## APS, AAPT and AIP Sponsor Students at WYP Kickoff Event

APS, the American Association of Physics Teachers, and the American Institute of Physics are sponsoring four former members of the US Physics Olympics Team to attend the kickoff for the International Year of Physics 2005. This launch conference, "Physics for Tomorrow," will be held at the UNESCO headquarters in Paris, France, January 13-15.

Over 1,000 people are expected to attend, including Nobel laureates, political leaders, established scientists, and several hundred students from over 60 countries.

"We wanted students with good physics knowledge and insights, and we also wanted students who would represent the United States on a very interactive level, so they would be able to discuss the future of physics, which is one of the purposes of the conference," said AAPT Executive Officer Bernard Khoury.

More information about the World Year of Physics launch conference is available at www.wyp2005.org/unesco.

The four students sponsored by APS, AAPT and AIP are:

**Natalia Toro**: Toro attended Fairview High School , CO, and participated in the Physics Olympiad competition in 1998 and 1999. Toro was one of the youngest female students on the US Physics Team. She brought home a silver medal. Toro enrolled at MIT and graduated with a bachelor's degree in physics and math in 2003. She is currently enrolled in the physics PhD program at Harvard University and is hoping to graduate in 2007 or 2008.

**Benjamin Schwartz**: Schwartz attended Staples High School, CT, and participated in the Physics Olympiad competition in 2001 and 2002. In the fall of 2002, he enrolled at MIT and expects to graduate in 2006 with a double major in physics with electrical engineering and math. Schwartz is spending this year at Fitzwilliam College in Cambridge University, Cambridge, UK. In his spare time, Schwartz rows for the MIT Varsity Lightweight Crew Team and sings with the Chorallaries of MIT, an a Capella group.

**Sean Markan**: Markan attended Roxbury Latin School, MA, and participated in the Physics Olympiad competition in 2002. In the fall of 2002, Markan enrolled at MIT and expects to graduate in 2006. He has been studying physics, math and computer science. This past summer, he worked at CERN with the group building the data acquisition system for one of the detectors that will be part of the Large Hadron Collider.

**Chintan Hossain**: Hossain attended The Charter School of Wilmington, DE, and participated in the Physics Olympiad competition in 2002 and 2003. At the 2003 competition in Taipei, Taiwan, he ranked 19th among all the students and received a gold medal. Hossain is enrolled in MIT and expects to graduate in 2007 with a double major in physics and brain and cognitive science.

## APS California Section Holds Fall Meeting

The APS California Section held its annual fall meeting December 3-4, 2004 at Harvey Mudd College in Claremont, California. Topics covered in the technical program included exploring the quantum vacuum through the Casimir effect, particle physics and dark energy, nanoscale applications for scanning tunneling microscopy, and satellite navigation and the ionosphere.

Friday evening's banquet speaker was Gregory Benford of the University of California, Irvine, who spoke of his experiences as a scientist in Hollywood, attempting to adapt his own novels for film and television.

Among the other invited speakers was David Pine of the University of California, Santa Barbara, who described new methods for making small clusters of colloidal particles with very well-defined symmetries, ranging from tetrahedral and octahedral to more exotic clusters with very complex symmetries. Such clusters can be used to create new nearly spherical colloidal particles that promote the growth of crystals or glasses with those same local symmetries. Pine calls such clusters "colloidal atoms."

In addition, the Jet Propulsion Laboratory's Dayton Jones described some of the expected advances in fundamental physics and astronomy research that could be achieved using the new Square Kilometer Array (SKA).

SKA is an international radio astronomy instrument planned for the next decade, which will be nearly 100 times as sensitive as any existing radio telescope or array.

Among the questions SKA could help resolve are the equation of state of the dark energy and its possible evolution with time, as well as the distribution of matter in the universe during the early stages of large-scale structure formation. Strong-field gravity will be probed through the discovery and timing of pulsars orbiting stellar mass black holes.

# Plasma Window 'Force Field' Featured at 2004 DPP Meeting

New wakefield acceleration techniques for electrons and X-ray movies of Z-pinch explosions were among the research highlights at the 46th annual meeting of the APS Division of Plasma Physics, held November 15-19, 2004 in Savannah, GA. The DPP meeting is the world's largest yearly gathering of plasma physicists, with more than 1500 attendees presenting 1425 papers covering the latest advances in plasma-based research and technology.

In addition to the technical program, the conference included a free Plasma Sciences Expo on November 18, open to teachers, students, and the general public.

The objective was to introduce the local community to the excitement of plasmas and the benefits of plasma research. Scientists from around the country and the world were there, ready to engage participants in lively hands-on demonstrations and explorations. Those attending were able to create arcs of lightning, observe their fluctuating body temperature on a special monitor, manipulate a glowing plasma with magnets, watch an electromagnetic wave demonstration, and confine a plasma in a tokamak video game.

**Compact Particle Beams for Science and Medicine**. New techniques for accelerating electrons are producing tightly focused, energetically uniform beams in compact devices that will be ideal for numerous scientific and medical applications. The accelerators, known as laser wakefield devices, are only meters in length and could replace accelerators that are currently miles long. Because of their compact size, laser wakefield accelerators are likely to find applications in laboratories that lack space for conventional accelerators. In laser wakefield machines, electrons in a plasma are accelerated when they ride the wake of an intense laser pulse, much like dolphins riding the wake of a ship on the ocean. Typically, the laser pulses in such machines spread out as they pass through a plasma, leading to diffuse beams with few energetic electrons.

Researchers at the Lawrence Berkeley Laboratory have improved the quality of laser wakefield beams by injecting preliminary pulses into a gas to create a plasma channel that guides a subsequent, accelerating laser pulse. The result is a nearly uniform, 100 million electron volt bunch of electrons only 10 femtoseconds long. The devices should fulfill applications in research and medicine that rely on accelerators to produce pulses of x-ray and infrared radiation, including high resolution imaging and treatments for certain types of cancer.

**Plasma Window Leads to New Welding Technique**. Electron Beam Welding (EBW), which relies on beams of electrons to melt and join metal pieces, provides the highest quality welds currently achievable. However, the technique requires parts to be kept under vacuum during welding because the electron guns that produce the beams cannot function in normal atmospheric conditions. EBW, therefore, has not typically been an option for welding of large structures such as cars, airplanes, or ships. Researchers with Brookhaven National Laboratory and Acceleron Inc. have developed a novel plasma window that separates the vacuum of EBW beam sources from ambient pressures while allowing electron beams to pass through.

The plasma window is formed of electric and magnetic fields, effectively leading to something resembling "force fields" trapping a plasma that separates an evacuated electron beam source from the atmosphere.

**Taming Plasma Bursts**. Creating a fusion "sun" on Earth, in plasma fusion machines such as tokamaks, will provide a critically needed, environmentally acceptable long-term source of energy. However, the task is complicated by the bursts from the 100-million-degree plasma that reach and threaten the life of the chamber surrounding the man-made sun. International teams of scientists at the PPPL National Spherical Torus Experiment (NSTX) and the General Atomics DIII-D National Fusion Facility carried out a series of investigations of these bursts, their varieties, and their dependence on the plasma conditions.

A new type of burst is identified to be particularly interesting, with much higher frequency and lower energy, and therefore delivers much weaker punches than the more studied varieties. Multiple ultra-fast high-resolution cameras (up to one million frames per second), infrared cameras, spectrometers, edge probes, fast gas puffs, and modern computing and modeling codes helped reveal the detailed nature and conditions of these bursts. An advanced diagnostic using atomic lithium beams has been developed to provide information on our understanding of when these bursts arise. Maintaining the proper fusion plasma conditions now holds the potential of taming these "astrophysical" bursts to ensure the fusion chamber survival.

**Progress in Direct-Drive Inertial Fusion Research**. Significant advances on the route to inertial confinement fusion have been achieved by researchers at the University of Rochester's Laboratory for Laser Energetics (LLE). Laser inertial confinement fusion consists of heating and compressing fuel in millimeter-sized capsules irradiated with powerful laser beams. In a series of papers presented at the meeting, LLE researchers reported on tests at the OMEGA, 60-beam laser facility that are helping to set the stage for the National Ignition Facility—the nation's premier fusion laser facility scheduled to be completed

*See* DPP MEETING *on page 7*

## AIP Reports Upturn in Number of Physics Graduate Students

*By Ernie Tretkoff*

The number of first-year physics and astronomy graduate students climbed to 3,076 in 2003, the highest number since 1994, according to a report released in October by the American Institute of Physics Statistical Research Center. While the total number of new physics and astronomy graduate students has increased, the number of foreign students declined in the past two years, according to the report.

The report surveyed first-year graduate students for the academic years ending in 2002 and 2003. First-year students were defined as those entering a particular department for the first time, including those who had completed previous graduate study at another institution and transferred to their current department.

First-year graduate student enrollment has been rising steadily in the past few years. The number of graduate students fluctuates over time, the report points out. "The enrollment has never been steady. It has always been on the rise or on the fall. It's a roller coaster," said Patrick Mulvey, one of the authors of the report.

Several factors, including economic outlook and the ease with which foreign students can enter the US, influence graduate student enrollment, the report says. "Frequently, increasing graduate student enrollment coincides with poor economy. Students exiting an undergrad program sometimes, rather than entering the work force, seek shelter in a graduate program," said Mulvey. The number of students receiving bachelor's degrees in physics has also been increasing in recent years, which may explain some of the increase in first-year graduate student numbers, Mulvey added.

In the past several years, the percentage of incoming graduate students who are US citizens has increased, to 54% in 2003, up from a low of 47% in 2001. This upturn comes after a nearly 30-year decline in the percentage of students who were from the US, from a high of 80% in 1976.

The report points out that while it might be tempting to attribute this change to the impact of the events of September 11, 2001, the shift actually started with students who entered graduate school before that date.

Visa difficulties may have had an impact on the number of foreigners studying in the US, but according to the report the full effect may not show up until the class that entered in the fall of 2003, which was not included in this data set, because of delays in implementing new regulations. "The report doesn't really address enrollment changes due to visa issues," said Mulvey, "Because the report only goes up to the fall of

*See* GRADUATE *on page 7*

# ANNOUNCEMENTS

## APS CONGRESSIONAL SCIENCE FELLOWSHIP 2005-2006

**THE AMERICAN PHYSICAL SOCIETY** is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

**QUALIFICATIONS** include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy, and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be US citizens and members of the APS.

**TERM OF APPOINTMENT** is one year, beginning in September of 2005 with participation in a two-week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

**A STIPEND** of $50,000 is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

**APPLICATION** should consist of a letter of intent of approximately two pages, a list of key publications, a two-page resume, and three letters of reference. Please see the APS website (http://www.aps.org/public_affairs.fellows.html) for detailed information on materials required for applying and other information on the program.

**ALL APPLICATION MATERIALS MUST BE POSTMARKED BY JANUARY 17, 2005 AND SHOULD BE SENT TO THE FOLLOWING ADDRESS:**

APS Congressional Science Fellowship Program
c/o Jackie Beamon-Kiene
APS Executive Office
One Physics Ellipse
College Park, MD 20740-3843

## APS Mass Media Fellowship Program

**Applications are now being accepted for the 2005 summer APS Mass Media Fellowships.** In affiliation with the popular AAAS program, the APS is sponsoring two ten-week fellowships for physics students to work full-time over the summer as reporters, researchers, and production assistants in mass media organizations nationwide. Information on application requirements can be found at **http://www.aps.org/public_affairs/massmedia/index.html.**

**DEADLINE: JANUARY 15, 2005**

**Visit *APS News* Online**

http://www.aps.org/apsnews/

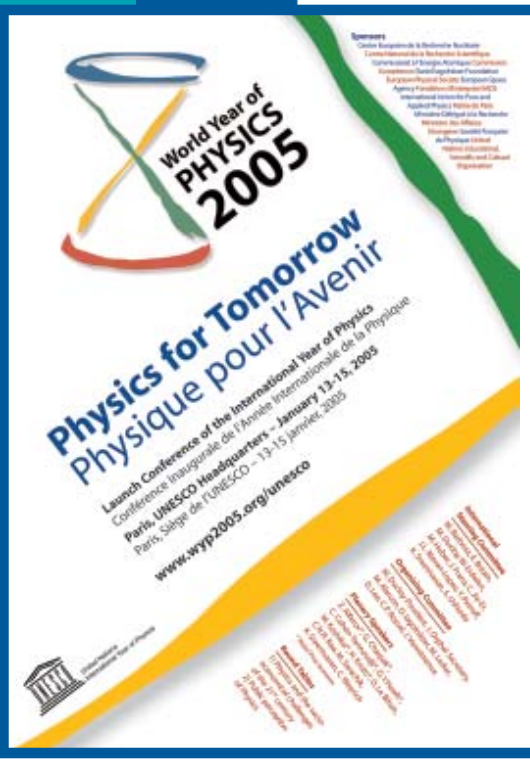
## APS Council and Committee Position Nominations

VICE-PRESIDENT; GENERAL COUNCILLOR (2); NOMINATING COMMITTEE; Vice-Chairperson-Elect • Members; PANEL ON PUBLIC AFFAIRS; Vice-Chairperson-Elect • Members • International Councillor

**Please send your nominations to:**

American Physical Society; One Physics Ellipse; College Park, MD 20740-3844; Attn: Ken Cole; (301) 209-3288; fax: (301) 209-0865; email: cole@aps.org. A nomination form is available at **http://www.aps.org/exec/nomform.html**.

**DEADLINE: JANUARY 31, 2005**




## GRADUATE *from page 5*

2002, it doesn't deal with all that post-9/11 stuff."

Asia sends far more students to the US than any other region, with China and India sending the most students. In 2002 and 2003, 29% of foreign first-year graduate students came from China, up from 25% in 1999 and 2000. The percentage of foreign students coming from Europe declined during that time period, from 37% to 25%.

The report also found that women are increasing their representation among physics and astronomy graduate students. In 2003 women made up slightly more than 20% of first- year students, up from about 16% in 1995.

Over 90% of first-year physics and astronomy graduate students reported that they considered themselves at least adequately prepared for graduate work, and most considered themselves "well prepared" or "very well prepared."

Foreign students rated their preparation for graduate school slightly higher than US students did. Almost half of the foreign students surveyed had completed some graduate study in physics or astronomy before entering their current departments, compared with about 10% of US students.

Among US students, the most popular subfields were astronomy and astrophysics (16%), followed by condensed matter (14%), and particles and fields (11%). Condensed matter was the most popular subfield among foreign students (22%), followed by particles and fields (10%) and astronomy and astrophysics (7%). Almost a quarter of first-year students have not yet chosen a subfield.

The vast majority (93%) of students entering physics or astronomy graduate school say they are aiming for a PhD.

"Though such a large proportion may set their sights on a PhD, every year at least a third of the graduate degrees are masters, most exiting from PhD departments, indicating that a significant number of students do not reach the goal they had when they began their graduate studies" the report says.

Most students who plan to earn a PhD hope to work in academia (70%) followed by industry (17%) and government or national labs (9%). The full report is available at www.aip.org/statistics.

## COHEN *from page 3*

**Q:** *In recent years, biology has been called by some the "science of the 21st century," while physics is viewed as the science of the past century. Do you think this is true?*

**A:** No! First of all no one knows where the big scientific discoveries are going to come. Biology has had tremendous growth and extremely exciting science is being produced. As biology develops, there may be more in the way of underlying principles discovered. Perhaps the observed science will be interpreted in terms of physics.

I think it is possible that there will be more coalescing of the fields, so maybe by the end of this century, this will be a non-question as the fields will be so intertwined.

I can predict that there are going to be a lot of discoveries in physics in the next 95 years. That's a safe prediction. The 21st century like the 20th is going to be a great century for physics, too.

**Q:** *Why did you decide to take on the task of being APS president?*

**A:** It's a question of giving something back. I care about physics, the welfare of physicists, physics education, and students. I'm happy to report that up to now, almost everything that I have been asked to do or that I have chosen to do with the APS has impressed me as important.

One of the main reasons for this is the marvelous trio, Marty Blume, Judy Franz, and Tom McIlrath. They are extraordinary. They are the secret of the success of this organization.

## DPP MEETING *from page 5*

later in the decade.

**X-Ray Vision for the Z-Pinch**. X-ray movies of wire-array z-pinch implosions on Sandia National Laboratories' Z-machine have been made for the first time, revealing a rich array of implosion phenomena. Wire-array z-pinches at Sandia National Laboratories' "Z-machine" are the world's most powerful laboratory x-ray sources, producing 1-2 million Joules of x-rays in 100-200 TW bursts.

Researchers presenting at the APS meeting successfully took x-ray pictures of z-pinch plasmas on the Z facility using a special crystal imaging diagnostic.

Now, for the first time researchers are able to study the growth and evolution of plasma instabilities during the z-pinch implosion. Z pinches begin as a cylindrical array of wires, each thinner than a human hair, that are vaporized into plasma by 20 million amperes of current. This plasma is then "pinched" to the axis of the array where it rapidly heats up and radiates soft x rays. Until now, very little information existed for the earliest stages of the z-pinch implosion. Each stage of this process has now been imaged, providing quantitative information about the mass distribution of the plasma that is being used to constrain existing physical models and simulations of z-pinch implosions.

**New Measurements in Plasma Heating**. In plasmas that include multiple species of ions, like those expected in potential fusion devices, the long wavelength, penetrating radio waves used to heat the plasma can spontaneously convert into short wavelength waves. It's important to identify where and how these waves convert to understand heating in machines such as tokamaks, which are likely to lead to the first practical fusion energy sources. Researchers at MIT have now succeeded in simultaneously measuring both the short wavelength and long wavelength waves in a tokamak for the first time on the Alcator C-Mod tokamak. The experimental results are consistent with theoretical predictions, bolstering physicists' confidence that they are on the right track in developing models for the complex interactions in plasma fusion machines.

*— James Riordon, Ben Stein and Phil Schewe contributed to this story.*

## MOON/MARS *from page 1*

Space Telescope, the Mars Rover, and Explorer missions, which have revolutionized our understanding of the universe while relying on comparatively cheap, unmanned and robotic instruments.

It is likely that such programs will have to be scaled back or eliminated in the wake of much more expensive and dangerous manned space exploration, according to the committee.

The report concluded that these recent spectacular successes amply demonstrate that we can use robotic means to address many important scientific questions. And while human exploration has a role to play in NASA, it should be within a balanced program in which allocated resources span the full spectrum of the space sciences and take advantage of emerging scientific opportunities and synergies.

"Astronauts on Mars might achieve greater scientific returns than robotic missions, but they would come at such a high cost that scientific grounds, alone, would probably not provide a sufficient rationale," says Joel Primack of UC Santa Cruz, who headed the committee.

The committee maintained that the scope of the proposed initiative has not been well-defined, its long-term cost has not been adequately addressed, and no budgetary mechanisms have been established to avoid causing major irreparable damage to the agency's scientific program.

To accommodate the Moon-Mars initiative, NASA has already begun to reprogram its existing budget, resulting in indefinite postponement or serious delay of science programs that were assigned high priority by the National Academy of Sciences (NAS) decadal studies.

The APS report includes three recommendations regarding the Moon-Mars initiative:

1. NASA should continue to be guided by the priorities recommended in the NAS decadal studies for its science programs.

2. Before the US commits to the Moon-Mars proposal, a review of the initiative's science impact should be carried out by the National Academy of Science.

3. Before the US commits to the Moon-Mars proposal, the likely budgetary impact should be estimated by the Government Accountability Office.