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PPPL NEWS

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

PPPL's Neumeyer Leads U.S. ITER Electrical Team

PPPL's Charles Neumeyer has come full circle with the ITER project. In the 1980s, he was a working member of the ITER Engineering Design Activities (EDA) Power Systems Team. This spring, he became the Task Leader for the Steady State Electric Power Network (SSEPN) for the U.S. ITER Project Office.

"I feel privileged to represent Princeton. It's a great challenge and opportunity, and I'm happy to participate again," said Neumeyer, an electrical power engineer with more than 20 years of experience in advanced technology engineering and project management.

PPPL Director Rob Goldston said, "Charlie is a highly experienced and creative engineer, with an excellent perspective not only on his own specific responsibilities, but also on the broad picture. I am really happy that he will be contributing to the success of ITER."

PPPL's Charles Neumeyer with the PPPL substation in the background..

ITER (Latin for "the way") is a large international fusion experiment aimed at demonstrating the scientific and technological feasibility of fusion energy. The U.S. is one of seven partners; the others are China, the European Union (EU), India, Japan, Russia, and South Korea.

The U.S. and the EU are responsible for the design and procurement of the SSEPN for ITER. Neumeyer leads the U.S. team, which will manage 75 percent of the procurements and participate in the design of the system. The EU will manage the remaining 25 percent of the procurements and have primary responsibility for the design. The SSEPN is one of two project pieces PPPL will oversee out of seven managed by the U.S. ITER Project Office. The other is diagnostics integration. Neumeyer will monitor the progress on the design activities by the EU team and lead the U.S. team when it is time to procure equipment such as transformers, switch gear, and circuit breakers. The procurement activities are expected to begin in a few years and the U.S. portion will go through PPPL and Lab subcontractors. The SSEPN is basically an AC power substation similar to that used in a conventional nuclear power plant.

Neumeyer began his fusion career at PPPL in 1976 on the Tokamak Fusion Test Reactor with the design, procurement, and commissioning of the AC/DC converter systems, and was eventually responsible for the operation of all power systems. Since 1997 he has served as the Project Engineer for the National Spherical Torus Experiment. In 2000, Neumeyer received the PPPL Distinguished Engineering Fellow Award and in 2001 the "Engineer of the Year" award from the New Jersey Society of Professional Engineers. Neumeyer received a B.S. degree in electrical engineering from the University of Virginia in 1975 and an M.S. degree in electrical engineering from the Polytechnic Institute of New York in 1987.

He described ITER as "a fabulous project," adding, "This is the culmination of my career." ●

Last Two Stellarator Vacuum Vessel Segments Arrive

In August and September, the second and third of three vacuum vessel parts for the National Compact Stellarator Experiment (NCSX) arrived. Staff at PPPL used a forklift, and then a crane and rigging to install them inside the NCSX Coil Winding Facility near the first segment. Major Tool and Machine, Inc., of Indianapolis, manufactured the segment.

During final assembly in the NCSX Test Cell, the three segments will be welded together to make a 25,000-pound chamber that looks like a hollow French cruller with only three twists. The completed vessel will have a total of 84 ports.

At right, staff install the second segment inside the NCSX Coil Winding Facility. Above, the third segment rolls into the PPPL site on the back of a flatbed. ●

PPPL NEWS

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PPPL Hosts Teachers for Summer Plasma Camp

In July, PPPL hosted its ninth annual Plasma Camp for six teachers from across the nation. Teachers from Florida, New Jersey, Michigan, Pennsylvania, Texas, and Washington spent one week in PPPL's Science Education Laboratory working on plasma physics experiments and developing plasma-based curricula for their classrooms.

They worked with plasma balls, half-coated fluorescent light bulbs, and DC glow discharge tubes. The teachers also created demos, lab exercises, computer-based constructivist learning activities, and in-class discussion questions on topics that ranged from creating a plasma ball in a microwave oven and states of matter to the properties of atoms and plasma discharges as circuit elements.

For the first time, a middle school teacher and a high school teacher from the same school district (Trenton) collaborated on vertically integrating curricula from their physical science classes.

Participants will return next year to further refine their curricula. Peddie School Science Department Chair Nick Guilbert and PPPL Science Education Program Head Andrew Zwicker led the workshop, which was administered by PPPL's James Morgan. ●

In the foreground, from left, teachers Dan Noyes of Clearwater, Florida, and Kelvin Kibler of Houston discuss their presentation on fossil fuels during PPPL's ninth annual Plasma Camp in July. In the background, from left, teachers Felice Farber of Trenton and Dan Dorsey of Redmond, Washington, discuss the plasma-based curricula they developed with Nick Guilbert, who led the workshop.

Summer Students Add Life to PPPL Halls

Students for the National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences (NUF) and the Science Undergraduate Laboratory Internships (SULI) spent 10 weeks participating in experiments at PPPL and other scientific institutions this summer. PPPL Science Education Program's James Morgan, who administered the NUF and SULI programs, said, "This is always an exciting time of the year for PPPL as the summer students collaborate with our researchers." The NUF and SULI programs are funded by the U.S. Department of Energy. Above are many of this summer's students.

Quark Park Features Plasma Sculpture and More

PPPL Director Rob Goldston joined about a dozen other noted scientists to inspire the artwork at Quark Park, a temporary garden in Princeton Borough that joins art and science. Goldston collaborated with Trenton artist Rein Triefeldt to produce *Stellarator*, which includes a giant pink plasma sculpture inside a stellarator-style cage modeled on the National Compact Stellarator Experiment (NCSX) structure. NCSX is being built at PPPL in collaboration with the Oak Ridge National Laboratory. A stellarator is an experimental fusion machine.

Fusion energy research led by Goldston motivated Triefeldt to carve the plasma sculpture. Plasma—the fourth state of matter—is the hot, ionized gas used as fusion fuel. Triefeldt coated his collaborative creation with resin and painted it a vivid pink, the color used to depict plasma produced in fusion devices.

"It was great fun to see our science through the eyes of an artist. Rein perceived the mysterious beauty of NCSX and created a delightful celebration of plasma," said Goldston. PPPL provided the frame for the sculpture. Along the path with plantings donated by MOON Landscaping is a curved "chair" that is a prototype segment of the actual vacuum vessel that will keep air away from the plasma in NCSX. This prototype is on loan from PPPL, as well as a box with two magnetized balls representing atomic nuclei undergoing fusion. MOON Landscaping also provided a spiral juniper tree that was secured inside the stellarator structure, representing one of the central magnet windings.

Triefeldt said, "For me this project is about the exchange of concepts and learning ...it's about peace on Earth through passive energy, about solving the riddle of abundant energy without hazardous by-products." The *Stellarator* installation is in good company. Next door is a sculpture from the team of Princeton University President Shirley Tilghman, Princeton University Electrical Engineering Professor James Sturm, and Jersey City artist Nancy Cohen. Nearby is a sundial from the collaboration of Institute for Advanced Study Professor Emeritus Freeman Dyson, U.S. Rep. Rush Holt (NJ-12), and Princeton architect Allan Kehrt. The park—developed by Princeton architect Kevin Wilkes and landscape designers Peter Soderman and Alan Goodheart—opened in September and is expected to remain in operation through Thanksgiving. For a comprehensive list of the scientist-artist teams and more information about the park, please visit: **http://www.princetonoccasion.org/quarkpark/.**

From left (bottom), are SENSATION: INTERIOR VIEW, Princeton University President and molecular biologist Shirley Tilghman, artist Nancy Cohen and electrical engineer James Sturm; HIPPOCAMPUS, Rutgers neuroscientist Tracey Shors, artist Steve Weiss, and landscape designer Dolph Geurds; AUGMENTED LITHOPHONE, Princeton Computer Science Professor Perry Cook and artist Jonathan Shor; ENCODED, Scripps Research Institute Molecular Biology and Chemistry Professor Paul Schimmel and sculptor Robert Cannon; SUBDUCTION AND OROGENY, Princeton Professor of Geosciences Lincoln Hollister and landscape architect Alan Goodheart; THE WEATHER GARDEN, Princeton Professor of Geosciences George Philander and landscape designers Holly Grace Nelson and Matt Kiefer, with Bill Flemer; (middle row) FORBIDDEN GEOMETRY, Princeton Professor in Science Paul J. Steinhardt and artist Christoph Spath; MOTION IN THE OCEAN, Princeton Professor of Mechanical and Aerospace Engineering Naomi Ehrich Leonard and glass artist Robert Kuster; an overall view of Quark Park; STELLARATOR, PPPL Director Rob Goldston (left) and sculptor Rein Triefeldt; (top left), the oculus in THE WEATHER GARDEN, filled with stained glass created by Maria Ivarsson and Zachary Smith.

Stratton Named New PPPL Diagnostics Head

This summer, PPPL Principal Research Physicist Brent Stratton was named the new Head of the Diagnostics Development Division at PPPL. Stratton replaces Dave Johnson, who became the U.S. ITER Diagnostics Team Leader earlier this year.

Stratton is responsible for the development and implementation of new diagnostics in support of all PPPL experimental activities in fusion facilities at the Laboratory and around the world. These range from the National Spherical Torus Experiment (NSTX) and the National Compact Stellarator Experiment (NCSX) at PPPL, to DIII-D at General Atomics in San Diego and Alcator C-Mod at MIT, to KSTAR in Korea and the Joint European Torus (JET) in the U.K. He will also be an advocate for ITER diagnostics work to be done by PPPL.

PPPL Director Rob Goldston said, "Brent is very well qualified for this challenging position, having 25 years of experience in spectroscopy and experimental plasma physics. He has been a key developer and user of diagnostics at PPPL and off site. We look forward to his efforts on behalf of the Laboratory's research program and in keeping PPPL at the forefront of diagnostic development."

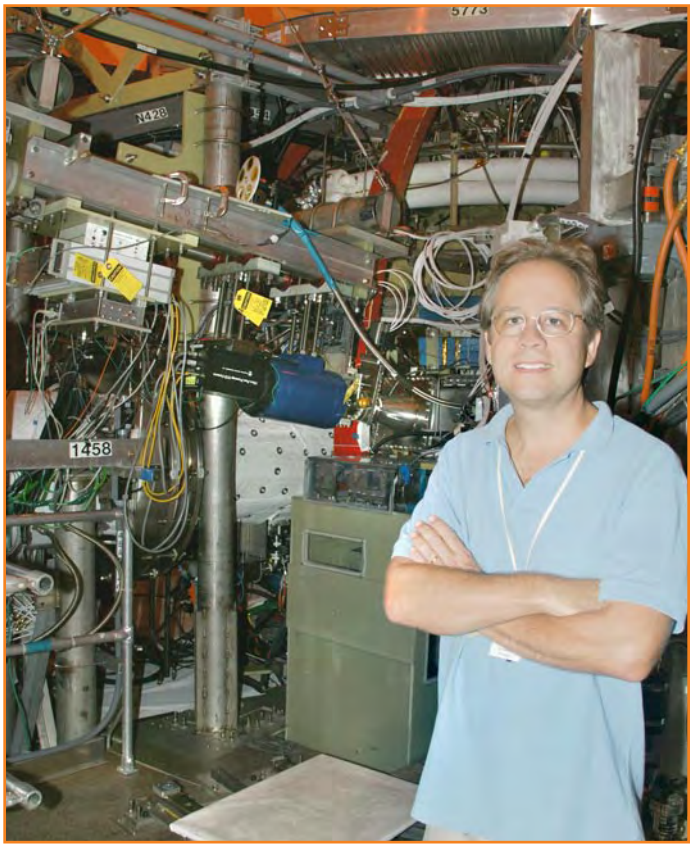
World of Diagnostics Constantly Changing

The world of diagnostics is constantly changing, with advances in technology leading to new methods in the field. "New diagnostics are continually being developed, including systems that make measurements with higher time and spatial resolution," Stratton said. "For example, the development of very fast cameras make possible a variety of fast imaging diagnostics that were not possible years ago."

New diagnostics recently developed at PPPL include a method for making fast two-dimensional measurements of the electron temperature on the TEXTOR tokamak in Germany and a system for lost alpha particle detection at JET.

Stratton joined the research staff at PPPL full time in 1985, after spending time at the Lab as a Johns Hopkins University graduate student working in plasma spectroscopy. Spectroscopy measures the light emitted by the plasma to provide information on the plasma.

As the new diagnostics head, his job is shifting from direct research to overseeing diagnostic design development and work. He oversees a staff of approximately a dozen, including physicists and some technicians and engineers engaged in diagnostic work at PPPL.



Brent Stratton

In addition to NSTX diagnostics, he has recently been involved in the planning of NCSX magnetic diagnostics, which will measure the structure of the magnetic field produced by the plasma itself.

Stratton received a bachelor's degree in physics from Franklin and Marshall College in Lancaster, Penn., in 1978, and a master's and a Ph.D. in physics from The Johns Hopkins University in Baltimore in 1980 and 1984, respectively.

He and his wife, Gayle, live in Pennington with their two children, 14-year-old daughter, Kent, and 10-year-old son, Oliver.

Stratton said he looks forward to his new duties at PPPL. "It should be an exciting time to continue diagnostic work on NSTX and other machines, and to develop diagnostics on NCSX, a brand new device," he said. ●

DOE Pulse

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Spotlight

Name: Charles Skinner

Position: Principal Research Physicist, presently involved in experimental research and diagnostics on the National Spherical Torus Experiment (NSTX). His work includes studies of deposition and dust, as well as spectroscopy support to track plasma purity.

Quote: "I have always been amazed and curious about the world and been eager to find out how it worked. One of my earliest memories is of standing on a chair, looking out the window at some newly fallen snow, and deciding that snow was white to reflect sunlight so it would last longer. As a teenager I was fascinated by relativity and atomic physics, and really excited to see Schrödinger's equation in a book at high school. Even though I didn't understand it at the time, I knew it was a powerful clue as to how the universe was made. I always knew I wanted to be a physicist," Skinner says.

Skinner grew up in post-war England — one of five children to a British Defense establishment engineer father and a mother who emigrated from Ireland to help with WWII work. He received a BSc and a Ph.D. from Imperial College, University of London, and joined PPPL in 1980 as a researcher working on X-ray lasers. Later he became involved with tritium diagnostics for the Tokamak Fusion Test Reactor (TFTR). His NSTX deposition and dust studies are an evolution of his tritium retention work on TFTR.

He describes dust as "both a mundane object of housekeeping and absolutely fascinating." For next-step tokamaks, dust levels will be much higher, and it must be diagnosed and controlled for safety reasons and to prevent plasma contamination, Skinner says. "The technology to do this is in its infancy and the best way to develop it is to do trials on small tokamaks such as NSTX," he explains. Tritium and deuterium (in NSTX) can be retained as in tokamaks and Skinner has observed a short-term form of retention called dynamic retention using some quartz microbalances on NSTX.

Other interests: Skinner has a passion for his family, the piano, and exploring the natural world. He met his wife, Dagmar, in Berlin while on a short-term assignment there at the Physikalisch Technische Bundesanstalt. They have one son, Patrick, who rekindled Skinner's interest in the piano 15 years ago when Patrick began taking lessons.

Skinner, who had taught himself to play the instrument as a child, decided to join in the fun. "With a good teacher, I realized how much I had missed both in the structure of the music and the techniques for practicing and playing it," he says. Now he enjoys playing more advanced pieces and is presently working on a Chopin Scherzo. By 1997, he had joined the board of the Steinway Society of Greater Princeton, becoming president in 2000. He invites people to check out the society's web site at http://www.princetonol.com/groups/steinway/ and to attend its monthly musicales.

When Skinner isn't practicing piano and attending recitals, he's often exploring the natural world. He has rafted down the Colorado River in the Grand Canyon and climbed the Rocky Mountains and the Swiss Alps. In New Jersey, he appreciates Island Beach State Park and the Pine Barrens, and runs 10 miles on the D&R canal towpath every weekend.

His trip down the Grand Canyon gave Skinner a new appreciation of time and evolution. He notes how human history represents just 1 inch of sedimentation in the billion-year history of the mile-high canyon. "I recall biology at high school as a dry listing of parts of organisms — as appealing as learning recipes for cooking — but now it has been transformed both in molecular biology and the genetic code. Underappreciated, but potentially the most revolutionary change, is the emerging understanding of how human behavior evolved," Skinner says.

Skinner notes that Stephen Hawking has posed the question whether homo sapiens would be still around in 100 years given the ongoing political strife in the world, the increasing proliferation of powerful military technology, and the deteriorating health of the global ecosystem that supports all life. "To me the problem is the consequence of an imbalance between progress in technology and lack of progress in understanding human behavior. Recent work in psychology, sociology, ethology, anthropology, evolutionary psychology, and sociobiology is bringing these fields under the unified theory of all biology, that is Darwinian evolution," he says. He recommends reading the work of Richard Dawkins (*The Selfish Gene*) and Steven Pinker (*How the Mind Works*). "Possibly we are at the brink of a neo-enlightenment that will enable us to understand who we are, what makes us happy and unhappy, and why we behave the way we do. With this understanding maybe we can defuse at their source some of the troubles that threaten us all today. I realize this is an optimistic, maybe naive hope, but I cannot see our species lasting hundreds of years, let alone the millions of years, typical of other species in the grand panoply of life, without big changes in our understanding of our behavior," he says. ●

Garden Flourishes Off PPPL's Lower Parking Lot

Schmidt and Nunes Use Green Thumbs to Nurture Plants

Off PPPL's lower parking lot, there's an oasis a few steps from the concrete desert — a patch of verdant with splashes of orange and purple. Left barren when a diseased pine was removed, the area was brought back to life this spring by *Physics of Plasmas* (*PoP*) journal staff Sandy Schmidt and Dianne Nunes. Now the 20-foot by 12-foot space attracts physicists, staff, and butterflies alike.

"We put in a dogwood tree and some shrubs in the fall, and added most of the plants in the spring," said Schmidt, *PoP* Assistant Editor. Among the fall plantings were holly and butterfly bushes.

Schmidt and Nunes drew up a plan for the *PoP* Garden Sanctuary, considering climate and sun exposure before selecting plants for installation. "We picked drought-resistant plants that really like the sun," Schmidt said.

The garden now boasts purple-flowered verbena, false indigo, Russian sage, pink fountain gaura, fanfare blanket flowers, Stella de Oro daylilies, and vibrant portulaca, among other offerings. The lavender-colored butterfly bush is a popular haunt for Eastern Tiger Swallowtail, Monarch, and Cabbage White butterflies. The bush has tripled in size since it was planted in February. "It just sprang up. The rain, the sun, and a little fertilizer was all it took," Schmidt said.

The space has become a community effort and hangout. The Facilities crew turned over the soil before the spring plantings and added topsoil and mulch, and PPPL's Tom McGeachen, Ken Tindall, and T.K. Chu have made floral and monetary contributions toward the garden. Nunes, the assistant to the *PoP* editor, dug and planted. Schmidt and her husband added a footpath and a birdbath — a hit with robins and brown-headed cowbirds out for an afternoon dip.

An Eastern Tiger Swallowtail butterfly drops by the garden to visit the butterfly bush blossoming with purple flowers.

Physics of Plasmas staff members Sandy Schmidt (left) and Dianne Nunes tend the garden.

Chu came up with the idea for the garden when the pine outside his office window was removed. "T.K. thought everyone could get together and put things into the garden, and that's how it evolved," said Schmidt.

Most of the plants are perennials, with a few annuals. Deer take drinks from the birdbath, but don't snack on the plants thanks to "Liquid Fence," an environmentally friendly spray that repulses them. "I've seen hoof prints in the garden. The deer come in and get a drink," Schmidt said.

She and Nunes planted the sanctuary over a few afternoons and a morning — on their own time. To maintain it, they weed, add plants, and water as needed. They selected plants and colors by what was available in the market and would flourish in bright sun. They wanted a variety of heights and colors to add interest and dimension.

Many staff members have thanked the two for their gardening efforts, which have transformed the sanctuary into a favorite break spot. "It makes it so much more pleasurable," Nunes said. Schmidt recalled a Saturday morning when a picnic table had been moved near the garden and filled with bagels and coffee for a break.

Nunes, noting a spot near the picnic area off the lower lot, said the garden could be replicated in other areas on site.

"It's nice coming into work everyday and passing the garden," said Nunes, who keeps an eye on the flowers from her office window. This fall, she and Schmidt plan to add mums to bring in a little autumn color, as well as bulbs such as deer-resistant daffodils and narcissus.

"It's been very rewarding watching it grow," Schmidt said. ●