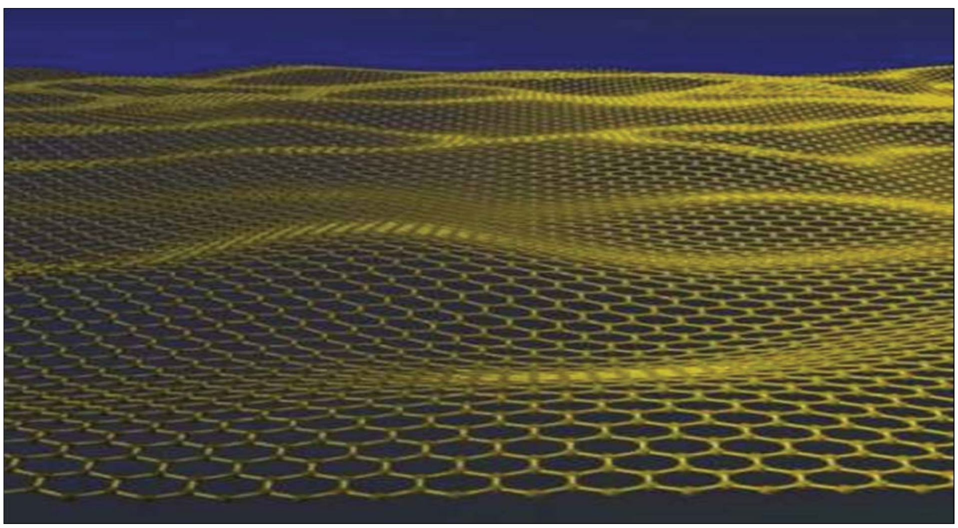
Physics INTERACTIONS

PURDUE UNIVERSITY

A NEWSLETTER HIGHLIGHTING THE DEPARTMENT OF PHYSICS AT PURDUE UNIVERSITY

2010

Quantum Matter & Device Laboratory Investigates Graphene's Properties



A layer of graphene can be only one atom thick. It consists of carbon atoms joined together in a hexagonal pattern similar to chicken wire.
Image Credit (www.nobelprize.org)

(page 8)

Inside

From the Head

Welcome to the latest edition of Interactions, the annual newsletter from the Department of Physics. It has been a privilege and a great pleasure for me to serve as Department Head for the past three years, and the source of this pleasure can be appreciated from the pages of this newsletter. Our students and faculty are doing some incredible things, and as Head I get to witness their work first-hand. Tony Coiro's development of a solar powered motorcycle (page 10) is an example of the great talent and creativity of our students. I am quite confident that Tony will do great things in the coming years, as will many of our students. I am also inspired by the initiative of our Undergraduate Women in Physics group. Under the mentoring of Professor Daniela Bortoletto, they are hosting the 4th Annual Midwest Conference for Undergraduate Women in Physics, which will be held here in January 2011.

Our faculty have also been quite busy. One example is the work by Professor Maxim Lyutikov, who is involved in a number of astrophysical studies. His recent work on the radiation emitted by a unique double pulsar system has led to new tests of general relativity and shed new light (!) on the fundamental nature of pulsars. While Maxim's work involves systems of astrophysical scale, objects that are orders of magnitude smaller can be just as interesting. Indeed, the field of nanoscience has quickly emerged as an important discipline, and several of our faculty are conducting research in this area. A nice example is the work of Professor Yong Chen on graphene, a form of pure carbon in which the atoms are arranged in a two dimensional sheet. Graphene has been in the news a lot lately, as the 2010 Nobel Prize in Physics was awarded for work on this material. Graphene is of interest for both its fundamental properties and potential applications, and Yong's work spans both of these areas. The first approaches for making graphene produced only relatively small pieces that were quite delicate to handle. Among other accomplishments, Yong and his collaborators have developed a new way of making large sheets of graphene, which should make many new studies possible. The work of our high energy physics group at the Large Hadron Collider in Geneva is also very exciting. In the coming years those experiments will extend elementary particle physics to an entirely new realm, and are likely to lead to a deeper understanding of why particles have mass and the nature of dark matter.

These are just a few examples of the exciting work that is taking place in our department. I am quite fortunate to be able to watch this work unfold. I hope that this newsletter will give you the same enjoyment that I experience every day.

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

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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Faculty Honors

Professor Daniela Bortoletto was named the Edward Purcell Distinguished Professor of Physics and received the College of Science Leadership Award.

Professor Martin Kruczenski received a National Science Foundation CAREER Award.

Professor Erica Carlson received the Ruth and Joel Spira Award for Outstanding Undergraduate Teaching.

Professor Denes Molnar received a Department of Energy Early Career Research Award.

Professor Thomas Clark received the Ruth and Joel Spira Award for Outstanding Graduate Teaching.

Professor Norbert Neumeister was promoted to Associate Professor.

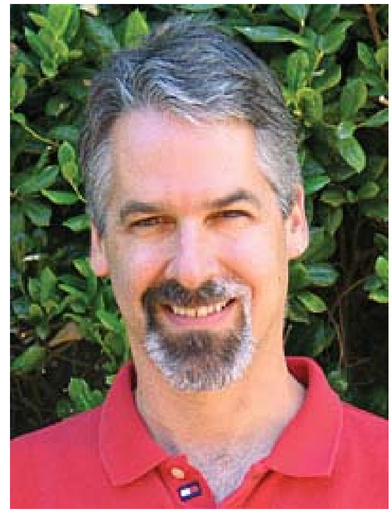
Professor Anant Ramdas was named a Fellow of the American Association for the Advancement of Science.

Staff Honors

Jaime Turner received the Professional Achievement Award from the College of Science.

Mathew Hughes received the Customer Service Award from the College of Science.

New Faculty



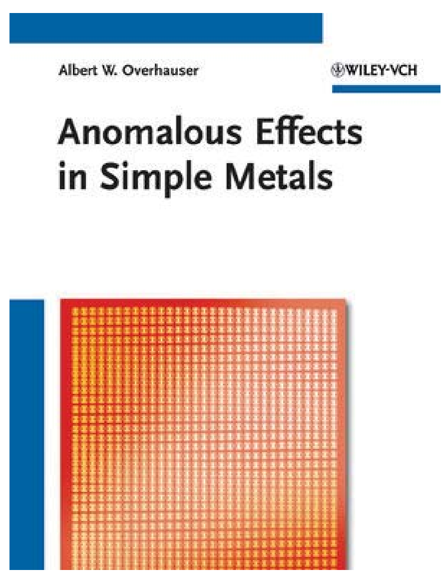
Nat Lifton, Assistant Professor of Physics, specializes in accelerator physics. As a contributor to PRIME Lab, his research interests focus on developing methods for using cosmogenic nuclides to derive surface exposure ages, erosion rates, and complex exposure scenarios involving glacial advance and retreat. Prof. Lifton comes to Purdue from the University of Arizona where he was a Research Scientist in the Department of Geosciences and the Arizona Accelerator Mass Spectrometry Facility. He holds a B.A. from the University of California at Santa Barbara and a Ph.D. from the University of Arizona. Prof. Lifton also has a joint appointment with the Department of Earth and Atmospheric Sciences.

Faculty News

Professor Overhauser Publishes Career Retrospective

In his new book, Anomalous Effects in Simple Metals, Professor Albert Overhauser reviews his distinguished contributions to condensed matter physics over the past 60 years, work that has led to a unified synthesis of alkali metal peculiarities. In addition, his discovery of the phenomenon of dynamic nuclear polarization, known as the Overhauser effect, revolutionized the field of nuclear magnetic resonance and has led to far-reaching applications in biology and medicine. 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 in 1994.

Anomalous Effects in Simple Metals is published by Wiley Press and will be released in December 2010.



Student Awards

Graduate Awards

Karl Lark-Horovitz Award – Outstanding Research
- Boyang Liu

H.Y. Fan Award – Outstanding Research in Condensed Matter
- Chen Fang

Akeley-Mandler Award for Teaching Excellence
- Alyssa Garrelts

Lijuan Wang Award – Women in Physics
- Sunanda Koduvayur
- Laura Boon

Edward S. Akeley Award – Outstanding Research in Theoretical Physics
- John Buncher

Outstanding Graduate Student Teacher
- Christos Deligkaris
- Alyssa Garrelts

AAPT Outstanding Teaching Assistant
- Christos Deligkaris
- Alyssa Garrelts
- Daniel Hartzler
- Jordan Heim
- Robert Niffernegger

Graduate Fellowships

Bilsland Dissertation Fellowship
- Chen Fang
- Jacob Hale

Gary L. Wright Memorial Fellowship
- Wendi Wampler

Undergraduate Awards

Richard W. King Award
Outstanding Physics Junior and Senior
- Phillip Hebda (Sr.)
- Kristen Ziegler (Jr.)

Lijuan Wang Award – Women in Physics
- Jenna Walrath

College of Science Outstanding Student Award
- Chenglian Zhu (Fr.)
- James Gloudemans (So.)
- Christopher Bairnsfather (Jr.)
- Phillip Hebda (Sr.)

David G. Seiler Physics Scholarship
- Kristen Ziegler

Kenneth S. and Paula D. Krane Physics Scholarship
- Christopher Bairnsfather
- Jenna Walrath
- Stephen Wolf

Department Head Nick Giordano with Lijuan Wang Award winners Sunanda Koduvayur (left) and Laura Boon (right).

Did You Know?

Kirk Arndt, Mechanical Engineer in the High Energy Physics Lab, serves as advisor for the Purdue Sailing Club.

Particles of Information - Graduate Research

Dynamics of Lipid Analogs in the Outer Membrane of *E. coli*

Alyssa Garrelts

It has been possible to characterize the mobility of molecules in biological systems for many years through various fluorescence techniques. However, to probe detailed molecular dynamics of rare and/or unsynchronized events without loss due to averaging, it is necessary to observe single molecules. Further, since molecule interactions may occur on short time-scales compared to conventional video frame rates, high frame rate video imaging must be used. To accomplish this, the Ritchie lab uses single molecule fluorescence techniques, which allow for the reduction of noise by filtering incident light, with small sample illumination (Illustration 1) to reduce background signal and fast (up to 1000 frames per second (fps)), low noise cooled intensified CCD cameras (Illustration 2).

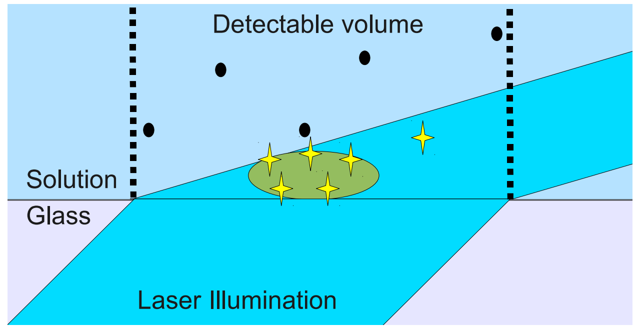


Illustration 1: Laser light illuminates a cell immobilized on a cover glass from the bottom of the cell. Because of the oblique angle, only a small detectable volume of the solution is illuminated. Fluorescent matter in solution is not excited while the fluorescent labels on the cell surface are.

These video imaging techniques give insight about the mobility of molecules in cells and hence imply structure, organization, and interactions of the molecules that compose biological systems. In particular, the molecules of the outer membrane of the bacterium Escherichia coli are discussed here. Though E. coli is well characterized biologically and the components of its cell envelope are known (Illustration 3), little has been done to study the dynamics of the molecules of its outer membrane (especially compared to the work done on mammalian cells). However, E. coli provides an ideal laboratory to study membranes because of its overall simple structure, its robustness, and the ease with which it can be genetically manipulated to alter specific interactions and structures.

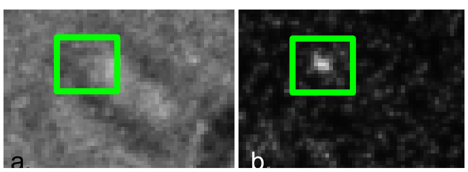


Illustration 2: a. A bright field image of a bacterium. b. A fluorescent reporter molecule on the same cell during laser illumination.

The outer membrane of E. coli is, like all membranes, a lipid bilayer with incorporated proteins. The standard description of a membrane is Singer and Nicholson's "fluid mosaic model," which predicted that the bilayer was a two-dimensional fluid of lipids with proteins solutes. According to this model, individual lipids should display random, Brownian motion, observed through a mean squared displacement (MSD) that grows linearly with time.

Experiments with the fluorescent lipid analog 3,3'-dilinoleyloxacarbocyanine perchlorate (FAST DiO) show relatively slow, apparently random diffusion on conventional video time-scales (0.27x10-3 µm2/s at 30 fps as compared with ~ 0.6 µm2/s for similar probes in mammalian cells and compared to 0.24 µm2/s for some proteins in the E. coli outer membrane) (Illustration 4). Interestingly, when this molecule is imaged at faster frame rates (260 and 60 fps), the MSD shows

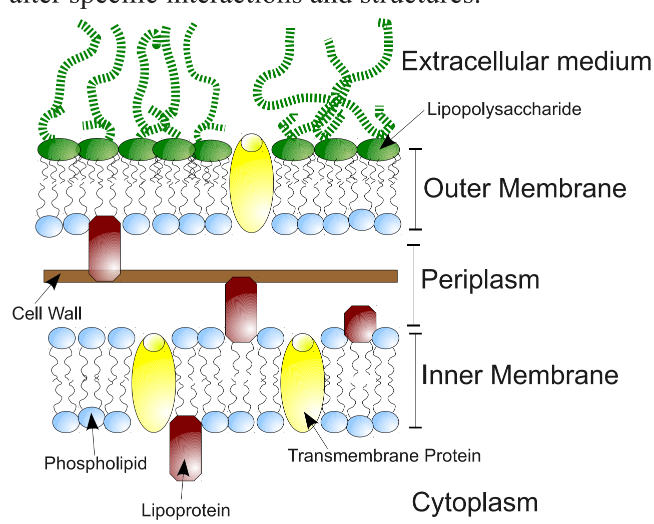


Illustration 3: The constituents of the cell envelope of E. coli.

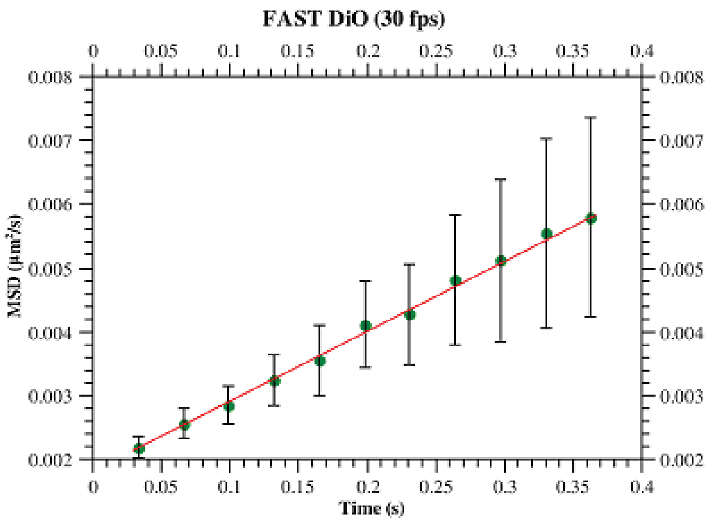


Illustration 4: Fast DiO in E. coli at 30 fps displays linear dependence of the mean squared displacement on time step – indicating Brownian diffusion.

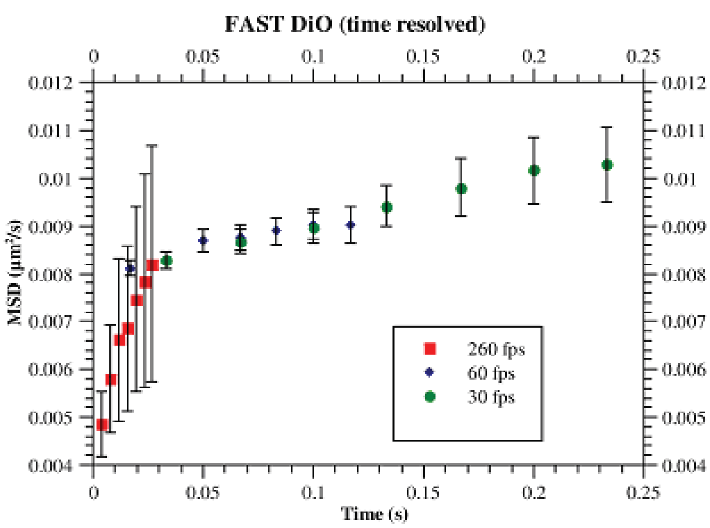


Illustration 5: The relationship between the MSD and time is not linear at shorter times - indicating structure in this 2D fluid.

strong non-linearity in time (Illustration 5), implying that lipids undergo anomalous diffusion at fast time scales. Similar behavior is noted with other lipid analogs. Further, this behavior can be manipulated through alteration of the expression of particular molecules constituent in the membrane.

These observations imply there is a structure in the lipid fluid that composes the membrane that remains hidden from observations performed at conventional video frame rates. This structure could be due to interactions of the FAST DiO with proteins that are themselves interacting with other cell components or perhaps the particular composition of the E. coli outer membrane leads to a "phase separation" of the lipid components forming separate fluid domains throughout the membrane.

Studies of the structure of the outer membrane of Gram negative bacteria like E. coli not only add to our fundamental knowledge of all biological systems but also may have great impact on applied fields of such as medicine, renewable energies, and other technologies.

Research expenditures in the Physics Department were up 5% in 2009-10.

Graphene: From Physics Novelty to Technology Wonders

by Yong Chen
Miller Family Assistant Professor of Physics and Nanoscience

The 2010 Nobel Prize in Physics was awarded to two physicists working at Manchester University, Andre Geim and Kostya Novoselov, "for groundbreaking experiments regarding the two-dimensional material graphene". Graphene (Fig. 1) is a single atomic layer of carbon and has rapidly risen in the past few years to be a wonder material in the world of science and engineering, with a seemingly endless array of superlative properties and exciting potential applications. It is the thinnest but strongest material ever made to date, with also the highest thermal conductivity among all materials. Electrons travel in graphene in a way that mimic massless relativistic particles (like photons), and light passes through graphene with a quantized absorption determined by the fine structure constant in quantum electrodynamics. The potential applications include ultrafast, energy-efficient nanoelectronic transistors that may find themselves in future computers and cell phones, and ultrathin and flexible transparent conductors for macroelectronics like large-area solar cells, display panels and foldable electronic newspapers. In the Purdue physics department, the group of Prof. Yong Chen (Quantum Matter and Device (QMD) laboratory) has been actively working on graphene since 2007 to unravel its remarkable physical properties and potential applications.

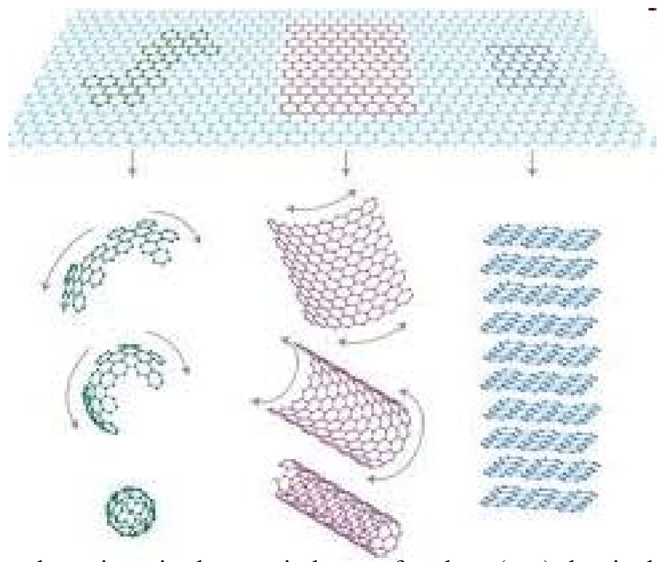


Figure 1. Graphene is a single atomic layer of carbon (top) that is the structural building block of buckeyballs (lower left), nanotubes (lower middle), and graphite (lower right). Image credit: A.K.Geim and K.S.Novoselov, Nature Materials, 6, 183 (2007)

The simplest method to fabricate graphene has been the "scotch tape" (exfoliation of graphite) method used by the initial graphene pioneers Geim and Novoselov to uncover the remarkable electronic properties of graphene (many Purdue undergrads have learned in Prof. Chen's lab to produce single atomic layer graphene using this remarkably simple method). This simple method, however, only produces very small graphene flakes (typically tens of microns), seriously limiting the large scale applications of graphene. High quality, wafer scale graphene is needed in order to fully realize graphene's potentials and this has been one of the holy grails in graphene research for the past few years. Prof. Chen's lab now grows their graphene by chemical vapor deposition (CVD) of carbon atoms (extracted from decomposing methane at high temperatures) onto copper foils, and then transferring the graphene onto other substrates (Fig. 2, where large single atomic layer graphene is visible with bare eyes). CVD deposition techniques onto metal substrates such as nickel have been around for several decades, and represent probably the oldest known method of graphene synthesis, much older than the "magic" scotch tape method used to isolate tiny graphene flakes which kicked off the "graphene era" in 2004). Since last year, there has been a strong revival and spectacular progress in metal-based CVD to grow large-scale graphene that can be subsequently transferred (by etching off the metal) to insulating substrates for electronic applications. While some initial experiments used nickel, copper later emerged as the metallic substrate that gave the best quality for large-area mono-layer graphene. The size of mono-layer graphene has grown rapidly, increasing from a few square centimetres to 30 inches as recently fabricated by a Samsung-supported team in Korea. In principle, there is no upper limit on the size of graphene that can be grown by CVD, aside from, perhaps, the size of copper foil that can be practically placed into the CVD furnace.

CVD synthetic graphene offers one of the most promising approaches to fabricate large-scale graphene which is also flexible and transferrable and has major implications for both nanoelectronics and macroelectronics. Prof. Chen's group has studied the physical properties of such CVD synthetic graphene, motivated in particular by their electronic applications. For example, earlier this year, Prof. Chen

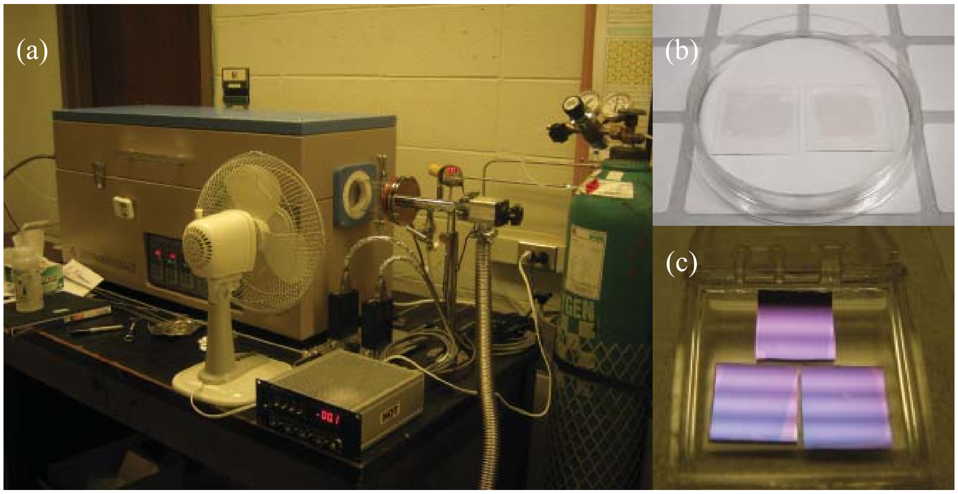


Figure 2. (a) A tube furnace (donated by Purdue alumnus Chuck Day) used in Prof. Chen's lab to grow graphene by chemical vapor deposition (CVD). (b-c) Large-area single atomic layer graphene grown in this CVD furnace and transferred to glass (b) and Si (c) substrates.

and his physics graduate student Helin Cao reported the first observation of "half-integer" quantum Hall effect (an electronic hallmark of monolayer graphene first observed in exfoliated graphene in 2005) on CVD graphene grown on copper, providing definite proof that such synthetic graphene possesses intrinsic graphene properties. The measured Hall resistance of the CVD graphene in a magnetic field shows quantized plateaus related to the fundamental quantum resistance h/e^2 (where e is electronic charge and h is Planck constant, Fig. 3a). These fundamental results on the electronic properties of CVD graphene are important for their device applications, and have also helped attract a recent NIST-funded project to develop graphene based quantum metrology. Due to the unique "relativistic" properties of electrons in graphene, such quantum Hall effects could be observed in graphene at much higher temperature (even room temperature) than was possible previously with other semiconductor materials. Prof. Chen and his postdoctoral associate Jifa Tian have recently studied the structural and electronic properties of CVD graphene (Fig. 3b) down to atomic scale using scanning tunneling microscopes (STM) at Argonne's National Laboratory's user facilities.

Although the large-scale graphene demonstrated so far is single layer, it is not single crystalline, as the perfect hexagonal arrangement of carbon atoms are interrupted by defects and grain boundaries. Studies of the mechanisms of domain formation, the roles of grain boundaries on material or electronic properties, and how to grow large single crystal graphene are some of the current frontiers in graphene research. Recently, Prof. Chen's group and collaborators performed a systematic study of single crystal graphene grown by CVD and of graphene grain boundaries and edges (Q.Yu and L.A. Jauregui et al., 2010). Prof. Chen and his electrical engineering graduate student Luis Jauregui applied spectroscopic Raman mapping to characterize the grain boundary separating two coalescing graphene grains (Fig. 3c), and studied the electronic transport across a single grain boundary, which is shown to enhance resistivity and scatter electrons.

Transferrable and macroscopically-sized monolayer graphene might have many other practical and fundamental implications. For example, it may be used as a functional coating in order to exploit graphene's chemical activity (or inactivity) or to passivate/protect the underlying surface, high thermal conductivity, or hydrophobicity. It will facilitate the fabrication of interesting 3D structures such as stacked graphene, electrically insulated graphene bilayers, graphene on novel substrates, and "curved" graphene with nontrivial geometry or topology. It can also simplify experiments such as scanning tunneling microscopy (which requires conductive substrates).

Prof. Chen has given invited talks on CVD graphene at the 2010 Electronic Material Conference and 2010 American Vacuum Society Annual Symposium. He is also to give an invited talk at 2011 American Physical Society March Meeting in Dallas about the physical properties of CVD graphene. For more information on a wide range of work on graphene's material and physical properties and novel technological applications, as well as other interesting quantum materials and quantum systems studied in Prof. Chen's group, visit the website of his group, Quantum Matter and Device (QMD) laboratory, http://www.physics.purdue.edu/quantum.

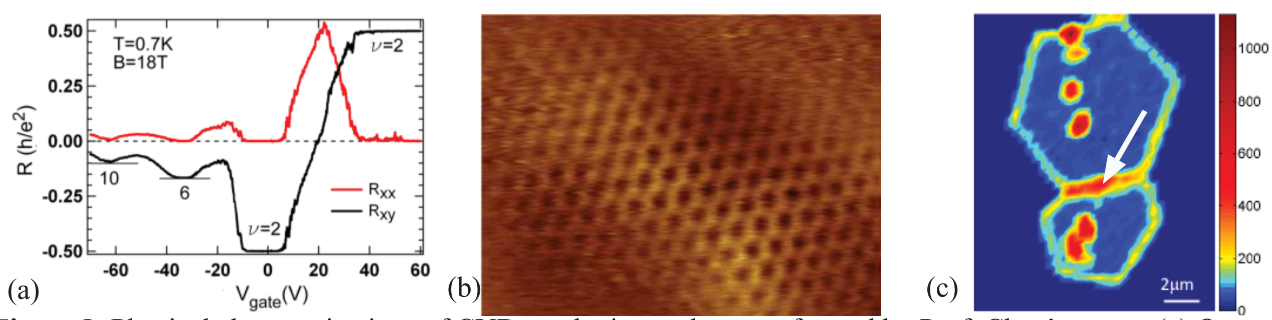


Figure 3. Physical characterizations of CVD synthetic graphene performed by Prof. Chen's group. (a) Quantum Hall effect observed in CVD synthetic graphene (H.Cao et al., Appl. Phys. Lett. 2010). (b) Scanning tunneling microscope (STM) image of atoms in CVD synthetic graphene. (c) Raman mapping of disorder "D" peak intensity in two merged single crystalline CVD graphene grains. The grain boundary (arrow) is clearly resolved. Also visible are nucleation centers and graphene edges.

Undergraduate News

Purdue Student Builds Solar Motorcycle, Launches Club to Push More Electric Vehicle Breakthroughs

A Purdue University student who created a solar-powered motorcycle is launching a club to help likeminded students expand environmentally friendly transportation options.

Physics major Tony Danger Coiro, a junior from South Bend, Ind., received a provisional patent for his motorcycle that uses solar energy to cut his transportation costs down to well less than a penny per mile. The lead acid batteries also can charge from plug-in AC current.

After purchasing a 1978 Suzuki for $50, Coiro spent $2,500 redesigning and retrofitting the bike, which gives him a range of up to 24 miles per charge and top speed of 45 miles per hour.

"The riding experience is surreal," Coiro said. "I get instant, silent, constant acceleration that outpaces urban traffic. It's like riding a magic carpet."

Coiro co-launched the Purdue Electric Vehicles Club with Jim Danielson and Sean Kleinschmidt, two sophomores from suburban Chicago. Danielson and Kleinschmidt spent their summer after high school converting a 1987 Porsche 924S they picked up for $500 to electric power. Kleinschmidt, a mechanical engineering major, translated that success into a summer internship at Tesla, where he helped develop batteries for the makers of the world-class, all-electric sports car. Danielson, who is majoring in electrical and computer engineering, spent his summer developing motor control electronics for Electro-Motive Diesel, which designs and manufactures diesel-electric locomotives.

"Purdue Electric Vehicles will encourage enthusiasm for, and knowledge and development of, electric vehicles by students and the community," Coiro said.

Tony Coiro and his solar motorcycle.

Coiro said the Purdue EV Club will patent and commercialize its breakthrough technologies and feed proceeds back into research and development of new prototypes. Coiro is already designing a 100-horsepower motorcycle that will travel up to 100 miles per charge, top 100 mph and draw even more of its energy from the sun. The all-wheel-drive bike would include motors in each hub and no drive trains.

"I've learned a lot building this first bike, and now I'm ready to make a game-changer," Coiro said.

Coiro, Danielson and Kleinschmidt oversaw construction of the 17 electric race karts that students built for the first-ever electric vehicle grand prix, held at Purdue this spring.

In 2011 that race is expected to draw student teams from throughout the Midwest. The race was created by Purdue's Indiana Advanced Electric Vehicle Training and Education Consortium to demonstrate the possibilities of electric vehicles and train a new breed of young engineers to improve them and reshape the auto industry in Indiana and beyond.

"Electric vehicles are four to five times more efficient than internal combustion engines – that's a big difference," Coiro said. "They're not the solution to our energy problems, but they will be an increasingly bigger piece of the puzzle."

When he graduates, Coiro plans to launch a company that develops electric vehicles. Eventually, he foresees launching a not-for-profit energy company.

"Gas is not in infinite supply, so we need to go to another energy source in the future, be it nuclear fusion or fission, solar or wind," Coiro said. "It's going to be a lot easier to charge an electrical vehicle off of the grid."

Writer: Jim Schenke, 765-494-6262, 765-237-7296 (cell), jschenke@purdue.edu

Photo Credit: Purdue News Service photo/Andrew Hancock

Alumni News

Where Are They Now?

Dr. Penny Warren with her husband, Eric Johnson.

Having followed a physics education and career from the Midwest, to California, to the East Coast, Penny Warren now lives in Boulder, Colorado and works at Ball Aerospace & Technologies Corporation.

Penny came to Purdue in 1987 from Kansas State University. She was convinced to join the High Energy Experimental Nuclear Physics Group for PhD work after thoroughly enjoying teaching the Modern Experimental Physics Laboratory course as a TA for Laszlo Gutay. She worked for Andy Hirsch, Rolf Scharenberg and Nobert Porile on a heavy ion beam experiment which looked for signals of a phase transition in nuclear matter at the Lawrence Berkeley National Laboratory Bevalac, receiving her degree in May 1996. One of her former students, Jon Schuler, began working at the Naval Research Laboratory and suggested she interview there. After one quick trip to this national lab, she had a job offer and moved to Washington, D.C.

The attraction of NRL was the ability to continue to work with cutting edge detectors. The CMOS infrared detectors and visible CCD sensors the lab was developing were very different from the scintillator counters and the time projection chambers of the LBNL beam line. But signal-to-noise and performance metrics are universal and the knowledge acquired on the beam line transferred. At NRL, Penny characterized these sensors. “I was amazed at the quality of the cameras. I had seen fuzzy IR images of a person that looked like a big white blob. These cameras could image the wrinkles in one’s upheld palm.” Penny worked to develop sensor fusion techniques to show multiple spectral bands in one image, presenting infrared information in the context of our familiar visual world. Testing a suite of visible and infrared cameras on the NRL roof, “I was stunned to be able to see the warm NRL steam tunnels running under the parking lot in the fused image on our data acquisition interface. It seemed like superhero-style vision.” Penny also began to lead teams of engineers and scientists as the Co-PI of a program to design and build a gimbaled-sensor system on an unmanned helicopter with a 12’ rotor.

A chance meeting on a plane with one of the lead detector engineers from Ball Aerospace led to her last move to a town that allows her to pursue her love of hiking and skiing. Ball also Penny found she could directly use her nuclear physics background when she was asked to characterize sensors for radiation hardness. The space radiation environment is harsh and, before integration into a spacecraft instrument, each detector is characterized for its ability to endure its planned mission. Penny has characterized CCDs for the Kepler Photometer, a NASA spacecraft that is currently on-orbit mapping Earth-sized planets, and those for another spacecraft, OMPS, yet to launch, that will map the ozone in the Earth’s atmosphere.

After a few years at Ball, Penny was asked to be a group leader of 6 detector engineers and, later, a half-time manger of the 32-person department. Ball provided excellent support to help Penny acquire this different set of skills. “I’ve learned that the things that make for an engaged, productive employee aren’t salary and benefits. People care that they have the right tools to do their job well, that they believe in the mission of their group, that they have excellent colleagues, that someone recognizes when they do a job well and that someone is there to encourage their development. I try to provide these things for this group.”

Penny married her hiking and skiing partner, Eric Johnson, in 2009. She and her husband are expecting their first child in April 2011.

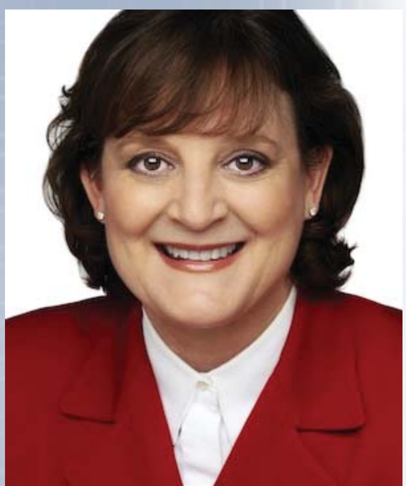
Penny Warren and 2 other students in the Nuclear Physics lab.

Where are YOU now?

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

Alumni News

2010 Distinguished Science Alumni Award



L. Celeste Bottorff

BS ‘75, Purdue University

MBA ‘83, University of Virginia

Celeste Bottorff is Vice-President of Living Well for Coca-Cola North America in Atlanta. Her work involves collaboration with leading scientists, policy makers, and opinion leaders regarding obesity and active lifestyle issues and development of consumer and employee messaging and advertising regarding Coca-Cola’s products and community involvement.

Bottorff started her career at Fermi National Accelerator Laboratory, where she worked in accelerator operations. She also worked for consulting giant McKinsey & Company, where she focused on technology and marketing practice groups. In addition, she has served as the senior vice president of strategy and marketing for AHL Services Inc., marketing director for the Atlanta-Journal Constitution, and director of global planning for Intercontinental Hotels.

She is a board member for Caraustar Industries, HireDynamics Inc., and the Cystic Fibrosis Reaching Out Foundation. She has served on both the Purdue University Science Alumni Board and the Dean’s Leadership Council.

Career Highlights

2008 Received the Lettie Pate Whitehead Evans Award for Corporate and Community Leadership

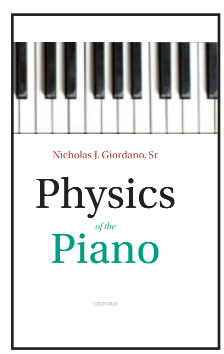
2007 Named one of Atlanta Woman magazine’s Atlanta Power Women

2007 Named an Outstanding Physics Alumna by Purdue’s College of Science

2002–Present Vice President, Living Well, The Coca-Cola Company

Did You Know?

Prof. Nick Giordano (BS 1973) is author of the book Physics of the Piano.



2010 Outstanding Alumnus Award

The Physics Department hosted its Outstanding Alumnus for 2010 on September 24, 2010. Dr. Derek Tournear was recognized for his contributions and leadership in the physics community. Dr. Tournear is a program manager for Defense Advanced Research Projects Agency (DARPA) Tactical Technology Office where he manages one of the largest portfolios in the agency. Prior to his position at DARPA, Dr. Tournear served as program manager of the DARPA X-ray Navigation Program at Los Alamos National Laboratory. Dr. Tournear earned his PhD in physics (2003) at Stanford University where he performed research on astrophysics and gamma ray detectors at the Stanford Linear Accelerator Center. He attained a B.S. in honors physics (1998) from Purdue University while conducting research in high-energy physics on a USN ROTC scholarship. Prior to Purdue, Dr. Tournear started his National Security career in the USN as a nuclear trained machinist mate.

College of Science Dean Jeffrey Roberts (left) and Outstanding Alumnus Derek Tournear (right).

Professor H.Y. Fan Conference Room

The Physics Department dedicated the Professor H. Y. Fan Conference Room on April 30, 2010. The 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 and were completed in February 2010. The Department is particularly grateful for the generosity of the family of Professor Fan (wife Manya Fan, sons David Fan and Hung Fan, and daughters Vicki Black and Frances McDonald), Dr. Aram Mooradian (PhD, 1966) and Dr. Stephen Thomas (PhD, 1968).

Front row: Manya Fan, David Fan. Back row: Frances McDonald, Ingrid Thomas, Anant Ramdas, Vicki Black, Vasantha Ramdas, Hung Fan, Stephen Thomas, Nick Giordano.

Alumni News

From the Director of Development

Greetings from the Purdue 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.

I would like to ask for your help in supporting our efforts. In our current world of economic uncertainty, we find ourselves evaluating where and how we allocate our income. If we all support the Department of Physics' efforts in whatever way we can, we will be able to make a positive impact on our world and the grand challenges we face. Every gift matters, regardless of its size. Your gift, in the form and purpose you choose, will play a crucial role in the progress and continuing success of the department. Your gifts enrich our students' educational experience and increase the department's competitive edge among its peers.

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

Hail Purdue!

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

Alumni Notes

- **Trinanjan Datta (PhD 2007)** was named a Kavli Institute for Theoretical Physics Scholar.

In Memoriam

- **William Spitzer (PhD 1957)** passed away April 14, 2010.
- **Yihong Liu (PhD 2010)** passed away September 26, 2010

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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Thomas, Jacob

Master of Science
Kane, Steven

Ph.D.
Chang, Chulhoon
Liu, Chang
Liu, Luxin
Shen, Tian
Wang, Xuefeng

May 2010

Bachelor of Science
Anderson, Michael
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Bone, Joshua
Chapman, Bryan
Cimaroli, Alexander
Fowler, Justin
Geurs, Pieter
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Hebda, Philip
Krzywda, Alex
Lilovich, Nicholas
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Strinka, Zohar
Williams, James
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Master of Science
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Watson, John
Zhang, Xuan

Ph.D.
Ding, Zhenwen
Liu, Boyang

August 2010

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Master of Science
Momeni, Fatemeh

Ph.D.
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If you are interested in supporting the Department of Physics remember 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 Javier Magallanes, Director of Development. (p. 14)