DOE Princeton Plasma Physics Laboratory

VOL. 6, NO. 1 • WINTER/SPRING 2002

PPPL NEWS

The Princeton Plasma Physics Laboratory is a United States Department of Energy Facility

PPPL Develops Detection System to Boost Anti-terror Efforts

Anti-terrorism efforts may get a boost from PPPL. A team led by Lab engineer Charlie Gentile is developing a miniature nuclear detection system to scan objects such as cars, luggage, and vessels for specific nuclear signatures associated with materials employed in nuclear weapons. This system could be installed at tollbooths and airports, as well as in police cruisers to detect unauthorized nuclear materials being transported.

From left are PPPL's Steve Langish, Charlie Gentile, and Andy Carpe with the miniature nuclear detection system.

The PPPL team of Gentile, Steve Langish, and Andy Carpe configured off-the-shelf components — a solid-state detector, multi-channel analyzer, hand-held computer, pre-amp, and amplifier — into a unique system that can determine various radiation energies, thus identifying radionuclides. It will be tuned to flag suspect signatures only; normal nuclear signatures from medical isotopes and radiography equipment would not give false positives.

This capability to differentiate radionuclides with a high degree of spatial resolution in a device that is light, small, robust, and portable makes the PPPL application unique. "We made it quite small," said Gentile, Head of PPPL's Tritium Systems Group.

Its robustness makes it suitable for a tollbooth or bridge entrance. A similar system using a positive intrinsic negative (PIN) diode as a detector was sent to Mars to look at radionuclides in Martian soil. "That system, like ours, is physically rugged and can take swings in environmental conditions," said Gentile, who was involved in developing technology that used a PIN diode as a tritium detector for surface contamination in PPPL's Tokamak Fusion Test Reactor vacuum vessel.

The PPPL-configured system includes a hand-held computer that stores databases of radionuclides for comparison, as well as three radiation detectors or heads to cover the whole gamut of nuclear signatures. The heads can include, for example, a boron trifluoride gas tube to detect neutrons; a PIN diode with a beryllium window to detect X-rays, including low-energy gamma rays; and sodium iodide crystals to detect higher energy gamma rays.

Radionuclides can be recognized and differentiated from one another since each has a distinctive energy signature or fingerprint. "Our detector looks at a fingerprint and reveals the nuclear material present," Gentile said, adding that there are a lot of electronics that can be configured to look at a nuclear spectrum.

The unit would typically be able to detect radiation (dependent on source quantity) up to about 10 feet away and would identify the type of radiation, but not the quantity. "We can't tell you how much source material there is, just that a particular kind of radionuclide, perhaps a transuranic or some unauthorized nuclear material, may be present. We can't say if it's 1,000 curies or 200 curies; our goal is to identify the radionuclide," said Gentile.

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Detection

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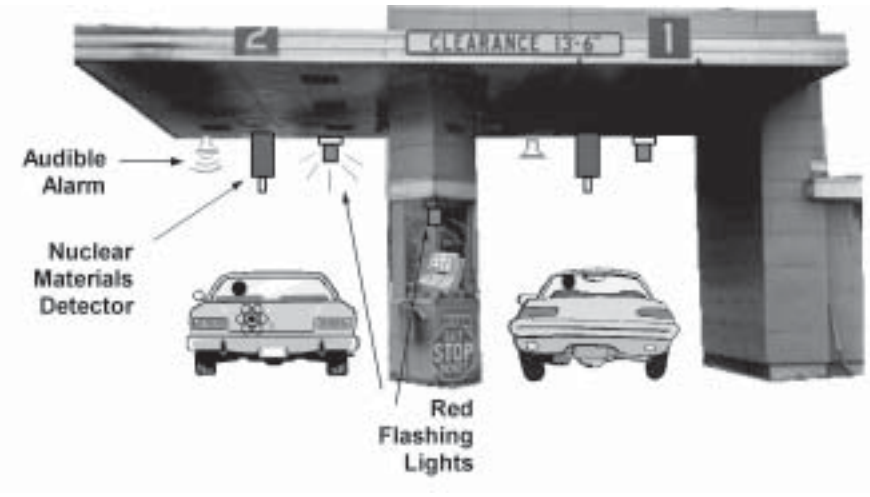
The system could be configured with one, two, or three heads to suit the needs of law enforcement officials. For instance, airport officials might be interested in detecting materials such as cobalt or cesium that would be used in a "dirty" bomb. "Law enforcement officials would tell us what materials they might be looking for and we would tailor the configuration to detect those materials," said Gentile.

At tollbooths or in police cruisers on the turnpike, the system would be tuned to recognize, but not sound an alarm on radioactive material from legal uses such as medical radioisotopes. "We are only interested in material found in weapons of mass destruction. The system would differentiate between approved and unapproved nuclear materials in the environment," said Gentile.



Miniature Nuclear Detection System Conceptual Configuration

The PPPL team is developing a library of specific spectra that would be associated with nuclear weapons. "Right now, up and down the New Jersey Turnpike, there are probably dozens of vehicles legally approved to transport nuclear materials such as medical isotopes. While a Geiger counter would detect nuclear materials in the environment, our system would detect and differentiate the materials, triggering an alarm only on those considered a risk," said Gentile.

Added PPPL's Steve Langish, "The system could be programmed to look only for specific nuclear fingerprints or spectra used for bomb making materials."

It also would be able to detect some shielded materials since shielding often results in the generation of certain energy X-rays. "Our software would be tuned to look for X-ray spectra associated with specific shielding configurations," said Gentile.

He added that transuranics put out several different energies or what he termed "very interesting spectra." A material with several specific energy peaks that the detector is scanning for may be noteworthy. "In addition, any neutron signal in the environment would be of considerable interest," said Gentile.

Once a unit is in place, it would be up to law enforcement officials to devise an alerting system. "For instance, it could be set up at a tollbooth so that when a vehicle is flagged, a picture is taken of it and an e-mail alert goes to authorities. The vehicle would then be stopped a short distance beyond the tollbooth," said Gentile.

The start-up cost for the whole system would be approximately $80,000, with a $17,000 price tag for each unit, not including installation charges. "This is relatively inexpensive," Gentile said. ●

PPPL NEWS

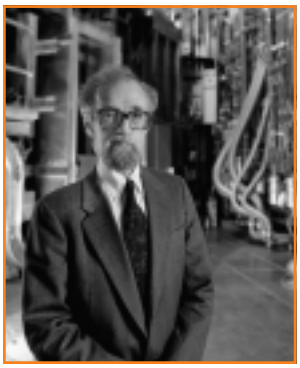
Information Services Head: Anthony R. DeMeo
Photographer: Elle Starkman
Editor/Writer: Patti Wieser
Layout and Graphics: Gregory J. Czechowicz and Patti Wieser

The PPPL NEWS is issued by the Princeton Plasma Physics Laboratory, a research facility supported by the United States Department of Energy and managed by Princeton University. Correspondence and requests to reprint material should be directed to: Information Services, Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08543; telephone 609-243-2750; fax 609-243-2751; e-mail pppl_info@pppl.gov

Harold Furth, the Passing of a Legend

Giant of the fusion science program, he initiated the Tokamak Fusion Test Reactor project at PPPL that went on to produce world record-setting results; Colleagues gather to remember him

Former PPPL Director Harold P. Furth, a pioneer in the U.S. fusion program and the originator of the Tokamak Fusion Test Reactor (TFTR) project, died February 21 in Philadelphia at the age of 72.



Harold Furth at TFTR

Furth made a career of research on controlled fusion, making countless contributions to the science of fusion plasmas and the fundamentals of plasma physics. He provided scientific and managerial leadership to the world fusion program throughout his career. In the early 1970s, he conceived the TFTR project, the most advanced and highest performance fusion device ever constructed in the U.S. Furth served as Director of PPPL from 1981 to 1990, during which time TFTR was launched. The machine produced world record-setting and major scientific results before closing down in 1997.

In 1999, Furth became Professor Emeritus of Astrophysical Sciences at Princeton University. He was active in research at PPPL until shortly before his death. He is survived by his wife, Christiane A. Ludescher, of Princeton; son, John Furth, of New York City; and sister, Inge Steer, of Conn. *(A complete obituary is on the web at http://www.pppl.gov/news/pages/furth.html.)*

Memorial Service

More than 200 friends, family members, and colleagues of Furth's gathered at PPPL on April 25 to pay tribute to the man they remembered as a powerful leader of the fusion community, the father of TFTR, a brilliant scientist, and a wonderful friend. Those close to Furth recalled, in particular, his eloquence, brilliance, and humor.

"The nicest thing about dealing with Harold is he made you smile," said Kenneth Fowler, who was among more than a dozen people offering eulogies.

"Harold led us on an amazing and wonderful adventure, and we owe him a personal debt of gratitude for this — a debt which we can only really repay to those who come after us," said PPPL Director Rob Goldston.

N. Anne Davies, of the DOE's Office of Fusion Energy Sciences, said, "Harold was a very special person at a very special place during a very special time."

She noted how Furth inspired a generation of scientists younger and older than himself, both at home and abroad, and had an "absolute commitment" to the fusion program. "He left us too soon. He was a giant of fusion and I will miss him," said Davies.

Professor Chuan S. Liu, of the University of Maryland, said Furth was an experimentalist who also did great theory and a scientist who wrote great poetry, while Marshall Rosenbluth, of General Atomics, described him as a brilliant, complex, fascinating person, friend, and scientist. "The best word to describe Harold is scintillating," said Rosenbluth.

John Willis, of the DOE's Offfice of Fusion Energy Sciences, read from a Langston Hughes poem about dreams, later saying, "Harold was a master at keeping our dreams alive."

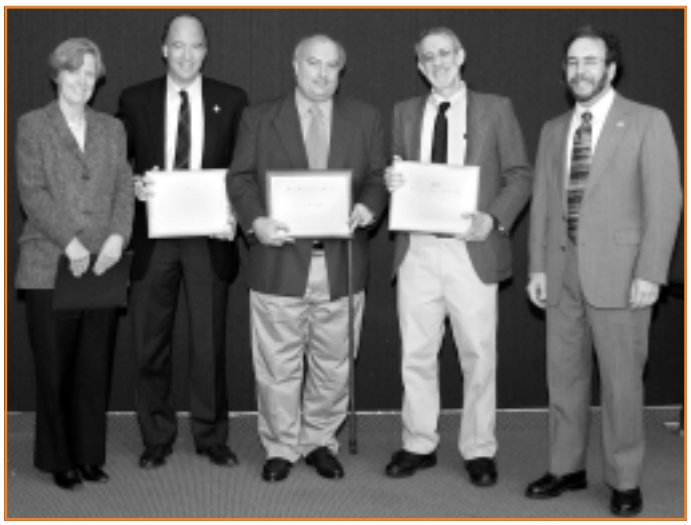
Nathaniel Fisch, PPPL Associate Director for Academic Affairs, talked about his early encounters with Furth, noting how Furth was always able to solve problems. More than 20 years ago, they were both attending a Fusion Energy Sciences Advisory Committee meeting in San Diego when they discovered a hotel mix-up that had them both booked in just one room. "Harold solved the problem. I went to another hotel," Fisch said.

The service concluded with personal remembrances touchingly delivered by Tina Ludescher Furth, followed by a dedication of the PPPL Library in Furth's name and a reception. ●

PPPL Director Rob Goldston (left) and Tina Ludescher Furth unveiled the nameplate for the Harold P. Furth Library during the dedication ceremony.

Accolades Abound for PPPL Staff

PPPL Researchers Grisham, McCune, and Reiman Receive Honors



Princeton University President Shirley Tilghman and PPPL Director Rob Goldston presented the PPPL Distinguished Research and Engineering Fellow Awards and the Kaul Foundation Prize for Excellence in Plasma Physics and Technology Development. From left are Tilghman, Engineering Fellow recipient Douglas McCune, Kaul Prize recipient Larry Grisham, Research Fellow recipient Allan Reiman, and Goldston.

In November, the Kaul Foundation Prize for Excellence in Plasma Physics and Technology and the PPPL Distinguished Research and Engineering Fellows citations were given.

PPPL physicist Larry Grisham received the Kaul Prize in recognition of his research contributions regarding the use of neutral beams for fusion applications. The award honors Grisham "for his distinguished contributions to the understanding and improvement of the first generation of high-power negative-ion-based neutral beams for fusion applications." In experimental fusion devices, a beam of neutral atoms is fired into plasma to increase the temperature for the production of fusion power. Princeton University awards the Kaul Prize to recognize a recent outstanding technical achievement in plasma physics or technology development by a full-time, regular employee of PPPL.

PPPL researchers Allan Reiman and Douglas McCune were named the PPPL Distinguished Research and Engineering Fellows, respectively.

Reiman, a physicist, was cited for his numerous contributions in diverse topics in plasma physics, including the theory of three-dimensional plasmas found in fusion devices called stellarators, and for his leadership in developing innovative approaches to the stabilization of plasmas in the design of the National Compact Stellarator Experiment (NCSX).

McCune, Co-head of the Laboratory's Computational Plasma Physics Group, was honored for seminal contributions to computational plasma physics, particularly in the area of high-level data analysis in fusion experiments, and for his more recent work in establishing and leading the PPPL Computational Plasma Physics Group, which has been vital to the development of modern computational physics and collaborative data analysis capability for both PPPL and the fusion energy science community.

The Distinguished Research and Engineering Fellow Program, funded by the DOE, was created to recognize members of the Laboratory's research, and engineering and scientific staff for their accomplishments. ●

Davis Awarded for Information Technology

Steve Davis (at right) received a 2001 Information Technology Quality Award for Management and Administrative Excellence from the Department of Energy (DOE) in March. Davis is Systems Development Head for PPPL's Computer Systems Division.

The award recognizes Davis for his "outstanding achievement in the design, implementation, and deployment of state-of-the-art communication and remote collaboration technologies at PPPL and throughout the DOE community." DOE Chief Information Officer Karen Evans presented the award to Davis at the U.S. DOE Annual Information Technology Conference in Denver. ●

PPPL Staffers Receive Engineering Award for Developing Diamond Wire Cutting

In February, PPPL received an award for "Project of the Year 2002" from the Professional Engineers' Society of Mercer County. The Laboratory was cited for its "Process for Use of Diamond Wire Cutting of Complex Metal Vessels," which was used in the disassembly of the Tokamak Fusion Test Reactor (TFTR) vacuum vessel.

The Decommissioning Project developed this process for use in the safe disassembly of TFTR. The experimental fusion machine, which operated from 1983 to 1997, used deuterium and tritium to fuel experiments beginning in 1993. As a result, the vacuum vessel was left radioactive and contaminated with tritium. In addition to the diamond wire cutting, PPPL staff developed lightweight concrete filling technologies to help complete the disassembly task safely, on time, and within budget. ●

From left are Bob Parsells, Erik Perry, Geoff Gettelfinger, and Keith Rule, the team that has filed for a provisional patent for the process for using the diamond wire cutting for complex metal vessels.

Jerry Faul (left), Manager of the DOE Princeton Area Office, presents PPPL's Jack Anderson with the DOE Distinguished Associate Award.

Energy Department Recognizes Anderson

Jack Anderson, Head of PPPL's Environment, Safety & Health and Infrastructure Support Department, recently received the DOE Distinguished Associate Award. He was recognized for his "significant contributions to the DOE's Safeguards and Security Directives Implementation Review Conference."

Anderson was part of a six-member team that organized an assessment of the impacts of existing security and counterintelligence orders on the scientific and security environment at all of the DOE's facilities. The team was established to address complaints about how recent overwhelming security changes in the national laboratories were adversely affecting researchers' ability to do science. Members concentrated on how to balance the need for new security and counterintelligence requirements issues with scientific freedom and progress. ●

American Physical Society Honors Two PPPL Scientists

PPPL physicists Edmund Synakowski and Randy Wilson recently received honors from the American Physical Society (APS). The APS gave Synakowski the 2001 Award for Excellence in Plasma Physics Research and named Wilson a Fellow during the Division of Plasma Physics meeting last fall in Long Beach, Calif.

Synakowski was cited for his contributions to experiments that demonstrated a novel means of suppressing turbulence and the loss of heat from plasmas.

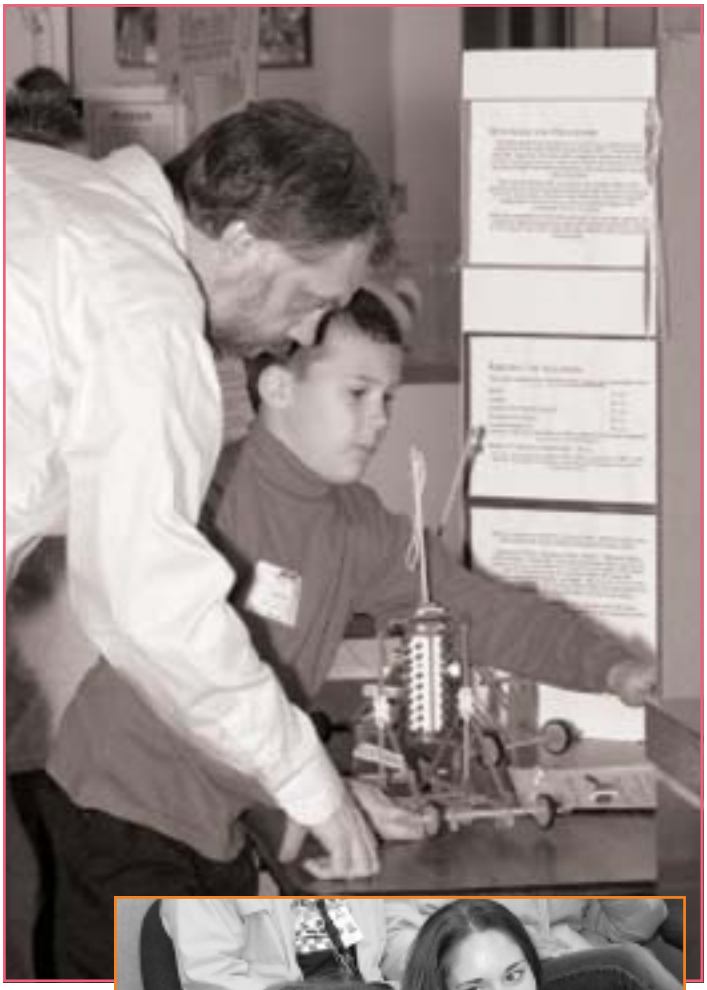
He led research on this subject at PPPL on the Tokamak Fusion Test Reactor (TFTR). These efforts led to joint research on this topic with physicists at General Atomics in San Diego.

Ed Synakowski

Randy Wilson

Wilson was named an APS Fellow in recognition of his major pioneering contributions to understanding the use of radio-frequency waves to heat and drive an electric current in fusion plasmas. ●

Show Them Science and They Will Come



At top left, PPPL physicist Ed Synakowski talks to Patrick Charles Callan about the youngster's Science Fair project, "Catapult." At top right, a group discovers a plasma ball during Pollution Prevention Awareness Day. At bottom left, two girls enjoy a presentation during Take Our Daugthers to Work Day. Above, Princeton University grad student Jill Foley (left) operates the Van de Graaff generator, one of the science toys featured among the exhibits at the girls' conference in March. The machine generates static electricity for "hair raising" experiences.

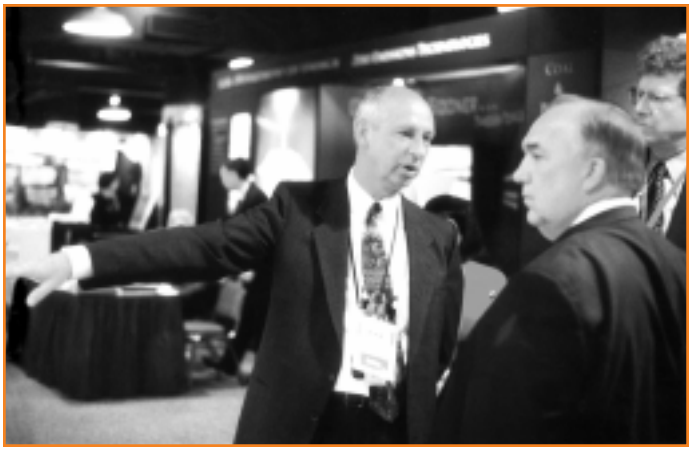
In March and April, about 500 students had a chance to discover that science can be fun when they participated in one of four events at PPPL — Expand Your Horizons Mini-conference for Young Women in Science, Mathematics, and Technology; Pollution Prevention Awareness Day; Science Fair; and Take Our Daughters to Work Day. For the girls' conference, female students from middle and senior high schools across the state came to PPPL to see science exhibits and hear talks by various women in the sciences. The Pollution Prevention Awareness Day featured an awards program for pollution prevention poster contest winners, as well as hands-on science demonstrations, guest speakers, and pollution prevention displays. For Take Our Daughters to Work Day, about two dozen children came to PPPL to see what their dads and moms do at work , as well as to listen to a fusion talk by PPPL Director Rob Goldston. During PPPL's annual Science Fair Day, about 17 students exhibited their science projects, which included cosmic ray detectors, silent propulsion, magnetic aqua drives, the heart and video games, and fiber-reinforced concrete. ●

"Walking in the Shoes" of an Engineer

A group of PPPL engineers recently celebrated National Engineers Week by passing their skills onto the next generation of engineers. This "next generation" included five students from Trenton Central High School and Mercer County Technical School, who came to the Lab February 20 to "shadow" the engineers. The day, organized by PPPL's Alex Ilic and sponsored by the Professional Engineers' Society of Mercer County, also included a presentation, a tour, and lunch.

PPPL engineer Bob Ellis (left) shows Mercer County Technical School student Nancy He the electron cyclotron heating launcher component Ellis is working on in one of the PPPL shops. ●

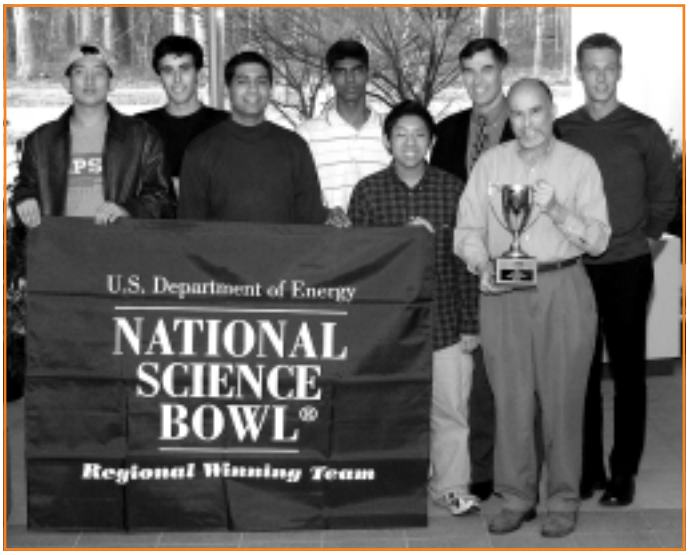
PPPL Represents Fusion Community at Energy Summit



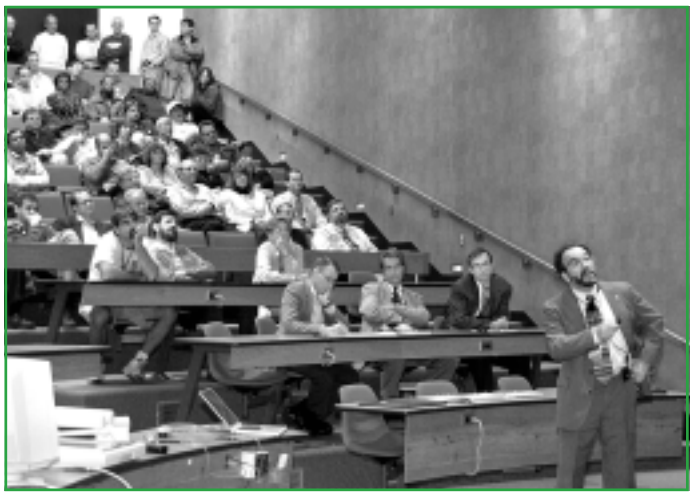
PPPL represented the fusion community during the Global 8 Energy Ministers' Summit earlier this month in Detroit. PPPL's John DeLooper and James Morgan staffed a community fusion poster exhibit. U.S. Energy Secretary Spencer Abraham and Michigan Governor John Engler, as well as about 75 others from across the world, stopped by the exhibit to hear more about fusion. Above, DeLooper (left) discusses fusion with Governor Engler. ●

PPPL Hosts Tenth Science Bowl

For the tenth year, PPPL hosted the New Jersey Regional Competition of the National Science Bowl®. On February 23, twenty-two teams from 17 high schools in New Jersey and nearby Bucks County competed in the annual event. East Brunswick High School (in photo below, along with PPPL Science Bowl Coordinator James Morgan at far right and Congressman Rush Holt third from right) placed first, followed by Governor Livingston High School and West Windsor Plainsboro High School North in second and third, respectively. ●



Goldston Delivers State of the Lab



PPPL Director Rob Goldston delivers his State of the Lab address.

PPPL Director Rob Goldston offered the following analogical summary of PPPL's past fiscal year to staff, "We are really on this boat sailing together. We have picked up speed by everyone pulling together."

Goldston delivered this message during his "State of the Lab" talk in the MBG Auditorium on November 20. The Director reviewed the Lab's achievements and discussed the future, dividing his talk into three categories: program, operations, and external relations. He concluded by thanking staff members for their hard work and special efforts "to sail the boat together." ●

DOE Pulse

The U.S. Department of Energy's (DOE's) National Laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security, and environmental quality missions. Interested in the latest achievements of the National Laboratories? Then visit the DOE Pulse at: http://www.ornl.gov/news/pulse/.

PPPL Speakers Go on the Road

The PPPL Scientific Speakers' Program kicked off in 2001. During the first year, researchers from the Lab delivered scientific talks at 11 sites, including colleges, universities, and research institutions. Those who participated in the program are Raffi Nazikian, Janardhan Manickam, Ed Synakowski, Cynthia Phillips, John Schmidt, and Daren Stotler. Not pictured is Ned Sauthoff.

The talks were given at Clarkson University in New York; the Eastern Regional Research Center of the Department of Agriculture in Pennsylvania; Florida Atlantic; Florida Tech; Moravian College in Pennsylvania; North Dakota State University; Southern University in Louisiana; SUNY-Albany; the University of Louisiana, Lafayette; The University of Massachusetts, Amherst; the University of New Hampshire; the University of Southern California, and Youngstown State University in Ohio.

Important Component of Outreach

As PPPL Director Rob Goldston noted during his State of the Lab talk, "This is an important component of outreach to the broader scientific community." ●

The PPPL researchers who have participated in the Speakers' Program since it was initiated are (from left) Raffi Nazikian, Janardhan Manickam, Ed Synakowski, Cynthia Phillips, John Schmidt, and Daren Stotler. Not pictured is Ned Sauthoff.