

PPPL *NEWS*

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

Spitzer Building Dedication and NSTX Groundbreaking Create Magical Day



PPPL celebrated the dedication of the Lyman Spitzer Building and the groundbreaking of the National Spherical Torus Experiment (NSTX) on May 18. Above, standing in front of a full-scale drawing of NSTX, are (from left) Masa Ono, NSTX Project Director; Robert Goldston, Director of PPPL; Martha Krebs, Director of the U.S. Department of Energy's Office of Energy Research; Anne Davies, Associate Director, U.S. Department of Energy Office of Fusion Energy Sciences; Doreen Spitzer, widow of Lyman Spitzer, Jr.; and Martin Peng, NSTX Program Director. In an earlier ceremony, PPPL's Laboratory Office Building was renamed in honor of Laboratory founder Lyman Spitzer, Jr., who died last year. At the newly dedicated building are (from left) Princeton University President Harold Shapiro, Goldston, Krebs, Mrs. Spitzer, former PPPL Director Melvin B. Gottlieb, Rep. Michael Pappas (NJ 12), and Rep. Rodney Frelinghuysen (NJ 11).



A Magical Day ...

By Patti Wieser

May 18 at the Laboratory was — in a word — “magical.”

With spectacular weather, red-white-and-blue ribbons, and festive balloons heralding the event, PPPL celebrated the dedication of the Lyman Spitzer Building and the groundbreaking of the National Spherical Torus Experiment (NSTX).

“It was truly a magical day for the Laboratory. Congressman Pappas was very supportive. Congressman Frelinghuysen gave a rousing positive speech. Martha Krebs also spoke very strongly in support of fusion and of the Laboratory’s role as a home for national facilities. Harold Shapiro spoke eloquently about endings and beginnings. Doreen Spitzer, however, put us all to shame with references to Thucydides, which I later learned she is reading in the original Greek! Indeed her speech was a high point, and she endowed the whole ceremony with magic,” said PPPL Director Rob Goldston in a message to staff the day after the events.

Prior to the unveiling of the Lyman Spitzer plaque, which now marks a pillar at the entrance to the former Laboratory Office Building, Goldston joined Princeton University President Harold Shapiro, U.S. Representatives Rodney Frelinghuysen and Michael Pappas, and Martha Krebs, Director of the Office of Energy Research at the U.S. Department of Energy, in the auditorium to offer remarks.

Krebs lauded the achievements of Spitzer and spoke of the Laboratory’s continuing leading role in fusion research. “Professor Spitzer chose to work on the ‘big’ problems of science, so it is no wonder that he chose to work on the problem of creating the energy of the stars on earth... He set the tone of scientific excellence which has characterized the Laboratory ever since,” she said.

The Department of Energy official spoke of the dramatic changes at the Laboratory and of the fusion program since Spitzer started Project Matterhorn in a small building on the other side of the Forrestal Campus. “With the restructuring of the fusion energy sciences program, Princeton Plasma Physics Laboratory has taken on a mission much broader than the original Project Matterhorn — developing the scientific understanding and innovations that will lead to an attractive fusion energy source. This mission includes working on both the scientific and engineering innovations that will lead to a lower cost design for the International Thermonuclear



Mrs. Spitzer (right) and Dr. Krebs view the building plaque after the unveiling.

Experimental Reactor and exploring innovative concepts like the National Spherical Torus Experiment,” Krebs said.

She also discussed the important roles of improved theory and computation, the need to continue making progress on alternate concepts, and the importance of small experiments, basic plasma science research, and outreach and science education.

“Fusion research is a long-range program and needs to be open and responsive to the development of new ideas,” said Krebs, later adding, “The primary mission of the fusion program is to develop the knowledge base for an economical and environmentally attractive source of fusion power.”

Krebs closed by paying tribute to the Laboratory’s founder. “Lyman Spitzer still provides an excellent inspiration to the whole of the fusion research program. His vision of the future was guided by both theory and computation, as tempered by actual experiments; his institutional and organizational efforts reflected a passion for excellence; his scientific reach was broad, allowing him to interact effectively with disciplines outside the bounds of plasma physics; his original goal of placing a star on earth remains a compelling challenge for those who follow in his footsteps,” she said.

During the unveiling outside the Laboratory, Doreen Spitzer, the widow of Lyman, spoke of continuity, renewed hope, the pleasure of the search, and the “power of the electron.”

Telling the crowd how wonderful it was to see so many familiar faces again, Mrs. Spitzer said, “We are remembering the 40th anniversary [of PPPL] on November 1, 1991, and Carl Sagan’s inspiring remarks, despair and gloom over cuts and retrenchments, now renewed

funding (never quite enough, of course), but plenty of renewed hope and energy, new ideas, new ways of tackling problems.”

She recalled her mother’s belief in continuity and in keeping up the search, and noted a quotation of Robert Louis Stevenson’s often repeated by her father, “To travel hopefully is a better thing than to arrive, and the true success is to labor.” Her father, she added, called Lyman a “night watchman.”

The Stevenson line became a family quotation, along with Lyman’s remark to his children when they asked, “Daddy, what did you do today?” and he replied, “I was thinking what I would do if I were an electron.”

After describing the people at the Laboratory as “quite wonderful,” Mrs. Spitzer said, “There will continue to be setbacks, and breakthroughs, errors, and triumphs. But you will be learning from these, and you will be teaching younger generations who must be well-trained in order to succeed you in their turn. It’s a marvelous time to be living in. Spectacular discoveries are being made in every direction. I have great confidence in the power of the electron.”

In closing, she added, “For me personally, the dedication of this building in the name of one of the finest scientists, yes and I’ll add — one of the finest human beings of our time — insures a continuity of fine minds working together with limitless labor and energy, com-

mitted to high purpose for humanity in our world. If there is technology magic in a name, there will be magic in NSTX. God bless, and carry on!”

Mrs. Spitzer and Dr. Krebs then pulled the red-white-and-blue banner to reveal a plaque inscribed “Lyman Spitzer Building.” Following the dedication, everyone made their way over to the NSTX Test Cell for a groundbreaking ceremony. On a raised platform, special guests and project leaders held glasses of chilled sparkling cider to toast the future of the next fusion device at PPPL.

The day concluded with a scientific colloquium in honor of Lyman Spitzer, Jr., featuring talks by Goldston, Princeton University Provost Jeremiah Ostriker, NSTX Program Director Martin Peng, Princeton University Department of Astrophysical Sciences Chair Bruce Draine, and Princeton University Department of Astrophysical Sciences Professor Edward Jenkins.

Said Goldston, “When you travel a long and exciting road like the one we are on, it is very important to have good companions. PPPL is a great place to work because of the high standards we set for ourselves, and because of the strong sense of teamwork we bring to these tough problems. This is a great team of scientists, engineers, technicians, and support personnel. Over and over I am amazed by their insight and by their dedication. It is an honor for me to work with such a team.” ●

NSTX Construction Marks Milestones

Assembly of National Spherical Torus Experiment to Begin in September



By Anthony De Meo

The delivery of the National Spherical Torus Experiment (NSTX) ohmic-heating (OH) solenoid on June 30 and its mating with the inner toroidal-field (TF) bundle on July 8 marked major milestones in the assembly of NSTX. According to Project Director Masa Ono, “The OH coil presented the most difficult and critical NSTX design and fabrication challenges, requiring a great deal of innovation. We are pleased that NSTX is the first spherical torus in its class to have successfully completed its OH assembly.”

Fourteen feet in height, the NSTX OH solenoid is the tallest in the world. It will play a crucial role in the creation of the NSTX plasma, the generation of the plasma current, and the formation of the device’s unique magnetic field geometry. NSTX will also have TF coils and poloidal-field (PF) coils, which play major roles in the creation of the magnetic fields that confine, stabilize, and shape the plasma.

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At left, PPPL’s Joe Bartzak guides the world’s tallest ohmic-heating solenoid as it is lowered over the inner toroidal-field coils of NSTX.

NSTX

Continued from page 3

NSTX is a compact machine, designed to produce a plasma resembling a sphere with a small hole running all the way through its middle. Consequently, the NSTX center column must have the smallest diameter possible. NSTX engineers successfully designed a uniquely thin (13-inch diameter) center column, enclosing the OH solenoid. The inner legs of the TF coils run vertically through the solenoid.

Though they must be thin and assembled without a large, massive support structure, NSTX's OH and inner TF coils will have to withstand high stress generated by the 7-tesla OH magnetic field. To achieve the required strength, the NSTX solenoid winding consists of the longest, continuous water-cooled copper conductor of any magnetic fusion device. Special insulation material was also required. To fit together properly, both the OH solenoid winding and the inner legs of the TF coils were manufactured with a radial accuracy of less than a hundredth of an inch, maintained over the entire height of the center column.

Challenges Successfully Met

These challenges were successfully met by the OH solenoid design team, led by John Citrolo, and the manufacturing team, led by Jim Chrzanowski. Fabrication of both the OH solenoid and the TF coils was performed by Everson Electric Company of Bethlehem, Pennsylvania. The PF coils were manufactured by Magnetic Enterprises International of Oakland, California. On July 8, the OH solenoid was slipped over the inner leg of TF coils to form the NSTX center column.

The second half of 1998 will be a busy time for NSTX staff. Within a three-month period beginning in September, major machine components will be assembled on the support structure in the Test Cell. The vacuum vessel,

which is being fabricated by Process Systems International of Massachusetts, will be delivered in August. It will reside in the RESA building for about six weeks of preparation, including the attachment of the four smallest PF coils. The larger PF coils will be attached to the vacuum vessel after it arrives in the Test Cell.

In early September, the center column will be brought to the Test Cell where it will be prepped for about one month prior

to its attachment to the vacuum vessel. In TFTR and other tokamaks, the vacuum chambers are separate from the center columns. To save space, the outer surface of the NSTX center stack will serve as the inner wall of the vacuum vessel. Preparation of the center column will therefore include the attachment of protective carbon tiles and various diagnostic sensors. By early November, the center column will be inserted into the center hole of the vacuum vessel. Following the installation of the remaining PF coils, the outer sections of NSTX's 12 TF coils will be attached to their inner legs.

Researchers expect that the entire NSTX device will be assembled before the end of December. Integrated systems testing will follow in January, 1999. Subsystems will be tested individually and then linked together and tested again in a building block process, until the entire NSTX device is tested at first plasma. "The plan is aggressive. If all goes well, we could beat our schedule which calls for first plasma in April, 1999," noted Dr. Ono. ●



PPPL's Joe Bartzak assists as the OH coil is lowered over the center stack TF coil bundle.



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Lab Garneres Two DOE Diversity Awards

In recognition of its progress in building sound and notable diversity programs and for implementing science education programs, PPPL received two Equal Employment Opportunity (EEO)/Diversity awards from the U.S. Department of Energy (DOE) on May 29.

On behalf of the Laboratory, PPPL Diversity Officer Pamela Lucas accepted the Turquoise Award for Commitment in EEO/Diversity and the EEO/Diversity Best Practices Award during the DOE's 1998 Diversity Conference in Oakland, California. In addition to Lucas, PPPL's Patti Wieser attended the gathering, which was titled "Diversity: One America in the New Millennium."

"This is a great honor for the Laboratory to receive two awards for our diversity efforts. We have been through many changes during the past year, including a significant downsizing and a reorganization. Throughout these changes we have remained strongly committed to diversity and to promoting an inclusive work environment in which all employees are respected," said PPPL Director Robert Goldston.

Added Lucas, "Winning both of these awards at this particular time is significant. In spite of the budget uncertainties we've experienced recently, PPPL's commitment to the principles reflected by these awards did not waver. This would not have been possible without the strong support of the PPPL leadership and the efforts of the Human Resources Division, the Director's Minority Advisory Committee, the Director's Advisory Committee on Women, and the Diversity Working Group."

The Turquoise Award recognizes PPPL's "commitment and implementation of EEO/Diversity practices and the progress demonstrated in building sound and notable diversity programs." Upon receiving the citation, Lucas said, "The Turquoise Award demonstrates that little can become much in the hands of capable, committed individuals and this provides PPPL with a strong base upon which to continue our efforts."

Last year, the Department of Energy established the National DOE and Contractors EEO and Diversity awards to recognize organizations that have advanced the cause of diversity in the workplace and have provided a positive role model for other facilities and programs within the department. The program, sponsored by the DOE's Office of Economic Impact and Diversity, is open to all DOE federal organizations, DOE laboratories, and managing and operating contractors. The award categories include the Turquoise Award for commitment, the Roadrunner Award for progress, and the Zia Award for excellence. This year there were two recipients of the Turquoise and



PPPL Diversity Officer Pamela Lucas (middle) and PPPL Chair of the Director's Advisory Committee on Women Patti Wieser (left) present two diversity awards from the U.S. Department of Energy to PPPL Director Robert Goldston. Lucas and Wieser attended the DOE Diversity Conference and awards ceremony in California.

two of the Roadrunner awards. In addition, several laboratories and contractors received "best practices" awards.

PPPL garnered the EEO/Diversity Best Practices Award for "implementing science education programs, including a 'Science over Supper' program, in which its scientists team with area teachers to explore science concepts taught in the classroom, and for its 'Research Enrichment Program' that targets minority students interested in careers in science."

"We have been through many changes... including a significant downsizing and a reorganization. Throughout these changes we have remained strongly committed to diversity and to promoting an inclusive work environment in which all employees are respected."

—Robert Goldston

"The 'Best Practices' Award for our efforts in Science Education was really a surprise. The entire Science Education Program and the PPPL staff who lead workshops for 'Science Over Supper' and those who serve as mentors to high school students in the Princeton Research Enrichment Program should be commended for their dedication and commitment to making the resources of the Laboratory available to all members of the community," commented Lucas. ●

Pollution Prevention Day Draws Students

More than 125 students from area schools participated in hands-on science demonstrations, watched some of their classmates receive awards for pollution prevention posters, and toured the Tokamak Fusion Test Reactor during Pollution Prevention Awareness Day at PPPL on April 23.

Poster Contest

The Laboratory hosted the youngsters, as well as about a dozen children of staff who came to PPPL for "Take Our Daughters to Work Day." The day featured a talk by Stony Brook Millstone Watershed Education Director Jeff Hoagland, recycling-related exhibits, and the presentation of awards to fifteen students for entries in the Lab's Pollution Prevention Poster Contest. The winning posters were among 620 created for the contest, many of which were displayed in PPPL's Lobby.

PPPL's Facilities and Environmental Management Division, Director's Advisory Committee on Women, and Science Education Program sponsored the poster contest and activities. In addition to the activities for youngsters, the Laboratory hosted two



Diane Carroll, Head of PPPL's Science Education Program, demonstrates to students the effects of magnetic fields on plasma in an uncoated fluorescent light bulb during Pollution Prevention Awareness Day.

programs that week for adults featuring speakers Kyra Hoffman, Daniel Caraccio, PPPL Deputy Director Richard Hawryluk, Richard Wetherald, George Hawkins, and PPPL Director Rob Goldston. ●

PPPL Hosts Regional Science Bowl

PPPPL hosted 21 teams from New Jersey and Pennsylvania at the New Jersey Regional Competition of the National Science Bowl®, held at the Lab in February.

"The Science Bowl is a challenging but fun day for some of the brightest students in the area. These youngsters who excel in science and math face competition that is often steep and answer questions on a variety of topics. It makes for an exciting day," said PPPL Science Education Program Leader Pamela Lucas.

Millburn High School won first place, but because of a scheduling conflict, was unable to avail itself of the top

prize — an all-expense paid trip to Washington, D.C., to participate in the Seventh Annual National Science Bowl® in May. The prize went to the second-place winner, Montgomery High School.

Teams made up of four students, a student alternate, and a teacher who serves as an advisor and coach, participated in the regional competition at PPPL. The students answered multiple choice or short answer questions in biology, chemistry, physics, astronomy, mathematics, and earth and computer sciences. The competition is sponsored by the U.S. DOE. ●

PPPL and Student Team Create Robot

Watch out for Spike. At 130 pounds, he's lean. And with the tenacity of a bulldog, he's mean. He — or rather it — is a robot created by a team of students and teachers from Hopewell Valley Central High School and a few engineers including Bill Blanchard from PPPL. Earlier this year, the PPPL/Hopewell Valley team took Spike to Rutgers University to participate in the Johnson & Johnson Mid-Atlantic Regional FIRST competition.

FIRST — For Inspiration and Recognition of Science and Technology — is a national engineering contest that immerses high school students in the world of engineering. This is the second year the Lab's Science and Education Program sponsored the PPPL/Hopewell Valley team.

PPPL Engineer Bill Blanchard spent more than 100 hours working with the students to design, construct, and test their robot, giving them an inside look at the engineering profession. "This project is good because it teaches students the practical applications of technology. They had to consider the robot's weight, size, and height in their design, as well as the cost of the material to build it," said Blanchard.

Spike is a combination of conduits, roller bearings, plywood, motors, pulleys, a 12-volt battery, sprockets,

and aluminum plates, among other items. The amount of any one type of material was restricted to encourage the students to use their imaginations and a wide variety of materials and parts in the design of the robot.

While devoting after-school hours and weekends to the project, the PPPL/Hopewell Valley team produced the robot in a room that was formerly one of the high school's wood-working shops. A core group of about five students worked at nearly every session, while other students participated for shorter periods. "Some of the students were really fired up. We worked just about every night after school, during weekends, and even on President's Day," said Blanchard.

In March, the PPPL/Hopewell Valley team took their creation to Rutgers. Each team's robot competed with two other robots in a hexagon-shaped playing field, complete

with an eight-foot center goal and three sets of rails. The robot collected, transported, and placed beach-ball sized balls in the center goal and on the rails to score points. During a match, each of the teams consisted of two drivers, two advisors, and one human player. Spike was operated by the student team in seven contests, winning first place once and second place six times. The team was ranked 22nd out of the 48 teams that participated in the three-day event.

So how did the team come up with Spike for a name? "The school's mascot is a bulldog. The students wanted to build a sturdy robot to ensure it would stand up to the rigors of competition, and they did. So Spike just seemed like a good name," said Blanchard. ●

This summer, at ceremonies marked by a robot roaming the halls of the State House, the New Jersey State Assembly passed a resolution honoring the 20 New Jersey teams — including the PPPL/Hopewell Valley Central High School team — that participated in FIRST in 1998.



The PPPL/Hopewell Valley team competes at Rutgers.



The PPPL/Hopewell Valley team with their creation, Spike, at the competition at Rutgers. PPPL's Bill Blanchard is fifth from the left.

PPPL Hosts Booth at Communiversiity



Photos by Gregg Wielage



In April, PPPL participated in Communiversiity, an annual springtime celebration that joins Princeton University with the community of Princeton. In photo at far left, PPPL Associate Director for External Affairs John DeLooper (left) demonstrates turbulence with a flowing bubble apparatus to the sons of PPPL Deputy Director Richard Hawryluk as Hawryluk (in sunglasses) watches. In the other photo, Information Services Head Anthony DeMeo fields questions about the Lab.

PPPL Participates in Plasma Science Expo

Photo by James Morgan



PPPL's scientific demonstrations drew a crowd at the Plasma Science Expo at George Washington University in Washington, D.C. The two-day April event attracted hundreds of students, teachers, and members of the public. PPPL'ers Diane Carroll, Anthony Contino, John DeLooper, Pamela Lucas, James Morgan, and Andrew Post Zwicker represented the Laboratory at the Expo. In front of the fusion display at left, Post Zwicker discusses science to a group of students. Contino, near the PPPL display at right, demonstrates an electromagnetic arm wrestling machine.

Spreading the Fusion Word through Community Outreach

Photo by James Morgan



Two area teachers conduct experiments with magnets during a workshop, "Magnetism," this spring hosted by the Lab's Science Education Program. The workshop, one of three held recently at the Ben Franklin Elementary School in Lawrenceville, is part of PPPL's "Science Over Supper" series in which area teachers team up with PPPL scientists to explore the science concepts they teach in their classes. The workshop was led by PPPL's Andrew Post Zwicker.

Photo by Dianne Nunes



PPPL's James Morgan demonstrates the electromagnetic arm wrestling machine to a visitor at Future Fest in May in Washington, D.C. PPPL participated in the annual outdoor street festival, which included science and education displays.

Photo by James Morgan



PPPL Science Education Program Head Diane Carroll (left) watches as Gov. Christie Whitman takes on the electromagnetic arm wrestling machine during a science and technology conference at Princeton University's Center for Photonics and Optoelectronics Materials. PPPL joined other local educational and business institutions in offering exhibits at the June conference. In addition to Carroll, PPPL's John DeLooper, James Morgan, and Andrew Post Zwicker gave hands-on science demonstrations and distributed information about the Laboratory during the event.

Photo by James Morgan



Dianne Nunes demonstrates a plasma ball at the Future Fest. Others from the Lab at the event included Dianne Carroll, John DeLooper, James Morgan, and Chris Ritter.

PPPL'ers Make a Difference



PPPL's Ronald Davidson, Pamela Lucas, and Susan Murphy-LaMarche are among a group of honorees recently recognized at Princeton University for "making a difference in the lives of women at Princeton." The President's Standing Committee on the Status of Women honored forty-three students, alumni, faculty, and staff who have, in ways large and small, made Princeton University a more welcoming environment for women to live, learn, or work. The group received certificates during a reception in their honor at Prospect House in May. From left are Davidson, Lucas, and Murphy-LaMarche.

Menard Awarded for Student Paper

American Nuclear Society Recognizes Menard's Contribution to Fusion Research



In recognition of his significant technical contribution in the area of fusion science and engineering, PPPL's Jon Menard garnered the "Best Student Paper" Award from the American Nuclear Society (ANS) Fusion Energy Division (FED) in June. Menard, who is at PPPL through a postdoctoral research appointment, received the ANS FED Certificate of Accomplishment and a cash award during the 13th Topical Meeting on the Technology of Fusion Energy in Nashville. Professor Gerald Kulcinski (left) of the University of Wisconsin presents Menard with the citation for "Best Student Paper."

Rutherford Honored for Career Contributions



Paul Rutherford, former Associate Director for Research at PPPL, is a recipient of the 1998 Distinguished Career Award from Fusion Power Associates (FPA). The award recognizes Rutherford's many outstanding technical and leadership contributions to fusion energy development throughout his career. It further notes that in addition to his many seminal contributions to fusion theory, he has provided "insight and leadership on the key issues of fusion energy development and has provided a continuing link between plasma theory and engineering applications." Rutherford received the citation on June 3 in Washington, D.C., during the FPA annual meeting. The awards are given annually to individuals who have made distinguished career contributions to fusion development.



DACW Draws Women of the Lab Together

The Director's Advisory Committee on Women (DACW) Open Meeting brought together about forty Lab women and supervisors to discuss issues on May 4 in the MBG Auditorium. The Director of the Laboratory and the DACW host the annual event to provide an open forum for the women of PPPL. Guest speaker Carol Kivler of Kivler Communications gave a presentation about "Developing Personal Resiliency to Change and Transition." Above, meeting participants jot down a list of changes during Kivler's presentation. From left are Marie Iseicz, Maria Pueyo, Joanne Bianco, and Virginia Finley.

Murphy-LaMarche Named Executive of the Year



Susan Murphy-LaMarche, Deputy Head of Human Resources at PPPL, is the 1998 "Executive of the Year" for the Mercer Chapter of Professional Secretaries International (PSI). Murphy-LaMarche received the award at PSI's luncheon on April 20.

Another Step Along the Way



The 23,000-pound vacuum vessel for the National Spherical Torus Experiment arrived at the Lab on August 5. The arrival marks a major step in the construction of the new device.

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