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HOTLINE

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

NSTX Up and Running Well

The National Spherical Torus Experiment (NSTX) operations kicked off on January 26, and in the first full week, the machine set a record for producing plasmas with high beta. Using strong neutral beam (NB) heating, the NSTX team achieved toroidal betas of up to 37 percent. Beta is the ratio of plasma pressure to magnetic field pressure and is an important measure of fusion power density and efficiency.

This fiscal year, the Laboratory plans on operating NSTX for 18 weeks, with many physicists on PPPL's research staff participating in physics experiments. "We will be addressing a broad range of toroidal physics issues," said Stan Kaye, NSTX Run Coordinator. Toroidal refers to doughnut-shaped magnetically confined plasmas.

The experiments focus on techniques for heating plasma, methods for starting up the plasma, improving the stability and magnetic confinement of plasmas, developing techniques for handling power to the walls in long-pulse discharges, the integration of heating mechanisms, and adding and upgrading diagnostic tools.

The Experiments

RF Heating and Current Drive

In addition to heating the plasma, radio-frequency (RF) waves can drive an electrical current in the plasma. [Using RF to heat plasma is similar to using microwaves to heat food.] This year, experiments focus on increasing the plasma current driven directly by the RF, using RF to heat electrons, and understanding the heating and instability mechanisms associated with RF. "Using RF power is one key to extending the plasma pulse length," said Kaye. "We can do this by heating the electrons to reduce the plasma's electrical resistivity and to help generate a self-induced current, the bootstrap current, as well as by driving current directly."

Reducing Turbulence and Improving Magnetic Confinement

Researchers are looking at ways to suppress plasma turbulence — which limits beta and negatively affects plasma performance — and at ways to increase the magnetic confinement of plasma. Some of this research concentrates on electron confinement.

"Electrons seem to be responsible for the flow of energy out of the plasma, and NSTX provides us with a unique testbed on which to study electron transport and the underlying turbulence that drives it," Kaye said. "We also have the opportunity to assess the importance of possible non-classical heating of the plasma ions."

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NSTX

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Magnetohydrodynamic (MHD) Stability

"The experimental results from the last two years of operation have given us an indication of just how much the high rotation in NSTX influences the plasma equilibrium and stability properties." Kaye said. "We plan to exploit and expand our understanding of this during the coming year." Rotation, for instance, is believed to modify the external and internal MHD modes that limit beta in NSTX. "One of our goals this year is to implement and test a scheme to control actively stray magnetic fields as well as beta-limiting MHD modes."

Start-up

Tokamaks and spherical torus devices use electric field coils, running through the center hole of the vacuum chamber, to start and to drive the plasma current. NSTX researchers are involved in the development of simpler methods of starting and maintaining the plasma current. Scientists hope to reduce or eliminate the center coils now used to induce the plasma current, allowing more compact and more powerful fusion reactors.

Stan Kaye

Edge Physics

Edge physics research strives toward the goals of controlling the amount of power and particles that hit the wall, and understanding the physics processes that control the edge confinement. "Important research topics in this area include testing new methods to fuel the plasma and to maintain a steady density, which is critical for producing controllable long-pulse plasmas. In addition, detailed measurements of the edge plasma will help us understand the boundary conditions governing global plasma confinement."

Integration

Researchers are working on integrating plasma control and heating techniques. "The goal is to combine heating and control techniques to produce high-performance plasmas – those with high beta and high confinement at the same time – for long pulse lengths," Kaye said. Experiments include the simultaneous use of RF and NB heating of the plasma. "This combination seems to be a key to many of our target scenarios that comprise high performance and long pulse length," said Kaye.

The FY04 NSTX experimental campaign is expected to wrap up in July. The remainder of the fiscal year will be spent analyzing data and maintaining the machine.

New Additions: Fueling and Diagnostics

One of the main additions to the program this year is a new lithium pellet injector, a particle control technique that fires a frozen lump of lithium into the plasma. This technique will be studied along with other gas fueling techniques, such as the supersonic gas injector.

Several diagnostics have been upgraded, including the gas puff imaging, reflectometers and reciprocating probe, which measure turbulence at the edge of plasma. "This is important for understanding what drives the energy out of the plasma," Kaye said.

Another diagnostic tool, CHERS, has been enhanced with additional channels. CHERS measures ion temperature, velocities, and carbon density profiles in the plasma. In addition, a new set of magnetic field sensors, which will measure the detailed structure of MHD modes that can limit beta, has been installed and calibrated.

Hotline

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Researchers monitor experiments and data in the NSTX Control Room. At the back is the new display wall, which was built in collaboration with the Princeton Institute for Computational Science and Engineering (PICSciE) and installed in the control room in January. It is a collaborative wall, which allows researchers inside of the control room to put their plots and displays on this wall, and move graphs on this wall from their desktop PCs.

synthesizes information about the proposed experiments and ideas. Then, individual researchers write formal, detailed experimental proposals, which must go through a rigorous review process. "Once an experiment is accepted, it is scheduled for run time," Kaye said.

Teamwork

Several people work on each experiment — theoretical and experimental physicists, diagnosticians, as well as the engineers and technicians who actually maintain the machine and keep it running.

"People are always working in groups," said Kaye, noting that team members include collaborators from around the world. "For instance, those who write experimental proposals not only brainstorm with other physicists about the goals of and approaches to the experiment, but they also have to discuss them with the physics operators to see if the machine is capable of producing the required plasmas."

Planning the Program

Kaye described planning a program for the NSTX experimental campaign as a "long process" that begins with defining the program's research milestones, which provide a framework within which individual researchers develop ideas for experiments.

First there is an annual research forum to discuss milestones. Researchers from around the country attend in person or remotely. "We first have plenary talks to describe the facility and diagnostic capabilities for the upcoming run," said Kaye. During the forum, each individual task group meets for half a day. At these breakout sessions, individual researchers are given an opportunity to describe what he or she would like to accomplish and how the proposed experiments will increase physics understanding and relate to NSTX scientific milestones. Researchers must indicate how long the proposed experiment will take, which is generally from one to two days. After individuals present these informal proposals, there is a group discussion during which ideas are prioritized. "Experimental task leaders have some guidelines for how many run days they will be allotted and the group prioritizes the experiments accordingly," said Kaye.

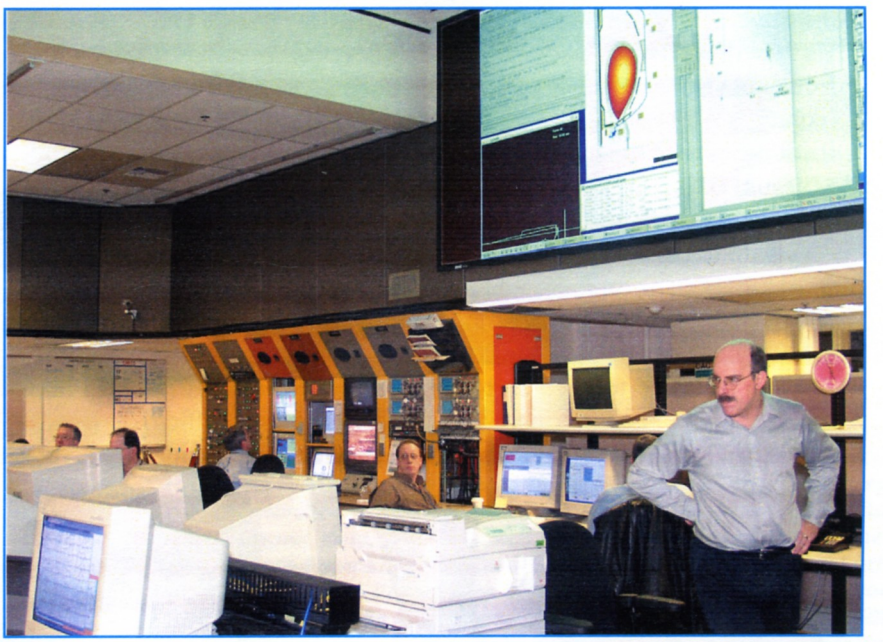
At this initial stage of developing a program for the year, the run coordinator

New Center Stack

NSTX operations resumed after a new center stack was designed, built, and installed — tasks that took up much of last year.

"It's good to have NSTX operating again. There is great anticipation about this year's run. We want to prove to the world again that this is a first-class machine," Kaye said.●

— by Patti Wieser



Steve Sabbagh (far right) and David Gates (seated) in the control room prepare the set up of the next NSTX plasma.

Hulse Takes Science Education Initiatives to Texas

PPPL Nobel Laureate Russell Hulse is heading south — to where the Lone Star shines upon armadillos and multinational technology giants alike — as a visiting professor of physics and of science and mathematics education at the University of Texas at Dallas (UTD). During his one-year appointment at UTD, Hulse will retain his affiliation with PPPL and continue to live on the East Coast. The appointment is through a Work-for-Others agreement between PPPL and UTD.

Hulse will be involved with developing innovative science and mathematics education programs for primary and secondary schools, including those in several Texas school districts, as well as with developing activities in more informal settings, such as science museums and libraries. Hulse also will continue to pursue his diverse research interests, including computer modeling, and a new interest in sensor systems for micro air vehicles, the latter in collaboration with PPPL's Dave Cylinder. Several of these research areas will have ties to the education programs Hulse plans to help develop in the Dallas area.

Promoting Science Education

"I have a longstanding interest in promoting science education through various programs both within and outside of the classroom. UTD has shown a strong commitment to contributing to its local communities through such science outreach programs, which is what attracted me to join UTD to help them make such programs a reality," said Hulse, who began the affiliation in January.

In recent years, Hulse has become deeply interested in the state of science and mathematics education. At UTD, Hulse will work with the University's Science/Mathematics Education Department, in concert with local school districts, including the Dallas Independent School District, and local institutions devoted to science education, such as the Dallas Museum of Natural History and The Science Place, in an attempt to determine the best methods for teaching science and math to children.

Hulse will be traveling to UTD periodically throughout the year, but will do much of the work while remaining in New Jersey, using electronic communications and teleconference facilities to keep in touch with his colleagues in Texas. During his first trip to Texas, where he has an office on the UTD campus in Richardson, Hulse met with a wide range of Dallas area community representatives to discuss science outreach programs. He also participated in a conference, "Community and Cultural Action: Youth as Central to a City's Design." The community representatives he met responded positively to the ideas he presented for various initiatives. "The atmosphere was energizing and entrepreneurial, with great interest in the Dallas area about doing science education activities," Hulse said.

A central goal for Hulse is to get Contact Science up and going. Contact Science is a project that will create, disseminate, and support small-scale traveling science exhibits in public libraries. Hulse began working on the idea several years ago, collaborating on its development with Plainsboro Public Library Director Jinny Baeckler. His goal is for the first Contact Science prototype exhibit series to be designed and constructed by the end of the year. "Having UTD as a supportive partner for initiatives such as Contact Science is a big boost and an important step towards bringing the project to fruition," said Hulse.

He also plans to encourage more UTD involvement in the community by connecting the resources of UTD — both students and faculty — with schools and other community and cultural institutions. "UTD wants to be a full partner in the community and that's where I can help out. One of th things I bring to Dallas is my experience in a number o science education initiatives," Hulse said.

Hulse has been involved in many science education activities at PPPL and outside the Lab, and has served on a number of advisory committees and boards. Presently, he is a member of the Senior Advisory Board for the University of Arizona Science Center.

His next trip to the Dallas area is planned for early March, to continue his discussions with community representatives about science education initiatives. In late March, he will return to Dallas to deliver a talk about the discovery of the binary pulsar as part of a science lecture series for high school students. Hulse won the 1993 Nobel Prize in Physics jointly with Princeton University Professor Joseph Taylor for their 1974 discovery of the first binary pulsar.

And he may squeeze in some shopping to help fill out his wardrobe with a few decidedly Texan accessories. A Stetson, perhaps?

"Maybe, but a little tricky for wearing on the plane. Maybe a belt buckle," Hulse said. ●

PPPL Nobel Laureate Hulse Named AAAS Fellow

Nobel Laureate Russell Hulse, a scientist at the PPPL, has been elected a Fellow of the American Association for the Advancement of Science (AAAS). New Fellows were announced at the AAAS Fellows Forum on February 14 in Seattle. The forum was part of the AAAS annual meeting.

Hulse was cited for the "discovery of the pulsar in a binary system and the resulting evidence for gravitational energy radiation." Hulse won the 1993 Nobel Prize in Physics jointly with Princeton University Professor Joseph Taylor for their 1974 discovery of the first binary pulsar — a twin star system that provides a rare natural laboratory in which to test Albert Einstein's prediction that moving objects emit gravitational waves, as well as other aspects of Einstein's general theory of relativity.

Hulse received a bachelor of science degree in physics in 1970 from Cooper Union for the Advancement of Science and Art in Manhattan. He received a Ph.D. in physics in 1975 from the University of Massachusetts at Amherst. After receiving his Ph.D., he was awarded a postdoctoral appointment at the National Radio Astronomy Observatory in Charlottesville, Va. In 1977, Hulse changed fields from astrophysics to plasma physics and joined the staff at PPPL, where he has been since. Many of Hulse's efforts in recent years have been focused on new initiatives in science education. While still a PPPL employee, earlier this year Hulse began an affiliation with the University of Texas at Dallas as a visiting professor of physics and of science and math education.

Russell Hulse

Each year, the AAAS Council elects members whose "efforts on behalf of the advancement of science or its applications are scientifically or socially distinguished." The honor of being elected a Fellow of AAAS began in 1874 and is acknowledged with a certificate and a rosette. ●

PPPL Participates in Super Science Weekend

On January 10 and 11, PPPL took part in the New Jersey State Museum Super Science Weekend. PPPL demonstrated plasmas, turbulence, and vacuum experiments. George Ascione, Lisa Carlucci, Tom Czeizinger, John DeLooper, Darrell Dicicco, Terry Greenberg, Ron Hatcher, Rich Hawryluk, Dave Johnson, Jan Johnson, Bob Kaita, Margaret King, Alex Ilic, Dick Majeski, Tom McGeachen, James Morgan, Franco Paoletti, Carol Phillips, Andrew Post-Zwicker, Chris Ritter, Marisol Rivas, Hans Schneider, Rod Templon, and Al von Halle staffed the PPPL booth that was visited by more than 3500 individuals. Above is von Halle (far left) and at left is DeLooper (far right) doing science demonstrations at PPPL's exhibit.

Photos by Carol Phillips

PPPL United Way Donations Highest in Ten Years

PPPL staff contributed a record $29,100 to 2003 United Way Campaign. This is the highest amount donated during the past decade. Thirty-five percent of the staff participated this year. A special thanks to all who helped make the campaign such a success! ●

From left are PPPL Human Resources Director Susan Murphy-LaMarche, Princeton University President Shirley Tilghman, and PPPL United Way Chairperson Mary Ann Brown at a luncheon on main campus for the United Way Campaign volunteers.

IT Works!

Attention Linux Users:
PPPL has purchased a limited number of licenses for the Red Hat Network Up-date services. This will enable Red Hat Linux users to download patches and updated software more easily and provide a better path for keeping systems updated. As support for older versions of Red Hat Linux is being dropped, this new service is an important capability for Linux users. To take advantage of this agreement or for more information, please send an e-mail to unixadmin@pppl.gov. ●

Thank You

I'd like to thank everyone at PPPL for all the good wishes sent to me while I was out with a broken elbow. The expressions of support were greatly appreciated. A special thanks goes to Susan Thiel and Bob Lamb of ESU for their help and compassion.

— Ceil O'Brien

Reporting Fraud, Waste, and Abuse

All PPPL employees, visitors, students, and employees of Lab subcontractors must report instances of fraud, waste, and abuse, violation of laws, danger to the health and safety of personnel, and matters involving mismanagement to appropriate authorities. The report may be made directly to a Laboratory official or to the Department of Energy (DOE) Office of Inspector General. They may be made in person or by mail, signed or anonymous. If the report is made by telephone or in writing, and if the employee does not wish to identify him or herself, sufficient information must be provided to enable the start of an investigation. Employees providing information are protected from consequent retaliation by the Laboratory's management regarding compensation and the terms, conditions, or privileges of employment.

Reports of wrongdoing should be made to the employee's supervisor or to any member of the Laboratory's Standard of Ethics and Conduct Committee, which includes Director Rob Goldston, Deputy Director Rich Hawryluk, Human Resources Director Susan Murphy-LaMarche, Business Operations Head Ed Winkler, and Sankar Suryanarayon of the Princeton University General Counsel Office. Reports may also be made to the DOE hotline, Office of Inspector General (1-800-541-1625) or mailed to the local Office of Inspector General, Department of Energy, P.O. Box 102, Princeton, NJ 08542-0102 or by calling (609) 243-3723. Any Laboratory employee who receives a violation repor must relay the information the Laboratory Director or Deputy Director as soon as possible. ●

BLOOD DRIVE

SPONSORED BY THE AMERICAN RED CROSS & PPPL

DATE: Wednesday, March 17

HOURS: 8:30 A.M. to 1:30 P.M.

(Appointments are every 15 minutes)

LOCATION: The American Red Cross Van will be parked in front of the LSB on the pad adjacent to the circular driveway.

For an appointment please call **x3200**

BLOOD SUPPLY IS CRITICALLY LOW.
YOUR HELP IS NEEDED!

For questions related to first-time donors, eligibility requirements, blood supply levels and other information please visit the American Red Cross website at:

http://www.pleasegiveblood.org/

or call 1-800-givelife

American Red Cross
Penn-Jersey Region

Spotlight

Name: Kareem Armstrong

Position: Custodian, Maintenance Department. Has responsibilities for first floor area that extends from the Theory Department to the Motor Generators, and for the second floor L-wing experimental area.

Quote: This is a really good place to work. I've been at PPPL nine months, and I have met and worked with so many nice people. I also enjoy seeing the machines and learning more about the experiments being done here.

Other interests: I really enjoy spending time with my six nieces and nephews. They range in age from newborns to 11. I like bringing them all together to play or taking a group of them to the movies. Besides spending time with my family — parents, three brothers, two sisters, and nieces and nephews — I like to shoot pool, go to clubs, and go fishing in the summertime. And I'm getting ready to go back to school soon to learn about real estate and property. That will keep me busy — working, taking classes, and studying.

Transitions

New Hires — ***PPPL welcomes the following people who have come on board since the beginning of the fiscal year:***

Sajjad Gilani
Electrician
Engineering

Paul Henderson
Software Engineer
Computer Division

Marianne Tyrrell
Administrative Assistant
Engineering

Calvin Armstrong
Janitor
Maintenance

John Lacenere
Head of AC Power
Engineering

Kevin Ranahan
Subcontract Administrator
Procurement

John Carisdeo
Cryo Technician
Engineering

(Photo Not Available)

WELCOME TO PPPL!