

Collective Behavior

Distinguishing the physics major from the sea of liberal arts graduates.

LU physics notes:

- **Robert Hanisch** ('76) established a departmental faculty development fund at Lawrence that will provide travel and equipment grants to departmental faculty. This fund will help extend the impact of and initiate new avenues of faculty research.
- Four Lawrence students were involved in applied optical science research off campus during the summer of 2014: Three were hosted by **Jennifer Herek** ('90) at the University of Twente in the Netherlands, and one was at the University of Rochester.

Letter from the Chair

This is the fourth departmental newsletter and my last as chair (at least in my current term). In January I depart for an eight month sabbatical in Germany, where I will participate in two experimental plasma physics projects: The Wendelstein 7-X Stellarator is a magnetic confinement fusion plasma experiment located in the northern city of Greifswald. It is scheduled to begin operation during my time there (Spring 2015). I will help develop the data analysis system for the Thomson scattering diagnostic that measures electron temper-

ature and density. The second project is a small experiment located near Munich that aims to produce the first experimental electron — positron plasma.

Doug Martin is also on sabbatical across the Atlantic this year. He and his family are in Warwick, England where Doug is collaborating with a biophysics group.

In its second year with a modern optics theme (see last year's newsletter), the Lawrence Physics Workshop yielded 14 matriculants (out of 28) participants, which is a



Matt Stoneking
Professor and Chair of Physics

recent record for this event.

Senior Experience Projects and Awards for 2013-14

Senior Experience Project Titles for 2013-14

- Joe Cullen: *Planetesimal-driven Versus Gas Driven Planetary Migration in Circumstellar Disks*
 Hannah Gabriel: *Edge Dislocations in 70.7 Liquid Crystal Films*
 Will Jakes: *Guitar Electronics*
 Erich Lohrmann: *Gravitational Lensing: An Interactive Simulation*
 Daniel Martinez Zambrano: *Surface Reconstruction of Crystalline B Liquid Crystal Films*
 Alex Patterson: *Group Theory in Modern Physics*
 Cooper Sinai-Yunker: *Structural Evolution in Ni-Zr Liquids and Glasses*
 Michael Van de Graaff: *Wavefront Shaping Through Use of a DMD*
 Michael Wennerstrom: *Electric Propulsion: The Hall Effect Thruster*



2014 physics graduates with department faculty and staff.

Student awards for 2013-14:

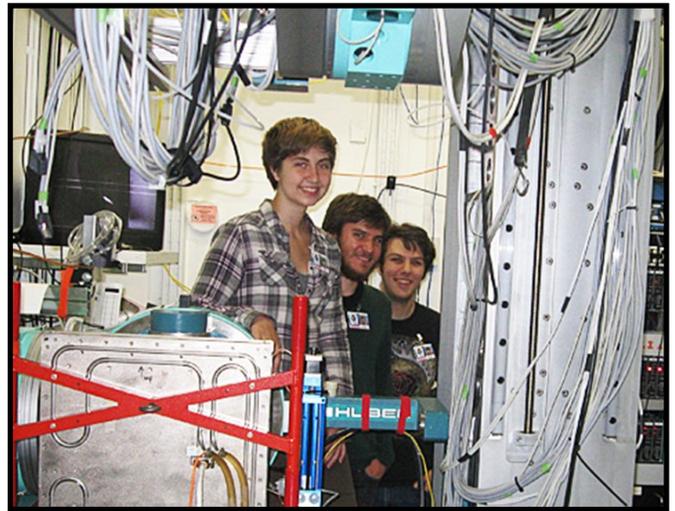
- Brackenridge Prize: Ashley Coenen ('15)**
Departmental Service Award: Michael Wennerstrom ('14)
Research Award: Joseph Cullen ('14)
S.I.N. Prize: John Hosmer-Quint ('15)

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Cooperative Agreement with Rochester Optics Program

Optical sciences is a growing area of applied science and engineering that offers opportunities for career paths in research, innovation and entrepreneurship. Lawrence University has entered into a cooperative agreement with the University of Rochester's Optical Sciences Department that gives Lawrence physics students access to its Master's degree program (at reduced tuition) and to summer research opportunities. Rochester's Optical Sciences program is one of the top two such programs in the country, and this agreement, the first such agreement that Rochester has formed, recognizing the quality of the Lawrence physics program and its special focus on modern optics and laser physics.



LU physics students Erika Roedl ('16), Leo Sussman ('15), and Ben Clark ('16) taking data on metallic glass structure at the Advanced Photon Source.

Spotlight On Metallic Glasses

Metallic glasses are very interesting and important systems. As a class of materials, they tend to be very strong, fracture tough and corrosion resistant compared to their conventional crystalline counterparts. Most people are familiar with silicate glasses, most commonly encountered in window glass, but it turns out that nearly any system can be formed into a glass, or non-crystalline solid. Glass formation, though, involves a very complicated interplay between thermodynamics and kinetics- cooling the system fast enough to bypass crystallization to the equilibrium state, thus forming a structure without long-range atomic order.

The research of visiting assistant professor **Nick Mauro (LU '05)** is focused on understanding how liquid atomic structure evolves. In his work, X-ray and neutron diffraction studies of liquids and glasses are coupled with advanced simulations of atomic structure to understand how atomic structural evolution relates to glass formation in a range of metallic alloy systems. Much of this work takes place at large user facilities like the Advanced Photon Source (APS) at Argonne National Laboratory and the Spallation Neutron Source at Oak Ridge National Laboratory. These facilities generate very bright beams of X-rays and neutrons, respectively, which can be used as

probes of static and dynamical ordering that takes place in a liquid, glass or any other solid state. Nick has been particularly interested in developing sample environments for use at these facilities and in making the experiments accessible to students. Most recently, he and three of his research students, Leo Sussman ('15), Erika Roedl ('16), and Ben Clark ('16) spent a week at the APS conducting highly successful experiments on metallic glasses with very interesting and unique structural properties. The results of these experiments will lead to a better understanding about how to tailor glasses for particular applications.

Update on Faculty Changes

Jef Wagner joined the Lawrence faculty in September as Visiting Assistant Professor of Physics. He has degrees from the University of Tulsa (BA, BS) and the University of Oklahoma (MA, PhD). His theoretical research had been in the fields of Casimir physics and biophysics. Recently he has worked on the behavior of genomic RNA and the role the genome plays in viral self-assembly. Prior to joining Lawrence in 2014 Jef worked as a post-doctoral scientist at the University of California, Riverside. We are de-

lighted to have Jef, his wife Kristen, and their daughter Irene as part of the Lawrence Physics family. They are due to add to that family sometime this winter.

Jef succeeds **Bobby Fleshman**, who did an outstanding job teaching in the Department during the 2013-14 academic year. Bobby remains in Appleton where he is pursuing a career in brewing. He is currently working as a quality assurance scientist for both Stone Cellar Brewpub and the Appleton Beer Factory.



Jef Wagner joined the LU physics department as a Visiting Assistant Professor in September 2014.

Alumna Profile: Cindy Regal ('01)

Since graduating from Lawrence *summa cum laude* in 2001, **Cindy Regal** has maintained her usual brisk pace. She completed a Ph.D. in BEC physics at the University of Colorado-Boulder in 2006 as a Hertz Fellow, married fellow physicist Dr. Scott Papp, accepted postdoctoral positions at Boulder and then at Caltech, and received prizes recognizing the high quality of her Ph.D. thesis. She then chose to return to Boulder to launch her academic career as a Clare Boothe Luce Assistant Professor of Physics and Fellow at JILA and to expand her family with Scott by way of a son Nolan and daughter Amelia.

Over the past few years, Cindy has built an experimental research group populated by postdocs, graduate students and undergraduates,

collaborated with fellow physicists at Boulder, taught a variety of physics courses, received major research and professional grants in support of her research and teaching, and continued to push back the frontiers of atomic/molecular/optical physics in areas such as trapping of a single neutral ^{87}Rb atom with optical tweezers, the exploration of near-quantum behavior of laser-cooled micro-mechanisms, and an examination of the opto-mechanical squeezing of light. Cindy still plays the violin when she gets a chance, and she, Scott, Nolan, and Amelia enjoy treks into Colorado Rockies. The Department of Physics and Lawrence University take great pride in Cindy's impressive array of accomplishments in these past fourteen years.



Cindy Regal ('01) is the Clare Boothe Luce Professor of Physics at the University of Colorado.



Robert Hanisch ('76) served as the Director of the Virtual Astronomical Observatory project during his tenure at the Space Telescope Science Institute.

Lawrence University alumni are devoted to their alma mater and **Robert Hanisch** could well serve as an exemplar of such devotion. Since graduating in 1976 with a major in physics and serious time spent on piano

Alumnus Profile: Robert Hanisch ('76)

performance, Bob has returned to Appleton frequently and made numerous contributions to Lawrence and the physics program in particular. After his graduate studies in radio astronomy at the University of Maryland—College Park, Bob was a visiting professor at Lawrence in the fall of 1981 during which he inaugurated the tradition of twice-weekly physics tea (with cookies!). More recently, Bob served as chair of the Physics Advisory Committee, a body that provides regular feedback to the LU physics department on its activities. He recently established a faculty development fund aimed at igniting new faculty research directions and broadening the impact of ongoing faculty research.

Bob's professional career has been impressive. Following a post-doctoral research fellowship in the Netherlands, Bob joined the Space Telescope Science Institute (STScI), Baltimore, Maryland (which operates the Hubble Space Telescope under contract to NASA), and led various software development, data archiving, and computational support activities. He also directed the development of the Virtual Astronomi-

cal Observatory (VAO). The VAO is an ambitious effort to systematize astronomical data and make it available to astronomers and astrophysicists worldwide. Recently Bob moved from STScI to the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland to which he brings his vast experience in the management of large and complex datasets. He will head a new department responsible for data management and informatics. In addition, he has served in a number of leadership roles with the International Astronomical Union and been a member of numerous advisory committees and review panels.

Bob continues to play the piano, accompanying a friend who is a cellist with the Lyric Opera Orchestra of Chicago and playing in the pit orchestra in amateur theatrical productions. His wife, Susan Neff, is an astrophysicist with NASA's Goddard Space Flight Center in Greenbelt, Maryland. Their daughter, Emma Hanisch, recently graduated from McDaniel College in Westminster, Maryland with a major in psychology.

LU physics alumni: please update us on changes in your careers and activities:

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The Department of Physics at Lawrence University strives to offer a truly distinctive undergraduate physics program of the highest quality. By featuring specialized signature programs in areas of faculty expertise, we engage students in the *practice of physics* across the curriculum and develop their ability to use contemporary tools of theoretical, experimental, and computational physics. We aim to attract diverse and eager students, to transform their abilities and aspirations, and to open doors for them to participate as professionals in training and to enter the ranks of the next generation of scientists. In practicing physics, we continually engage in scholarly activities that involve students in collaborative physics research in order to maintain our professional vitality, contribute new knowledge to the discipline, and enrich the curriculum. Ultimately, because physics comprises an important component of the liberal arts, we aim to communicate a coherent scientific world view to all members of the Lawrence community.

www.lawrence.edu/academics/study/physics

Student Focal Point: A Report from the SPS Officers

There's a reason why the Physics Department at Lawrence is so tight-knit. Maybe it's the weekly tea and cookies that bring us together, or perhaps it's the annual winter retreat to Bjorklunden. Then again, maybe the frequent late nights spent together working through problem sets contribute most to our sense of community. Whatever the reason, the physics majors at Lawrence feel like one large family.

The events that the Society of Physics Students organizes help create an environment of trust, cooperation, and understanding within the Department that encourages us to grow as students and as future physicists. As current students, it's difficult to say whether we learn more from the professors or our fellow classmates. We have each been mentored by students in classes above us, and in turn we tutor students in the classes below us. These experiences are far from uncommon; many of our classmates also give back to the Department by working as lab assistants, tutors, and graders in addition to providing informal support to underclassmen.

One notable annual opportunity that helps build community is the Lawrence Physics Workshop (LPW). During a weekend every February, almost every physics student hosts a prospective student who has expressed interest in physics at Lawrence. In addition to introducing workshop participants to the dual wave-particle nature of light and other fascinating phenomena through hands-on experiments, we introduce them to our community and share with them our passion for physics. Last year's workshop was a notable success. We hosted 28 prospective students, and 14 of them decided to come to Lawrence.

This year we are inaugurating a completely new event - a winter physics formal. This event will provide yet another opportunity to socialize with students and potentially with faculty. The timing of the event - a



Society of Physics Students President Erika Roedl, Vice President Amber Betzold, Social Chair Ben Roque, and Treasurer Rachel Lindley

couple weekends after the Bjorklunden retreat - will make it an ideal event for freshman to continue getting to know the department. Formal dress will be encouraged but not required. There will be a DJ and refreshments. Attendees will also be free to bring a non-physics-major plus-one. It should be a good time all around and hopefully the start of a new tradition. Over the last few years we have built a stronger sense of community within the Department, and we hope to pass that legacy on to underclassmen through new events such as the physics formal and old traditions like the Bjorklunden retreat and LPW.