

## Department of Physics

The MIT Department of Physics is one of the largest physics departments in the United States. The department has 75 faculty slots. One reason for this size is that, unlike most of MIT's peer institutions, we do not have a separate astronomy department. Because physics covers so many areas, the department is separated into four divisions: astrophysics; atomic, condensed matter, and biophysics; nuclear and particle theory; and nuclear and particle experiment. For the eighth straight year the MIT Department of Physics has been named the number one physics program by *U.S. News and World Report*. The strength of the department comes from its unwavering devotion to both research and teaching. Together our faculty and alumni have won 14 Nobel prizes, 20 faculty are National Academy of Sciences members, and two faculty are MacArthur Fellows.

### Faculty Count, Promotions, and Departures

At the end of academic year 2009, the Physics Department consisted of 74 regular rank faculty members, which consisted of 48 full professors, 12 associate professors, and 14 assistant professors. Five faculty members were promoted this year. Adam Burgasser and Bernd Surrow were promoted to associate professor without tenure, Iain Stewart was promoted to associate professor with tenure, and Nergis Mavalvala and Max Tegmark were promoted to full professor.

The 2009 faculty search process resulted in acceptances by three assistant professors in the fields of biophysics, experimental high energy physics, and theoretical particle physics. A current Pappalardo Fellow, Jeff Gore, will join the department in biophysics beginning January 1, 2010, as will Jesse Thaler, who will be joining the Center for Theoretical Physics. In July 2009, Markus Klute will join the experimental nuclear and particle theory group. Also in 2009, we will add Jocelyn Monroe in the nuclear and particle group. Jocelyn is another of our former Pappalardo Fellows who accepted her position as part of our 2008 search but deferred her appointment for one year.

Walter Lewin and William Bertozzi retired effective June 30, 2009, and Richard Yamamoto agreed to retire effective January 1, 2010. Taken together, these three retirements will reduce the Physics Department faculty slots by three, as part of our cost-cutting arrangement with the School of Science.

### Administration

Edmund Bertschinger will continue as the department head.

Thomas Greytak announced that he would step down as associate department head effective September 1, 2009. He will be replaced by Krishna Rajagopal.

The Physics Council membership will remain as follows:

Ed Bertschinger – department head

Tom Greytak – associate department head (replaced by Krishna Rajagopal September 1, 2009)

Deepto Chakrabarty – division head, astrophysics

Patrick Lee – division head, atomic, biophysics, condensed matter, and plasma physics

Peter Fisher – division head, experimental, nuclear, and particle physics

Edward Farhi – division head, Center for Theoretical Physics

Richard Milner – lab director, Laboratory for Nuclear Science

Jacqueline Hewitt – lab director, Kavli Institute for Astrophysics and Space

Matt Cubstead replaced Sarah Smith as the departmental administrative officer effective May 1, 2009.

### **Faculty Awards**

Following are a few of the many honors and awards conferred on faculty members during the 2009 academic year:

John Belcher was elected a fellow of the American Physical Society.

William Bertozzi won the inaugural 2008 American Physical Society's Division of Nuclear Physics' Mentoring Award (inaugural).

Robert Birgeneau received the 2008 Academic Leadership Award from the Carnegie Corporation.

Janet Conrad received a Guggenheim fellowship.

Mildred Dresselhaus was elected a fellow of the Materials Research Society, won the Vannevar Bush Award, and was elected a fellow and charter member of the Massachusetts Academy of Sciences.

Alan Guth won the Isaac Newton Medal of the Institute of Physics.

Eric Hudson won the Baker Teaching Award and the MIT Excellence Award for "fostering diversity and inclusion."

John Joannopoulos was elected to the National Academy of Sciences.

Mehran Kardar won the 2008 Graduate Student Council Teaching Award and was elected a fellow of the American Academy of Arts and Sciences.

Wolfgang Ketterle received the Leonie Wild Medal of the town of Eppenheim (his hometown) and the James Joyce Award of the Literary & Historical Society of University College, Dublin, Ireland.

Ernest Moniz was appointed to the President's Council of Advisors on Science and Technology.

Miklos Porkolab received the James Clerk Maxwell Prize of the American Physical Society.

David Pritchard received the International Union of Pure and Applied Physics Senior Scientist Medal in Fundamental Metrology.

Sara Seager was named one of *Discover's* top 20 under 40.

Marin Soljačić was named a 2008 MacArthur Fellow.

Iain Stewart received the Friedrich Wilhelm Bessel Award from the Humboldt Foundation.

Alexander van Oudenaarden won the 2008 NIH Director's Pioneer Award.

Frank Wilczek received the inaugural Julius Wess Award from the Karlsruhe Institute of Technology and won the Casimir Funk Award.

Jan Egedal-Pedersen, Enectali Figueroa-Feliciano, Nuh Gedik, and Pablo Jarillo-Herrero all received the National Science Foundation CAREER Award.

Pablo Jarillo-Herrero, John McGreevy, and Robert Simcoe received the Alfred P. Sloan Research Fellowship.

## **Education**

A total of 207 students pursued SB degrees in physics and 82 SB degrees were awarded. Of the degree recipients, 70% chose the flexible degree option. The flexible option was introduced in AY01 to allow students to develop a strong foundation in physics and then build on this foundation as they prepare for career paths that may not involve a graduate degree in physics. This option is attractive today in light of the growing spectrum of technology-related career opportunities. Fifty percent of our graduating seniors earned dual degrees. Twenty-three percent of degree recipients were nominated to Phi Beta Kappa.

A total of 237 students pursued graduate degrees in physics. Thirty-seven PhD and four SM degrees were awarded. The 2009 admissions cycle for graduate students continued to be very competitive. Offers of admission were made to 89 applicants, 18 of whom were female. Yield rates were very high: 50% in general and among female candidates. Together with three students who deferred admission from 2008, the incoming class of 2009 consists of 37 men and 10 women.

## **Diversity**

Diversity is a concern at all levels: undergraduate students, graduate students, postdoctoral fellows, and faculty. The Physics Department uses multiple strategies to recruit women and underrepresented minorities at all levels.

At the undergraduate level, we offer two options for the SB physics degree: focused and flexible. The flexible option significantly increased the fraction of female physics majors

after it was introduced. Currently, about 28% of our undergraduate majors are women, compared with a national average of 22% reported by the American Institute of Physics in 2005.

At the graduate level, professor Eric Hudson serves as the department's designated faculty member overseeing diversity efforts. Professor Hudson, along with the graduate admissions coordinator, reviews and tracks all minority applications to ensure that due diligence is applied in the candidate review. The department subsequently funds all travel expenses for accepted underrepresented North American applicants who choose to visit the MIT campus. Professors Hudson and Figueroa-Feliciano and the department head have worked this year with MIT recruitment programs such as Converge and the MIT Summer Research Program. The department head attended the annual diversity meeting of the National Society of Black Physicists and the National Society of Hispanic Physicists in February.

Our recruiting success for women is due largely to the efforts of our Graduate Women in Physics group. With support from the department head, they organized a traveling "Physics Ambassadors" program of visits and talks by MIT graduate women in physics to peer universities. They and our Undergraduate Women in Physics group also made a major showing at conferences on women in physics held at the University of Southern California and Yale University. Their enthusiasm and energy led to our recruiting success in graduate admissions.

Recruiting and retaining women and underrepresented minorities to physics faculty positions is a high priority. Search committees are actively working to seek out underrepresented groups by preparing a presearch plan to attract underrepresented qualified candidates.

Throughout the recruitment process, advertising is targeted to reach these groups through diversity and organizational job boards and publications. Applicant data are closely tracked, and applications from qualified women and minority candidates are given consideration across all the divisions. In addition to junior faculty candidates, we consider stars for senior faculty positions.

### **Research Highlights**

Jeff Gore and Alexander van Oudenaarden have used game theory and yeast sucrose metabolism as a concrete example of how cooperative behaviors can be compatible with evolutionary theory.

Eric Hudson and other MIT physicists have discovered that several high-temperature superconductors display patchwork quilt-like variations at the atomic scale, a surprising finding that could help scientists understand a new class of unconventional materials.

Jocelyn Monroe, a newly appointed assistant professor and former Pappalardo Fellow, and James Battat, a current Pappalardo Fellow, are both part of MIT's new experimental effort to discover the wind of cosmic dark matter expected to blow past our solar system.

William Bertozzi helped create imaging techniques that could enable screeners to examine the contents of a cargo container for the presence of radiological or nuclear material without having to open the container.

Joshua Winn led an international team of researchers that discovered a planet around another star whose orbit is steeply tilted from the plane of the star's equator, a finding that contradicts some theories about how solar systems form.

Michael Feld has led research that uses two advanced microscopy techniques to show in unprecedented detail how the malaria parasite attacks red blood cells. This work could lead to new ways of detecting and treating malaria.

Marin Soljačić and his colleagues have developed a new form of wireless power transmission they call WiTricity. WiTricity is based on strongly coupled magnetic resonance and can be used to transfer power with high efficiency over distances of a few meters. This advance is being commercialized and could be used to wirelessly recharge laptop computers, cell phones, and other devices.

### **Pappalardo Fellows**

Neil Pappalardo has made possible a program in the department to attract recent PhDs of exceptional promise. The purpose of the Pappalardo Fellowships in Physics is to identify and support unusually talented young physicists and to provide them with the opportunity to pursue research of their own choosing. Pappalardo Fellows have complete freedom in their choice of research and are matched with a mentor chosen on the basis of their research interests. Fellows have special status in the department and are invited to attend faculty events. The first three fellows arrived in September 2000 and since then the program has supported 35 fellows. Of them, four have joined the department as assistant professors, proving that this program has developed into a useful recruiting tool.

The program was designed, in part, to identify and encourage promising young researchers who might be recruited to join our faculty, and to help differentiate the department from other universities and recruit women and minorities. About 35% of all Pappalardo Fellows have been women, and the program has proved to be a strong source of our own faculty recruiting, as four members have joined the MIT Physics Department, including two women: Gabriella Sciolla and Jocelyn Monroe.

### **Community Events**

The Physics Department strives to create a community of scholars and endeavors to create opportunities for our faculty, students, and alumni to come together to share and explore ideas. During 2009 the department sponsored the following events designed to foster the exchange of ideas.

- Faculty lunches are held each week during the fall and spring semesters. All faculty are invited to join their colleagues for an informal meal and to hear a talk from one of their colleagues on their research.

- An afternoon colloquium series is held each week at which a physicist from outside MIT is invited to give a talk on a topic of interest. This event is open to the MIT community. These talks are digitized and then made available to MIT physicists and students who are unable to attend.
- Twice a semester alumni are invited to a breakfast to hear about physics research being done by one of our outstanding faculty presenters.
- The Pappalardo Fellowship program sponsors a weekly lunch that brings Pappalardo Fellows and physics faculty together for conversation.
- In spring 2009, the department launched the “Women Postdocs in Physics Luncheon Series.” Three times last semester a group of 18 physics-related MIT postdocs, and one Harvard postdoc, met in a roundtable format to discuss those topics deemed relevant to women postdocs pursuing an academic career in physics or related fields. Speakers included faculty members Sara Seager, Gabriella Sciolla, and Nergis Mavalvala.

**Edmund W. Bertschinger**  
**Department Head**  
**Professor of Physics**

*More information about the Department of Physics can be found at <http://web.mit.edu/physics/>.*