

Spring 2013

# *DIMENSIONS*

Department of Physics & Astronomy

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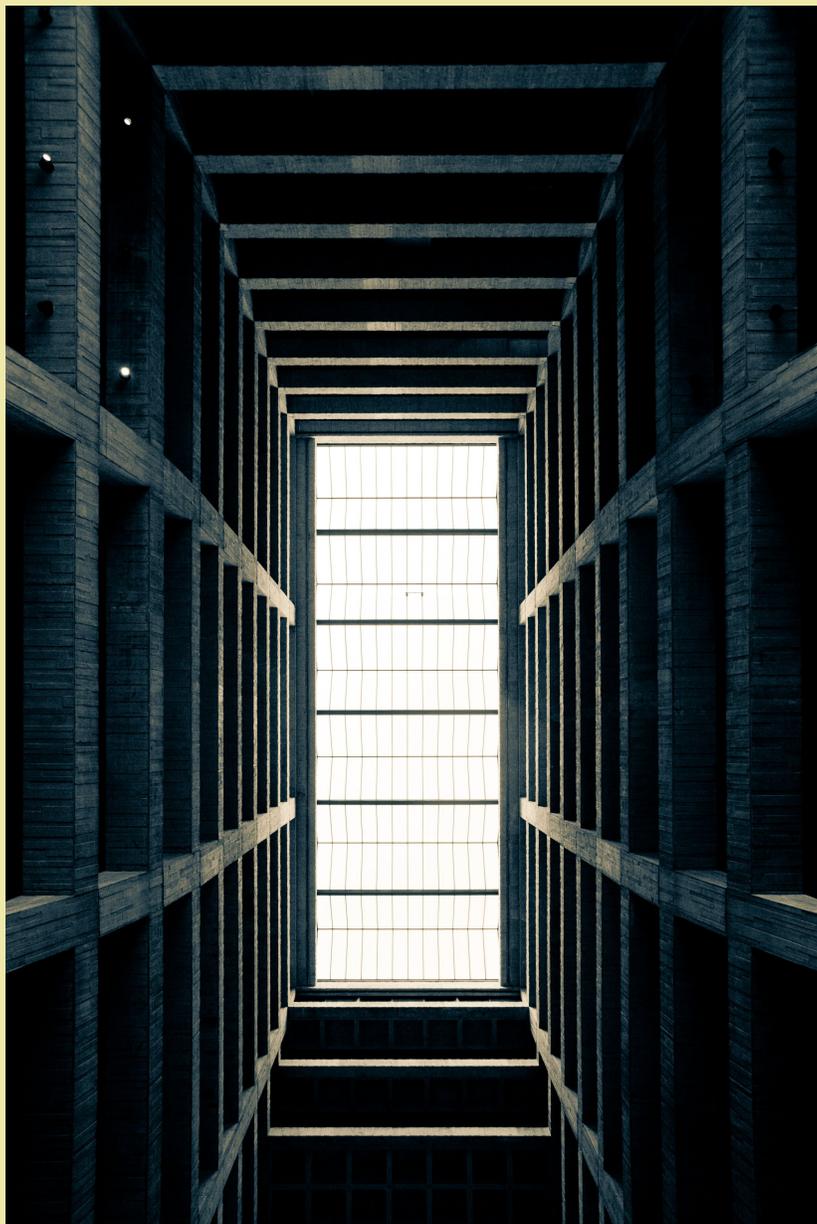


Photo courtesy of Robert Tilden

Upward view in the atrium at Fermilab

# Letter from the Chair



Dear Friends of Physics & Astronomy,

2013 has been a very eventful year in the department.

We have one piece of sad news, Professor Bruno Gobbi passed away in February 2013. Bruno was one of the top instrumentalists in high energy physics and trained a multitude of outstanding students and postdocs who revered him. I personally learned about Northwestern and how to build tracking chambers when I visited his lab in 1988 and his presence here was a major motivation for me to come to Northwestern. Although he officially retired in 2008, he continued to come to the lab every day until a few months before his death. His memorial service brought together many of his former colleagues and students as well as his many friends and family in Evanston. We will miss him.

On the positive side, Northwestern welcomed Professors Kristian Hahn and Eric Dahl to the faculty last Fall. Kristian joins us from MIT and works on the CMS experiment at CERN with Professors Mayda Velasco and Michael Schmitt. He was one of the major participants in the recent discovery of the Higgs boson. Eric Dahl was previously a Kavli Fellow at the University of Chicago and just started taking data with the COUPP dark matter detector in the SNOLab underground laboratory in Canada.

It has been a banner year for recognition of our faculty. Giles Novak received the Weinberg college award for research mentorship, Jim Sauls received the Bardeen Prize in Superconductivity, Nate Stern received a Sloan Fellowship, Fred Rasio was named editor of *Astrophysics Letters*, Michael Bedzyk has become a Fellow of the AAAS, Vicky Kalogera and Ian Low were able to spend the year on sabbatical thanks to Simons Fellowships, Chris Jacobsen, Anupam Garg and André de Gouvêa have become Fellows of the American Physical Society and just as we were finishing this newsletter, Adilson Motter was given the Erdős–Rényi Prize in Network Science in Copenhagen.

This spring we admitted 14 new graduate students. They come to us from prestigious centers of learning all over the world: The University of Illinois, Case Western Reserve University, India Institute of Technology, the University of Georgia, Louisiana State University, Hampton University, the University of Notre Dame, the University of Chicago, Stony Brook University, Rice University, Boston University, and the University of Michigan.

Our current graduate students continue to excel in their work. Vivien Raymond won the International Stefano Braccini Prize for his 2012 doctoral thesis. Joo Sang Lee received one of three Young Investigator Trans-Network Program research grant through Northwestern's Physical Sciences-Oncology Centers for his work with Prof. Adilson Motter. Jennifer Hobbs was appointed a 2012-13 Teaching Fellow by the Searle Center for Teaching Excellence, and Roberto Vega-Morales was awarded a 2012-13 Fermilab Fellowship in Theoretical Physics.

Our undergraduate majors number 52. Among them, Sascha Herrman won an NSF Graduate Fellowship which will support three years of graduate study. Jennifer Mills won a Marshall Scholarship to support two years of study at Cambridge and Edinburgh Universities. In addition, Xiaowen Chen and Tyler Rehak won summer Undergraduate Research Grants for their work with Professors Brian Odom and Mayda Velasco. We congratulate them on their achievements.

The building renovation project continues, with a new department office and conference room and half of the astrophysicists already moved into new space on the 2nd floor. Art Freeman's group and the most of the remaining astrophysicists will be moving back into the final phase on the 2nd floor of Tech late this summer. At that point the seemingly endless construction will be over and we can relax assured that we won't be moving for a while. I've moved 6 times since coming to Northwestern in 1990.

With best wishes,



Heidi Schellman, Professor and Chair  
Department of Physics & Astronomy

## In Memory: Professor Bruno Gobbi



Professor Gobbi came to Northwestern University in 1972 and was one of the premier instrumentalists in elementary particle physics. Among his major accomplishments were the forward tracking systems for the D0 experiment at Fermilab, used in the discovery of the top quark in 1994 and the forward pixel detector for the CMS experiment at CERN, which was used in the recent discovery of the Higgs Boson. He retired from teaching in 2009 but continued working in the lab until last summer. Professor Gobbi is survived by his wife, Dr. Elizabeth Gobbi (Feinberg School) and two daughters. His memorial service on February 11, 2013 included former students and colleagues from all over the world.

Please visit the Physics and Astronomy website for a complete list of upcoming events:  
[www.physics.northwestern.edu/events](http://www.physics.northwestern.edu/events)

Be sure to check out our Facebook Fan page and our LinkedIn Group Page.  
Type in "Department of Physics and Astronomy, Northwestern University".

## Faculty News

**Michael Bedzyk** has been named a fellow of the American Association for the Advancement of Science. The AAAS is an international non-profit organization whose mission is to "advance science, engineering, and innovation throughout the world for the benefit of all people."

**Eric Dahl** is part of a group of physicists that has launched an unusual new experiment in an attempt to be the first to directly confirm the existence of dark matter. He spoke with the Northwestern Newscenter recently about his research.

<http://www.northwestern.edu/newscenter/stories/2013/05/quest-for-dark-matter-begins-with-a-few-tiny-bubbles.html>

**Andre de Gouvea** and **Anupam Garg** have been selected as Fellows of the American Physical Society in 2012. Only 0.5% of the membership are recognized in this fashion each year.

Andre de Gouvea's citation is "For exceptional service to the field of neutrino physics through innovative studies of possible neutrino properties and their experimental implications." Anupam Garg's citation is "For theory and predictions of molecular magnetism and macroscopic quantum phenomena."

**Kristian Hahn** has begun to use Northwestern's High Performance Computing system, Quest, in his classroom by requiring the students in his undergraduate Computational Physics class to use it in their coursework. Hahn believes his students will take this experience out of the classroom and use it to further their career goals after graduation. He told the NUIT newsletter that, "Most will need to reference this experience when seeking employment in their field after graduation, and it's important to have this type of computational experience when applying for graduate school."

**Bill Halperin** was featured in Northwestern University Research Newsletter, November 2012 issue in an article on the Cryogenics Facility: Northwestern's Gas Station. The facility supplies twenty to thirty labs at any given

time, as well as the Tech renovation project.

For more information visit

<http://cryogenics.facilities.northwestern.edu>.

**Vicky Kalogera** has been working closely with Quest-Northwestern's High Performance Computing system, as they continue to expand their capabilities.

<http://www.it.northwestern.edu/ecomm/2013-winter/faculty/hpc.html>

A new high-performance computer cluster, named "Grail", was installed at Northwestern in October 2012; it will enable research in gravitational-wave physics undertaken by Professor Kalogera, Professor Fred Rasio, and collaborators at Northwestern. This high-performance cluster is exceptional in that it provides not only for general-purpose high-performance computation with 1344 computer 'cores', but also includes 32 special purpose Graphics Processing Units, appropriate to scientific computing, which allow accelerated parallel calculations. This cluster will also serve as a training ground for undergraduate students in HPC computing and computational research. "Grail" was made possible by a Major Research Instrumentation grant to Professor Kalogera, Professor Rasio, and collaborators across Northwestern: Professors Alok Choudhury and Erik Luijten, as well as the past Associate Director for Research Computing, Thomas Hauser, and the current Associate Director, Joe Paris.

**Prem Kumar's** research from two decades ago has been highlighted in the November 2012 issue of Physics Today in an article entitled "Manipulating the color and shape of single photons." In the byline to the article authors Michael Raymer of the University of Oregon and Kartik Srinivasan of the National Institute of Standards and Technology (NIST) state: "In a future quantum internet, individual and photons might well be the agents that carry information between different kinds of devices. But physicists must first learn to tailor some of their essential features."

In the early 1990s, Kumar theorized and with his student demonstrated a process he termed "quantum frequency conversion," by which the frequency of a light beam can be changed while preserving its quantum state. This early work is turning out to be fundamental and groundbreaking in the quest to create technologies for a futuristic quantum internet where the exchange of information will ride on the quantum properties of light.

Read the full article at <http://dx.doi.org/10.1063/PT.3.1786>

**Adilson Motter** is the new editor of Chaos: An Interdisciplinary Journal of Nonlinear Science. Motter has a strong background in interdisciplinary work in the dynamics of complex systems and maintains ties with several science departments at Northwestern. His research includes theoretical work on networks as well as network modeling and applications. Also, Adilson Motter and Reka Albert's article 'Networks in Motion' was the most viewed subscription-only Physics Today item in 2012.

Motter has received the 2013 Erdos-Renyi Prize in Network Science. He is being honored for his outstanding work in complex networks; the citation notes "his groundbreaking contributions to the study of synchronization phenomena and the control of cascading failures in complex networks." The prize is given each year by the Network Science Society to one researcher in the broad field of network science under the age of 40. It consists of a cash award, a plaque and an honor lecture at the International Conference on Network Science (NetSci2013). The Award ceremony took place on June 7 at the Royal Library in Copenhagen, Denmark. Motter will donate \$3000 from his award to Northwestern undergraduate student activities that promote the most outstanding students in the Physics and Astronomy program.

Read news article here

<http://www.northwestern.edu/newscenter/stories/2013/06/physicist-awarded-the-erdősrenyi-prize-in-network-science.html>

**Heidi Schellman** has agreed to continue as Chair of the Department of Physics and Astronomy for a three-year term, September 1, 2013 to August 31, 2016.

Heidi Schellman, Postdoc Laura Fields, and graduate student Cheryl Patrick are in the top 10 list of Physics World for their MINERvA Collaboration. Physics World recognized MINERvA for "being the first to demonstrate communications using neutrinos."

See the entire article at

<http://physicsworld.com/cws/article/news/2012/dec/14/physics-world-reveals-its-top-10-breakthroughs-for-2012>

**Nathaniel Stern** has been awarded a Sloan Research Fellowship. Stern works at the boundary between Optical and Condensed Matter physics and spans nano-structures and quantum computing.

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**Sara A. Solla**, Professor of Physiology and Professor of Physics and Astronomy, has been invited to participate in a new national panel on the "Physical and Mathematical Principles of Brain Structure and Function." This is of the first steps in the implementation of the BRAIN (Brain Research through Advancing Innovative Neurotechnologies) Initiative announced by President Obama on April 2, 2013. Professor Solla, who represents Northwestern University, is a theoretical physicist working in computational and theoretical neuroscience. Her research focuses on constructing mathematical models to understand how networks of neurons acquire, store, and process information. Current projects include the decoding of neural signal from primary motor cortex for the guidance of prosthetic limbs, and the encoding of sensory signals by neurons at the base of rats' whiskers.

**Farhad Zadeh** was featured in the Northwestern Newscenter in January 2013 for his new work on radio imaging of dusty stars and interstellar clouds. He told the Newscenter that "knowing details of these clouds is important because the clouds can produce stars and also provide material for the growth of black holes."

Read the full article at

<http://www.northwestern.edu/newscenter/stories/2013/01/detecting-dusty-clouds-and-stars-in-our-galaxy.html>

## Staff Science Salon

Two of our faculty members, David Meyer and Michael Schmitt, gave talks to college staff this winter as part of the "Science Salon" series. Professor Meyer spoke about the Hubble telescope, focusing on what astronomers have learned from some of its most famous pictures. Professor Meyer said "I had a great time talking to a large group of NU staff about the Hubble Space Telescope. The beautiful images generated a lot of excellent questions about the science behind them. I hope to do another Science Salon talk next year." Professor Schmitt spoke about the Higgs Boson, in particular what its recent discovery means for our understanding of physics. Professor Schmitt told us that, "Sharing the excitement of the discovery of the Higgs Boson with intelligent and interested members of the Northwestern staff was a wonderful experience. The questions were really good and the enthusiasm of the audience was remarkable. I hope these seminars will bring these two sides of the university together- there should be no real gap between staff and faculty, in my opinion."

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## Selected Publications

**Michael J. Bedzyk**

*Molecular Crystallization Controlled by pH Regulates Mesoscopic Membrane Morphology* by Cheuk-Yui Leung, Liam C. Palmer, Bao Fu Qiao, Sumit Kewalramani, Rastko Sknepnek, Christine J. Newcomb, Megan A. Greenfield, Graziano Vernizzi, Samuel I. Stupp, Michael J. Bedzyk, Monica Olvera de la Cruz. **ACS Nano** **6**, 10901-10909 (2012). DOI: **10.1021/nn304321w**

Viruses, organelles and wall envelopes of archaea organisms are examples of microcontainers of diverse shapes that perform specific biological functions. These closed crystalline structures are biological reactors that control various processes including metabolic flow even at very high salt concentrations as with archaea organisms or enhance the fixation of CO<sub>2</sub> in cyanobacteria as with organelles called carboxysomes. They undergo transformation to perform specific functions, such as the conformational changes of viral capsids to release of RNA inside cells. The mechanisms that lead to the emergence of various shapes at the mesoscale, as well as how these shape transformations couple to the functions of the nanocontainers, have been a mystery. Self-organized strong shells that undergo various geometrical transformations are of particular interest to nanotechnological applications including imaging, catalysis, compartmentalization and targeted delivery.

By co-assembling oppositely charged lipids, Northwestern University researchers found a mechanism that leads to complex crystalline polyhedral shells and how their crystalline structures can be modified by externally modifying the surrounding electrolyte. That is, they found a way to regulate the shape of crystalline nano-containers.

The Northwestern group found that the co-assemblies of oppositely charged multivalent amphiphiles buckled into diverse geometries including fully faceted regular and irregular polyhedral such as square and triangular shapes or mixed Janus-like vesicles with faceted and curved domains that resemble cellular shapes.

The symmetries of the resulting ionic nanocontainers were regulated by the pH values of the solution, which induced changes in their molecular structures. Transmission electron microscopy and in situ small- and wide- angle X-ray scattering demonstrated that these faceted ionic shells have hexagonal crystalline symmetry and that this symmetry makes them stable in closed shapes, and at high salt concentrations.

The researchers demonstrated that the competition of physical interactions and charge-regulation induced transition in crystalline states that translate in changes of shapes. The changes of packing symmetry translate in bilayer thickness changes that open the closed shapes (like a switch).

Collaborations between the research groups of Professor's Olvera de la Cruz, Stupp, and Bedzyk were used to publish this paper.

<http://pubs.acs.org/doi/abs/10.1021/nn304321w>

**Jens Koch**

*Symmetries and Collective Excitations in Large Superconducting Circuits* by David G. Ferguson, A.A. Houch, and Jens Koch. **Phys. Rev.** **x3**, 011003 (2013).

The huge success of modern electronics is an indisputable testimony to the power of the concept of electronic circuits. At the heart of this success is modularity--the limitless possibilities to combine elementary building blocks into large networks for new functionality. Currently there is much excitement about the possibility of using superconducting building blocks to construct a "quantum circuit," i.e., a circuit where voltages and currents obey the laws of quantum mechanics. Such circuits may be utilized to build a quantum computer or to otherwise explore the limits of quantum mechanics.

Already, quantum coherence in circuits comprised of more than 40 superconducting elements have been demonstrated, with the excitation frequencies of such circuits sensitively probed by experiments. However, as with nearly all nonlinear many-body quantum systems, the theoretical prediction of such excitation frequencies poses a significant theoretical challenge.

In their work "Symmetries and Collective Excitations in Large Superconducting Circuits" Jens Koch and his postdoc David Ferguson address this challenge by leveraging the internal symmetries of certain superconducting circuits--symmetries which include permutation symmetry. As such a symmetry-based analysis reveals, superconducting circuits provide an intriguing example of an interacting quantum many-body system with states that obey novel permutation symmetries beyond the conventional bosonic or fermionic permutation symmetry of naturally occurring particles. In addition to opening new perspectives on emergent symmetries not readily observed in nature, their work provides new tools for understanding and improving future generations of superconducting quantum circuits.

#### **Adilson E. Motter**

*Spontaneous synchrony in power-grid networks* by A.E. Motter, S. A. Myers, M. Anghel, and T. Nishikawa. **Nature Physics, 9: 191-197 (2013).**

An imperative condition for the functioning of a power-grid network is that all of its power generators remain synchronized. A new study by Adilson E. Motter and Takashi Nishikawa was published in Nature Physics establishes conditions under which power grids can synchronize spontaneously. Given that most power outages involve equipment or operational errors, this is relevant both for reducing dependence on conventional control devices, thus offering an additional layer of protection, and for contributing to the development of self-healing networks that can recover from failures in real time. The other authors of the study are Professor Motter's former undergraduate student Seth A. Myers (now a graduate student at Stanford) and Marian Anghel of LANL.

<http://www.nature.com/nphys/journal/v9/n3/full/nphys2535.html>

<http://www.northwestern.edu/newscenter/stories/2013/03/no-more-blackouts-preventive-care-for-the-power-grid.html>

*Network Observability Transitions* by Yang Yang, Jianhui Wang, and Adilson E. Motter. **Phys. Rev. Lett. 109, 258701 (2012).**

In the modeling, monitoring, and control of complex networks, a fundamental problem concerns the comprehensive determination of the state of the system from limited measurements. This problem leads to a new type of percolation transition---a network observability transition---which is recognized and characterized for the first time in this study.

<http://link.aps.org/doi/10.1103/PhysRevLett.109.258701>

#### **Brian C. Odom**

*Resonant Few-Photon Excitation of a Single-Ion Oscillator* by Y. W. Lin, S. Williams, and B. C. Odom. **Phys. Rev. A 87, 011402(R) (2013).**

We show that, when modulated at the oscillation frequency of a single trapped ion, resonant laser light can induce measurable motion of a trapped ion system.

The number of photon kicks required in our scheme is small--of order one hundred--which opens up interesting new possibilities for the challenging problem of reading out the internal states of trapped molecular ions.

<http://pra.aps.org/abstract/PRA/v87/i1/e011402>

#### **Serhii Shafraniuk**

*Carbon Nanotube Quantum Dots As Highly Sensitive Terahertz-Cooled Spectrometers* by S. E. M. Rinzan, G. Jenkins, H. D. Drew, S. Shafraniuk, and P. Barbara. **Nano Lett. 12(6), pp 3097-3100 (2012).**

A highly sensitive detector the THz waves based on carbon nanotube quantum dot. The external THz field induces the non-equilibrium self-cooling which is beneficial for the system's performance.

<http://pubs.acs.org/doi/abs/10.1021/nl300975h>

*Coherent nonlocal transport in quantum wires with strongly coupled electrodes* by Y. Yang, G. Fedorov, P. Barbara, S. Shafraniuk, B. K. Cooper, R. M. Lewis, and C. J. Lobb. **Phys. Rev. B 87, 045403 (2013).**

We have observed a quantum entanglement between two remote carbon nanotube quantum dots. The suggested theory explains the experiment very good.

<http://prb.aps.org/abstract/PRB/v87/i4/e045403>

## New Research Staff

**Aaron Geller**, a Lindheimer Postdoctoral Fellow, was awarded an NSF Astronomy and Astrophysics Postdoctoral Fellowship (AAPF). The AAPF award funds a three-year integrated program of independent research and education, which Dr. Geller will carry out at Northwestern in CIERA- Center for Interdisciplinary Exploration and Research in Astrophysics and the Department of Physics & Astronomy. The AAPF program is intended to recognize early-career investigators of significant potential and to provide them with experience in research and education that will establish them in positions of distinction and leadership in the community. His research will focus on modeling the dynamical evolution of planetary systems in star clusters. For his education component, he will work with a GK12 graduate student fellow to develop and test high school curricular materials that are directly tied to his research on star clusters and exoplanets.

**Esfir Katsnelson** is a visiting scholar in the Ketterson group and was awarded a US Patent: US 8,154, 957 B1, April 10, 2012, "Magneto-Optical Device with an Optically Induced Magnetization" by Esfir Z. Katsnelson et al.

The properties of a magneto-optical device (MOD), the fabrication method, and possible practical applications are disclosed in our patent. The MOD comprises an epitaxial Mg-Mn-Co-ferrite film deposited on MgO substrate. Room-temperature illumination of the ferrite film with particular combinations ( $H_+$   $\sigma^+$  or  $H_-$   $\sigma^-$ , "writing" combinations) of a low-intensity ( $0.4 \text{ W/cm}^2$ ) circularly polarized laser beam (CPL) along with a static magnetic field (about 3 kOe) using the Faraday effect geometry leads to the appearance of the optically induced magnetization (OIM) with a unidirectional anisotropy, an offset of the hysteresis loop, and an increased Curie temperature. Effects observed have a long-lived relaxation time. The OIM cannot be erased with conventional AC demagnetization, but can be removed by applying two other field-light combinations ("erasing" combinations). The OIM appears as a residual magnetization  $M_{\text{IFE}}$  generated by an inverse Faraday effect.

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Practical applications of the MOD are described in three Patent's Embodiments. The MOD can be utilized as magnetic element, which pins the magnetization in a preferred direction in the ferromagnetic layers, which are used in magnetoresistive sensors and Magnetic Force Microscopes. The MOD can also be utilized as magnetic memory cell thereby offering a new method of room-temperature magneto-optical (non-thermomagnetic) recording. This method was described in our presentation "*Room-temperature magneto-optical recording with optically induced magnetization*" at the 12th Joint MMM-Intermag Conference, January 14-18, 2013, Chicago, IL.

Also, a second patent, No. 13/506,115, March 1, 2013, "Magneto-Optical Device with Optically Induced Magnetization" by Esfir Z. Katsnelson et al.

In the new (second) patent, definitions of magneto-optical device, ferrite film and substrate (as a recording medium) are extended.

**Dale Stentz** has accepted a position as a visiting scholar working with his former advisor, Professor Michael Schmitt. Stentz completed his thesis in December, 2011, on production of hadronic jets in association with a W boson, using data collected with the CDF detector at Fermilab. His magnum opus has been described as "three theses in one." Stentz is working on a long paper to be submitted to Physical Review D.

**Laura Trouille** of the Kalogera group, who is a CIERA Postdoctoral Fellow, has accepted a new joint position between Northwestern University and the Adler Planetarium. She now works half-time at CIERA (where she will continue both her research and outreach work, as a CIERA Fellow and half-time at Adler.) Laura will be working in Adler's education and outreach programs, as well as continuing her own research in AGN at Adler.

**Francesca Valsecchi** works in the Kalogera group and has been selected as one of two winners to give the 2013 DAP Early Career Recognition Lectures (a "Young Stars" award). She gave a lecture at the April 2013 APS-American Physical Society Division of Astrophysics meeting in Denver, Colorado.

# Alumni News



**Adrian Barker**, CIERA Postdoctoral Fellow, has been in the Lithwick group since 2011 and has accepted a Research Associate position in Astrophysics at the Department of Applied

Mathematics and Theoretical Physics at the University of Cambridge. Adrian will begin his new position at Cambridge in Fall 2013, and he will work with Drs. Latter and Ogilvie, and Professor Papaloizou.

**John Davis** earned a PhD in 2008 in Physics and Astronomy and is an Assistant Professor of Physics at the University of Alberta. He and his wife Juli Gibbs-Davis, graduate of the Chemistry department at Northwestern University and also a professor at the University of Alberta, both have been awarded Sloan Fellowships. John is a condensed matter experimentalist having established a laboratory to perform research in a variety of extreme experimental conditions including the study of quantum fluids and quantum condensed systems at ultra-low temperatures. He joins the ranks of three other Sloan fellows who are graduates from Bill Halperin's group.



**Will Farr**, CIERA Postdoctoral Fellow, has been in the Kalogera group since 2009 and has accepted an offer for a Birmingham Fellowship at the University of Birmingham, UK. He will be

taking a faculty position as a Lecturer in the School of Physics and Astronomy beginning Fall 2013



**Hua-bai Li**, graduate from Physics and Astronomy in 2006, has accepted an appointment as Assistant Professor in the physics department of the Chinese University of Hong Kong

(CUHK). At Northwestern, Hua-bai worked in Professor Giles Novak's group where he helped build

submillimeter instrumentation for telescopes in Antarctica and at the 14,000 foot summit of Mauna Kea in Hawaii. After his graduation, he did postdoctoral work at Harvard University and at the Max Planck Institute for Astrophysics. His recent Nature paper with Thomas Henning revealed that magnetic field lines in Giant Molecular Clouds in the spiral galaxy M33 line up with the local directions of spiral arms, providing an important constraint on theories of star formation. CUHK is ranked as the seventh best university in Asia (and 40th worldwide ) by U.S. News and World Report. Hua-bai plans to continue his studies of cosmic magnetism, exploiting various new facilities in the Chilean deserts including the Atacama Large Millimeter/Submillimeter Array (ALMA).



**Victoria Martin** was a post-doc in Professor Michael Schmitt's CDF group, and was advised by Professor Mayda Velasco while Professor Velasco was at CERN. In August, she will become a Reader at the University of Edinburgh,

a position equivalent to an associate professor. Dr. Martin is currently a member of the ATLAS collaboration at CERN, and a Lecturer at the University of Edinburgh.



**Vivien Raymond** earned a PhD in Physics and Astronomy in 2012, working with Professor Vicky Kalogera. He has won the International Stefano Braccini

Prize for his doctoral thesis. Every year the gravitational-wave community gives the Stefano Braccini Prize for the best thesis on gravitational waves and related subjects (either theoretical or experimental). This year was exceptional in that two prizes were given; one of those prizes was awarded to Vivien for his thesis "Parameter Estimation Using Markov Chain Monte Carlo Methods for Gravitational Waves from Spinning Inspirals of Compact Objects." He is now the Richard Chase Tolman Postdoctoral Scholar in Experimental Physics at the California Institute of Technology.



**Geralyn "Sam" Zeller** earned her PhD in 2002 with Heidi Schellman, and has been named co-spokesperson of the Micro-BooNE experiment at Fermilab. This research group of

around 80 physicists is mounting a novel liquid argon detector experiment at Fermilab to study low energy neutrino interactions. Zeller is well known for her work on neutrino cross-sections and received the 2003 Tanaka Dissertation Award from the American Physical Society. She has been a postdoc at Columbia University, a Director's Fellow at Los Alamos National Laboratory and is now an Associate Scientist at Fermilab in the Neutrino Department.

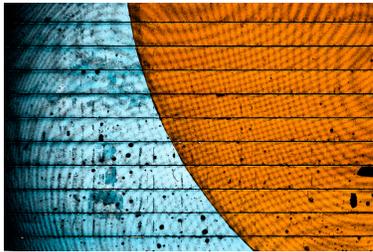


Photo courtesy of Robert Tilden

## Undergraduate Achievements



**Sascha Herrmann** has been awarded an NSF Graduate Research Fellowship. Sascha is a senior in physics and mathematics and has done research over the past two years

under the guidance of Professor Motter while supported by the Physical Sciences-Oncology Center. The NSF Fellowship provides stipend and tuition support for three years of graduate studies.



**Jennifer Mills** has won a Marshall Scholarship. The Marshall Scholarship will support her studying for two years after graduation at Cambridge and Edinburgh Universities, where she

will study climate science. She has already received numerous awards, including a Goldwater Scholarship.

## 2013 Senior Class Plans

**Bridget Bellavia** is looking forward to life after college.

**Rachael Bucci** is looking forward to life after college.

**Noah Charles** will be teaching in the Chicago Public Schools through Chicago Teaching Fellows, a two-year alternative program. Afterward, he plans on applying to graduate school and pursuing teaching at the secondary or post-secondary level.

**Daniel Douglas** is looking forward to life after college.

**Timothy Earles** is looking forward to life after college.

**Dale Fox** is looking forward to life after college.

**Leah Isaman** is looking forward to life after college.

**Taylor Kennedy** is looking forward to life after college.

**Laura Klein** will be working in technical sales with Schneider Electric.

**Stephen Richard Okoniewski** will pursue a PhD in Physics at the University of Colorado, Boulder.

**Harsh Shah** is looking forward to life after college.

**Louis Shekhtman** will be taking a year off in Israel and applying to graduate schools towards a PhD in the field of complex systems.

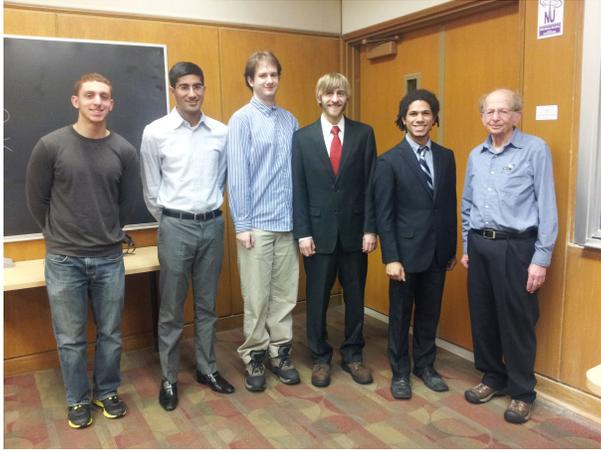
**Andrew Srisuwananukorn** will pursue an M.D. at Indiana University School of Medicine.

**Talia Strait** will be traveling after graduation and then searching for a job.

**Crystal Xia** will be working as a consultant with Oliver Wyman in Chicago.



# Northwestern's Society of Physics Students (SPS)



Left to right: Jonathan Kernes, Annas Rahman, Ben Godek, Dan Douglas, Noah Charles, Dr. Murray Peshkin

In winter quarter 2013, the Society of Physics Students brought Murray Peshkin to campus to speak about his time working on the Manhattan Project during WWII. Dr. Peshkin was a scientist who worked at Los Alamos as part of the United States' effort to build the world's first nuclear bomb. He talked about his experience enrolling in the project, the projects he worked on, his time working with Richard Feynman, and his views on the bomb. The audience filled the room to capacity and the talk was very successful. This talk follows our successful Higgs Boson panel we held in the Fall. Also, the Society of Physics Students held its annual physics majors dinner at Thai Sookdee, where physics majors and physics professors have dinner, chat, and get a chance to know each other outside the classroom. SPS partnered with the Biology and Chemistry student groups on campus (the Biology Students Association and the Undergraduate Chemistry Council) to form a new partnership between the science groups on campus. Together, we petitioned the NU Student Government (ASG) to grant the first ever Science Senator seat in the ASG Senate. This is the first time ever that ASG will introduce a science voice in the senate. SPS President Annas Rahman, who spearheaded the campaign, is serving as the interim Science Senator while a search for a permanent representative is underway. This new SPS-BSA-UCC partnership represents the inclusion of NU's STEM interests in the student government, and paves the way for increased collaboration between the three science groups.

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# Dearborn Observatory

The **Dearborn Observatory** is open for public observing with the historic 18.5" refracting telescope every Friday night.

Visiting schedule:

Spring/Summer Hours (April-September)

9-10 pm: One hour session by reservation only. Your group will be able to use the telescope for the full hour.

10-11 pm: Walk-ins are welcome, but space in the dome is limited.

Fall/Winter Hours (October-March)

8-9 pm: One hour session by reservation only.

9-10 pm: Walk-ins are welcome.

There is no charge for these Friday night tours; however, we do require a refundable deposit for groups of 10 or more. Additionally, the Observatory is available for private viewing events on other evenings. To place a reservation, or for more information, contact Monica Brown at 847-491-7650 or [monica.brown@northwestern.edu](mailto:monica.brown@northwestern.edu)



**Dearborn Observatory**



# Department Events

## Heilborn Lectures 2013:



Photos courtesy of Robert Tilden



**The 2013 Walter and Christine Heilborn Lectures Welcomed Dr. Carlo Rubbia**

The Department of Physics and Astronomy has been organizing a highly successful annual series of Heilborn Lectures since 2001. The series was endowed by our alumnus George Heilborn in honor of his parents, Walter and Christine Heilborn, and has hosted seven Nobel Prize winners in the previous years. For 2012-2013 the distinguished lecturer was Professor Carlo Rubbia from CERN who received the 1984 Nobel Prize for one of the most important discoveries in particle physics, the discovery of the W and Z particles which unite the electromagnetic and weak interactions.

Prof. Rubbia was a long time professor at the Harvard University, and Director of CERN, the European laboratory for Nuclear and particle physics during 1984-89. He has received numerous international medals, prizes, and honorary degrees (including one from Northwestern). He is a member of several National Academies, including the US National Academy of Science, and the Papal Academy of Science.

During his stay in the department during April 15-20, Professor Rubbia gave three lectures:

Monday, April 15: " Neutrinos: a golden field for astroparticle physics."

Wednesday, April 17: "Non-Liouvillian cooling in particle accelerators: from proton-antiproton colliders to a Higgs factory."

Friday, April 19: "The future of energy."

Prof. Rubbia's lectures were heavily attended. The Colloquium lecture on the "future of energy" drew a standing room crowd of about 400 people from various departments of the University and the general public. The event was capped by a Banquet in honor of Prof. Rubbia at the Chef's Station Restaurant. It was attended by 40 members of the faculty and administration, spouses, George Heilborn, and guests from Fermilab and Argonne. All in all, it was an extremely successful event.

## CIERA Fourth Annual Public Lecture: "Science@NASA"

On Tuesday, February 19th, CIERA held its Fourth Annual Public Lecture. Dr. John Grunsfeld delivered the talk, entitled "Science @ NASA;" Dr. Grunsfeld is a former space shuttle astronaut, working often as a "Hubble repairman" and is now the Associate Administrator for NASA's Science Mission Directorate. Dr. Grunsfeld talked not only about his flights as a shuttle astronaut, but also gave a broad overview of science currently underway at NASA: programs that range from supercomputer simulations of weather patterns and climate change, to the Mars rover "Curiosity," and the building of the James Web Space Telescope. He also narrated video clips from his space-shuttle flights and described the most recent updates from the Mars rover, all the while emphasizing the thousands of people who made all of these various missions possible, and who work on them on a daily basis.



## Jens Koch Hosts Middle-School Physics Adventure at NU



In May 2013, middle-school students visited Northwestern as part of the after-school Science Club run by Science in Society. They joined Professor Jens Koch and a group of our graduate students to learn about extremely low temperatures in a "physics adventure."

Graduate student Bill Gannon told Science in Society that, "I think the thing that we hope the kids will get out of the trip is that science is not just your teacher, who you may or may not like very much, writing on the blackboard. Science is something that's happening all the time and it's fun and it's not just something that's abstract."

Read the full story from Science in Society, or visit their facebook page for more pictures.

<http://scienceinsociety.northwestern.edu/content/articles/2013/science-club-kids-embark-physics-adventure>

## 2013 PhD Graduates



**Paul Dalach** (Don Ellis). Thesis title: Correlations between Atomic Structure and Dynamics in Porous Nano-dominated Materials.



**Kunal Kumar** (Ian Low). Thesis title: Considerations in Discovering the Higgs at the Energy Frontier.



**Daniel Lascar** (Ralph Segel). Thesis title: Precision Mass Measurements of Short-Lived, Neutron-Rich, R-Process Nuclei about the N=82 Waiting Point.



**Benjamin Stripe** (Pulak Dutta). Thesis title: Control of Orientation and Morphology of Crystals Grown Under Organic Templates.

## 2013 Masters of Science Graduates



**Myriam Johnson** (Ralph Segel).



**Jeongseop Lee** (William Halperin). He is continuing with PhD studies in Physics at NU.



**Cheryl Patrick** (Heidi Schellman). She is continuing with PhD studies at NU on the MINERvA experiment.



**Sara Rastegar** (Fred Rasio). She is pursuing a PhD in Earth & Planetary Sciences at NU.

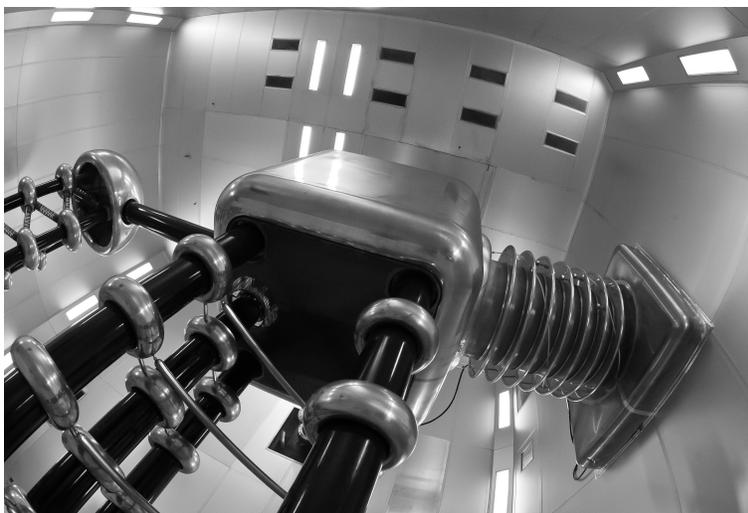


Photo courtesy of Robert Tilden

**Cockcroft-Walton generator at the beginning of the Fermilab linear accelerator. This is where the protons come from for the accelerator.**

## Staff News



**Gretchen Burnett** joined Physics and Astronomy in March 2013 as Financial Assistant, after spending three years in Chemistry. Gretchen's primary responsibilities include payroll, research appointments, visa applications, and postaward administration. Gretchen also has experience in the legal and aviation industries. Prior to joining Northwestern, she held positions as a litigation paralegal preceded by many years as an international purser for American Airlines. Her husband is also a part of the Northwestern community. Also, she holds a bachelor's degree in studio art, and is passionate about the equestrian arts, spending her Sundays schooling hunters and jumpers at a local training facility.



**Janet Howe** joined CIERA in May 2013 as Information Coordinator. Janet has been living in Chicago for about a year, and is a founding member & Co-Artist Director of (re)discover theatre. There she works as a director, costumer designer and producer. She is very excited to be joining the Northwestern family and feels so lucky to be surrounded by such incredible people.



**Katherine Lamb** joined The Astrophysical Journal Letters as Editorial Assistant in November 2012. She resides in Edgewater, Chicago and is originally from Urbana, IL. Currently, her favorite pastry is an almond croissant. In a recent realization, it occurred to her that 'festoon' might very well be her favorite word. She has read all of the novels of Jane Austen.

## Tech F-Wing Construction Update



Renovations to the Technological Institute's F-Wing have reached another milestone. A large portion of the second floor, previously home to the staff offices, kitchen, and conference room, was remodeled to create faculty offices, CIERA staff offices, and a home for Astrophysical Journal-Letters. Professors Vicky Kalogera and Fred Rasio, along with some CIERA postdocs, graduate students, Astrophysical Journal-Letters Editorial staff, and CIERA staff moved from the Dearborn Observatory to the newly renovated space in late April, 2013. The new offices let in a lot of sunlight with large windows and glass walls. In addition, the newly renovated offices give a temporary home to members of Professor Art Freeman's group, while their offices are remodeled. From May through August offices on the west side of the F-Wing hallway will be under construction, and Professor Freeman's group will move into many of them at the end of the summer, after which the remaining CIERA postdocs and professors currently in Dearborn will move Tech. This summer will mark the final phase of departmental renovations, which began in early 2010.

Compiled by Monica Brown

# Alumni News

Name: \_\_\_\_\_

Degree: \_\_\_\_\_

Graduation Year: \_\_\_\_\_

e-mail Address: \_\_\_\_\_

Phone Number: \_\_\_\_\_

News: \_\_\_\_\_

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The department newsletter is a means of reaching out to the alumni to keep them abreast of current research and developments in the Department of Physics and Astronomy. It is also a forum for alumni to keep the department informed of their accomplishments; the department welcomes submissions from alumni of newsworthy items for publication in the newsletter. Please feel free to send in items using this form (just fold and staple the page), or to email your news to Monica Brown [monica.brown@northwestern.edu](mailto:monica.brown@northwestern.edu).

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