0669 or jmagalla@purdue.edu

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