

HOTLINE

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

Teamwork Credited for DIII-D Fast-wave Milestone



From left are Elmer Fredd (PPPL), Wally Baity (ORNL), Nevell Greenough (PPPL), Tony Horton (ORNL), Ward Martin (GA), and Bob Pinsker (Project Manager, GA). Not pictured is Glenn Barber (ORNL).

By Anthony DeMeo

The drawings for major hardware were in German. Tens of thousands of electrical and mechanical components had to operate correctly in unison. The required high-voltage power supplies, designed for an arid climate, had recently been pelted with months of rain. A dead coyote, quite a few lizards, and a colony of mice had to be removed from the outside equipment cabinets. These are just some of the challenges faced by the team responsible for bringing DIII-D's fast-wave systems back online after a five-year hiatus. Three million watts of radio-frequency energy were injected into the plasma in April.

Members of the group included staff from PPPL, Oak Ridge National Laboratory (ORNL), and General Atomics (GA), the home of DIII-D. Elmer Fredd and Nevell Greenough represented PPPL for the entire two-year effort, making numerous trips to GA, which is near San Diego. In

Continued on page 2

PPPL Provides Small Plasma Lab to Goshen College

By Patti Wieser

A small plasma lab soon will be on its way from PPPL to Indiana to serve as a teaching tool for undergraduate students at Goshen College. The tabletop lab is the first PPPL has created specifically for use by undergraduates outside of PPPL.

Prompted by a conversation between Goshen physics professor Carl Helrich and PPPL's Stewart Zweben, PPPL staff designed and built the experimental device. Last summer, Helrich was at PPPL working on a project with Wei-li Lee for a week when Zweben took him on a tour of the experimental facilities. Along the way, they stopped by Sam Cohen's Grad Lab, where they saw a small plasma lab. Zweben wondered if Goshen might like a similar lab. Helrich said the college indeed would be interested in getting help establishing an undergraduate research experiment in plasma physics.

Continued on page 3



Surrounding the tabletop plasma lab (from left) are Goshen College Professor Carl Helrich and PPPL's Stewart Zweben, Lane Roquemore, and Mike DiMattia. Zweben designed the experiment, DiMattia built it, and Roquemore helped locate equipment and diagnostics.

DIII-D

Continued from page 1

the last year alone, Fredd spent 121 days at GA, with little time for anything but work.

Fast waves are radiofrequency (RF) waves that can heat plasma and drive and control plasma current. The potential of the tokamak as a fusion reactor depends on whether its plasma current can be maintained continuously. For this reason, the DIII-D project decided to restart its fast wave systems. If the efficacy of fast waves for current drive and control is confirmed on DIII-D and other experiments, fast waves are likely to be used for this purpose in ITER, and the U.S. is likely to have responsibility for major components of the ITER fast-wave system.

**“The individual team members
have lots of experience
in their areas of responsibility.”**

— Elmer Fredd

“PPPL is the high-power RF sources expert, and ORNL specializes in RF antennas and antenna controls. GA folks are the project managers and are determining the kinds of fast-wave experiments that will be run on DIII-D. The individual team members have lots of experience in their areas of responsibility,” noted Fredd.

Effective Collaboration

He stressed the role that effective collaboration among the three labs played in allowing work to proceed more rapidly than expected.

“Getting folks to ‘jell’ is a major accomplishment. People trying to collaborate are apprehensive. They feel out what the other team members are trying to do and the personalities involved. We certainly put personalities aside in this thing. After working at GA for while, we found that other GA staff outside the team saw when we needed help and provided it without us even asking. For example, John Lohr, head of the GA’s Electron Cyclotron Heating group, was instrumental in helping us through a couple of very difficult situations when repair work needed to be done overnight. This was something that Nevell, I, and the ORNL and GA

Fast-wave collaborators could not have done alone,” Fredd explained.

Raffi Nazikian, who oversees DIII-D collaborations within the PPPL Off-site Research Department, said, “When we undertook the effort to fully commission the DIII-D fast-wave systems, the details of the job were not clear except that we knew it was going to be a lot of work. In order to make this succeed, we needed a partnership of technicians, engineers, and physicists working together as a single team, even though they were spread across the country in three centers that have fast-wave experience.”

Two of DIII-D’s fast-wave systems were never fully commissioned because of problems encountered with their power amplifier tubes. A third system also needed repair. Consequently, the DIII-D fast-wave systems never operated optimally. According to Fredd, “All three systems had lots of parts that just sat for a long time, aged and deteriorated. The systems were made operational quickly, but when powered up, they didn’t last very long.”

However, as a result of this teamwork, all three systems are now operational, one at 60 MHz and two at 117 MHz. Together they can produce three megawatts of fast-wave RF power for a few seconds. DIII-D physicists can now study how efficiently these particular frequencies of RF waves impart their energy to the electrons versus the ions.

“Given all the variables and all the unknowns inherent in restarting and fully commissioning very complicated systems that were in a state of disrepair for five years, coupled with the necessity of putting together an effective multi-institutional collaboration, it is remarkable that the three-megawatt milestone was accomplished sooner than expected,” said Nazikian. He added that this achievement did not go unnoticed. MIT’s Ron Parker, chairman of the DIII-D Program Advisory Committee, extended his congratulations, noting the complicated nature of RF systems generally and the substantial effort expended by the team.

DIII-D’s fast-wave RF power now will be increased further in two stages, first to four and then to five million watts during the next two years. Nazikian explained, “In terms of the amount of power produced and the efficiency with which this power can be coupled to the plasma, fast-waves are an important option that needs to be considered along with other RF heating and current drive methods for ITER, such as lower hybrid and electron cyclotron frequency waves.” ●

Hotline

Editor/Writer: Patti Wieser **Graphic Artist:** Greg Czechowicz
Photographer: Elle Starkman **Layout:** Patti Wieser

The HOTLINE is issued by the Princeton Plasma Physics Laboratory, a research facility supported by the United States Department of Energy. It is primarily an internal publication. Correspondence and requests to reprint material should be directed to the Editor, PPPL HOTLINE, P.O. Box 451, Princeton, NJ 08543; Interoffice correspondence should be addressed to MS-38, LSB Bldg., C-Site; fax 609-243-2751; telephone 609-243-2757; e-mail pwieser@pppl.gov.

Goshen

Continued from page 1

Helrich was talking to the right person. Zweben is Head of PPPL's Off-site University Research Support Program, which is supported by the Department of Energy through Darlene Markevich, Office of Fusion Energy Sciences, and has a mission to reach out to small colleges. "The idea is for PPPL to act as a resource," said Zweben. Being a resource means offering staff time and expertise to work with university colleagues, for example, to help design and build experiments and their components.

"I had an idea to do a small clone of Sam's lab and adapt it for undergraduate students at Goshen. I thought we could assemble a plasma source from spare parts around the Lab," said Zweben. He pitched the project to the higher ups and then to Markevich. PPPL management, including Director Rob Goldston, Deputy Director Rich Hawryluk, and Plasma Science and Technology Head Phil Efthimion, joined Markevich in supporting the pursuit. With the go-ahead, Zweben began working with PPPL technician Mike DiMattia.

"Mike took my idea for the lab and built it from scratch using old but serviceable equipment and spare parts from the Laboratory. Much of the surplus was from the 1970s and 1980s, yet everything worked," said Zweben. "Mike worked half time on the plasma lab from January to June and did a really excellent job. He designed the vacuum and gas delivery systems for it, and showed a lot of creativity and initiative in the project."

When DiMattia was finished with construction, Zweben tested the device and wrote a manual on physics and safety issues that will be used by Goshen to operate the plasma lab. "Experiments that can be done range from basic — how to create a plasma — to complicated — looking at waves, instabilities, and the effect of magnetic fields on plasmas," said Zweben.

The lab is designed to give students some hands-on experience in experimental physics and to teach them some plasma physics, specifically giving them experience with vacuum systems, basic electrical measurements, optical measurements and spectroscopy, plasma diagnostic techniques, and data analysis. It also will allow for creativity and the design of new experiments.

The lab uses helium and neon gases for plasmas and consists of two glass plasma-filled tubes, one at the left of the workbench or tabletop, which is X1, and a second larger one at the right, which is X2. Both X1 and X2 use the same vacuum system, gas delivery system, and high-voltage power supply, so experiments may not be done using both at the same time. X1 is for the simpler experiments and X2 is for the more advanced experiments.

The small lab recently received a complete safety analysis by Jerry Levine and PPPL's safety folks, and Helrich

returned to PPPL to see how it operates and to review its manual. "I am first very grateful to Stewart Zweben who had this idea during my visit to PPPL in August of 2004. I have appreciated Stewart's keeping me informed of the details of construction and the manual for the experiments that could be done as this was developed. That gave me a sense of being truly involved in this project from the onset," said Helrich. "The hospitality shown me by PPPL also made working through the experiments a pleasure. Specifically, I am grateful to Mike DiMattia, who helped with details of the apparatus, and to Sam Cohen, who made me feel like a true colleague."

Through a Department of Energy agreement arranged by Andrew Post-Zwicker, PPPL will loan the experiment to Goshen for an initial one-year period, which may be renewed annually. As the plasma science program at Goshen develops, the experiment may be transferred to Goshen under DOE's Energy Research and Laboratory Equipment grant program. The experiment is expected to be operational at Goshen in time for the January 2006 semester.

"It was fun for me," said Zweben. "Plus, I could play with plasmas that I could actually see with my own eyes."●

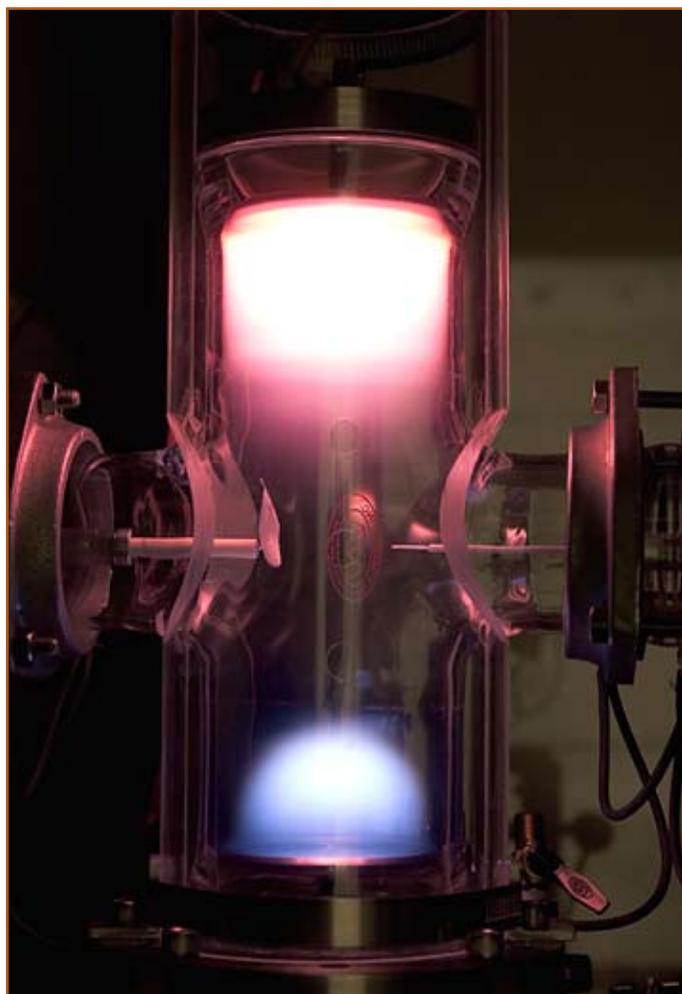


Photo by David Zweben

Above is a neon plasma in the plasma lab for Goshen College.

Colleagues and Friends Remember Gary Kater

On August 1, Gary Kater passed away after a long battle with leukemia. Kater, who had been at PPPL for 30 years in Human Resources, most recently as the Manager of Compensation, was 59. His friends and colleagues at PPPL remembered him as a wonderful and dedicated co-worker, a warm and caring individual, a sports enthusiast — both a player and a watcher — and a devoted husband and father. Many continue to feel his presence.

“Gary is a part of Human Resources each day. He’s on my phone list, his signature is on our forms, his baby picture is on the wall, his name is in books here. He comes to mind when I strain to remember how we handled something a few years back or when calls come in from retirees asking how he is and responding so very sadly, or when I stumble upon recent notes from a pad recording procedures for Jean [Wernock], or get a call from Steve Iverson — there’s so much. Gary shared with me just a few weeks ago how lucky he is to have had so many good friends here and just as many to look forward to seeing again. Gary handled his sickness with grace, patience, and concern for how we all felt. He is my friend and I miss him,” said PPPL Human Resources Head Susan Murphy-LaMarche. Murphy-LaMarche worked with Kater for many years and continued to keep in touch with him while he was out on disability in recent times.

Calm Demeanor

Former Human Resources Head Steve Iverson praised Kater for his professionalism, depth of knowledge, and sense of tranquility. “Gary served the Laboratory with dedication and distinction. He created a compensation program for PPPL that was endorsed by the University and the Department of Energy. His analyses and recommendations were extremely professional and maintained PPPL salaries at competitive levels. His counsel and calm demeanor will be deeply missed,” Iverson said.



Sue Hill, who worked with Kater in Human Resources, remembered him as a “huge baseball fan” with a sense of humor. Baseball even crept into his eulogy in the form of a favorite Kater joke about two best friends who loved baseball and wondered whether it was

played in heaven. One died and some time later, the other was awakened during the night. He thought it was his deceased friend, Fred, visiting him. “Fred, is that you? Tell me, is there baseball in heaven?” Fred said he had good and bad news to deliver. “Yes, there’s baseball in heaven ... And you’re pitching tomorrow!”

Accounting and Financial Controls Head Tony Bleach knew Kater at and outside of PPPL. “I worked with Gary for over 23 years. I knew him both professionally and personally. We debated on many issues at work, competed on the golf course, and bluffed each other at the poker table. While there was always extra joy when one of us defeated the other, we never let the competition get out of hand. I will miss those times with him,” Bleach said.

For many at PPPL, Kater was the first person they met since his job at one time involved interviewing prospective employees.

Maintenance and Operations Head Carl Potensky said, “I have known Gary for my entire career at PPPL. He was the first person I met in Human Resources when I interviewed for the job 26 years ago. Gary happened to be in the waiting room and I thought he was there for an interview like me. I started a conversation by asking him, ‘So what do they do here besides study blood?’ He looked at me and said, ‘I don’t exactly know what job you are applying for, but my guess is you will get the job.’ Gary and I then set on a 26-year relationship that touched on family, politics, sports, and, yes, work. He was always there when I needed him. I miss him as I am sure all of us do. He was a great person.”

Continued on page 5

PPPL Receives Funds for Mathematics Research

PPPL's Wei-li Lee, along with Mark Adams of Columbia University, has been awarded \$1.7 million over three years for plasma particle simulation research. The research award is funded by the Department of Energy (DOE) Office of Science's Multiscale Mathematics Program, which addresses science problems that span many time scales — from femtoseconds* to years — and many length scales — from the atomic level to the macroscopic. The problems cannot be easily broken down into simpler problems for solutions using traditional mathematical techniques.

"Science is replete with examples that range over orders of magnitude in length and time scales," said Raymond L. Orbach, Director of the Office of Science. "Brute force computational simulation, even on the most powerful present-day computers, cannot handle these ranges, so new mathematics is needed. This initiative is meant to surmount this barrier to our understanding of nature."

Lee and Adams, joined by PPPL's Stephan Ethier, Hong Qin, and Ed Startsev, will develop numerical algorithms** and computer codes that describe the complex behavior of magnetized plasmas. These cover a range of time and spatial scales and will be used to solve equations relating to ion cyclotron waves and various modes of plasma behavior that affect plasma stability and confinement. Ion cyclotron waves are used to heat plasma.

Wide Applications

The codes developed by the team will have wide applications in fusion and space physics, as well as astrophysics, and will provide training for graduate students and

post docs who are interested in computational plasma physics. The new project will sponsor a short summer school in collaboration with the interdepartmental Program in Integrative Information, Computer and Application Sciences (PICASSO) of Princeton University, for the students and young researchers from the U.S. and abroad.



Wei-li Lee

In DOE's Multiscale Mathematics Program, 13 major research awards totaling \$20 million will go to 17 universities and eight national laboratories. The program will fund more than 100 researchers who will use higher-level mathematics to help solve problems in energy production, pollution cleanup, manufacturing ever smaller computer chips, and making new nanomaterials. ●

* A femtosecond is one millionth of a nanosecond.

** An algorithm is a procedure or formula for solving a problem.

Kater

Continued from page 4

Added Information Services Head Anthony DeMeo, "Recently, while looking through some old papers at home, I found the letter offering me employment at PPPL. The letter was from Gary — one of the first people I met at the Laboratory. He was generous with his time and advice then, and throughout my career at PPPL. He will be missed greatly as a colleague and a friend."

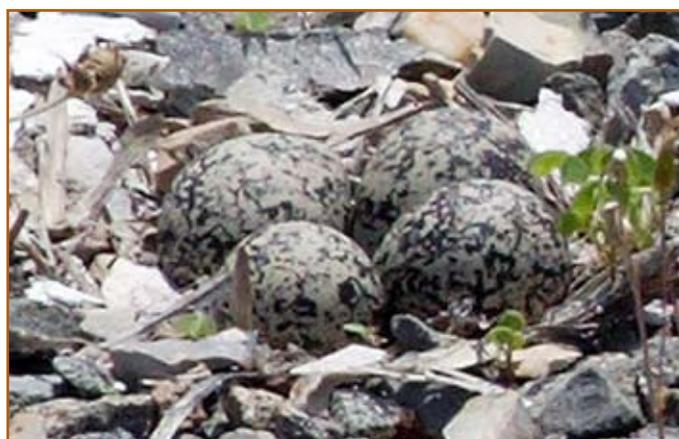
Media Services Head Carl Scimeca enjoyed working with Kater, as well as hitting the links and the slopes with him outside of PPPL. "I feel blessed that I had the honor to know Gary Kater. On occasion we played golf or skied together. At work he would stop by my office and we would discuss different ski resorts we had been to or would like to try. A few years back we went to Mountain Creek, New Jersey, to ski. Gary could always ski the icier conditions better

than I could. He was good. I can still picture him pointing the tips down the hill and letting them run. I will miss him as a co-worker, skier, and friend," Scimeca said.

Born in Trenton, Kater had been a resident of Springfield Township for the past 32 years. He received a degree in business administration from Rider University in 1968, was a U.S. Navy veteran, and active with the Hamilton Township Recreational Soccer Association.

He is survived by his wife of 32 years, Helen, a daughter, Stephanie, and her fiancé, José R. Colón.

Funeral services were held at the Saul Colonial Home in Hamilton Square on August 5, followed by a funeral mass at the St. Paul Roman Catholic Church in Burlington. Memorial contributions may be made to the Leukemia Society of America, 216 Haddon Avenue, Suite 328, Westmont, New Jersey 08108. ●



PPPL Electricians Come to Hatchlings' Rescue

Earlier this summer, PPPL's Joe Byczkowski, Jeff Bennett, and Mark Snyder were walking near the cooling towers when they noticed a small bird dragging her wing. The three, electricians in PPPL's Maintenance and Operations Division, tried to help the ring-necked bird, but she always seemed to be a few paces ahead of them, according to Shawn Connolly. Byczkowski, Bennett, and Snyder soon realized the bird was using the "broken wing" guise as a defense mechanism to draw their attention away from her four eggs, nestled in the gravel near the tower. "It was really neat to see how they made their nest in the rocks. The eggs just blended in with the gravel," said Connolly.



The birds, called killdeer birds, make a shrill sound, "kill-dee" or "kill-deer," to ward off prey. But the electricians — protectors rather than prey — were concerned that the eggs would get stepped on so they put blue cones around them. The electricians, along with other interested PPPL'ers, kept an eye on the eggs for the next few weeks. Sometimes, the female's adult male companion squawked at them — "kill-dee!" — if the female was not nearby to do her broken wing routine. When three eggs hatched, the hatchlings nearly came out running, a characteristic typical of the breed. Soon the chicks took cover at the air conditioning unit near the tower. Then the adult birds scurried the three hatchlings off. The fourth egg never hatched.

"We never saw them again, but we were glad the chicks made it safely out of their shells," said Connolly. ●

Clockwise from bottom left: a killdeer bird takes a bath near the cooling tower; the mother bird blends into the gravel where her eggs are protected by a blue cone; the four killdeer eggs nestle into the stones; the protective blue cone stands in the gravel between the road and the nest of eggs.

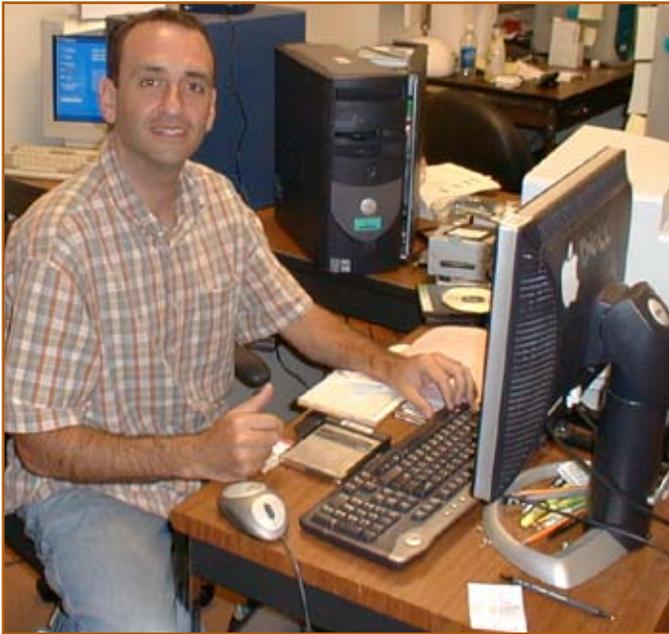


Photo by Marc Cohen

Name: Chris Minervini

Position: User Support Specialist in PPPL's Computer Division. As part of a team at the Help Desk, his primary responsibilities include providing support for desktop personal computers (PCs) at PPPL. Minervini is equally versed in PCs and Macs.

In addition to his Help Desk duties, he does some administration of the mail server and for the Windows Domain. Minervini also helps with special projects. At one of the Snowmass fusion meetings in Colorado, he worked with PPPL's John DeLooper to set up a ten-computer help desk with a printer and wireless network.

Quote: "I like PPPL. In my position, I get to see every area of the Lab. I think I've been to nearly every office since I joined the Lab five years ago. I also like solving computer problems. There are so many types of systems and software, and we have to come up with inventive solutions. The problems here are interesting because nothing is straightforward," says Minervini.

Minervini received a degree in advertising and public relations in 1993 at Johnson and Wales University in Providence, Rhode Island, and went into graphic arts for five years. As a college grad, he says he had a "cheap little Mac." That soon changed. The business where he worked used mostly PCs, except for the publishing staff that included him. Soon,

Minervini became the unofficial Mac user support person for the group and was becoming more and more interested in computers, both Macs and PCs. Minervini decided to take courses at The Chubb Institute to acquire a more formal education in computers, especially PC support, and earned a certificate. He then took the job at PPPL.

Minervini described a typical day at work. When he arrives, there is usually somebody calling or at his door asking for advice on a computer problem. From there, he tackles one computer dilemma after another, ranging from fixing simple configuration problems to repairing hard drives, and from setting up new systems to answering users' everyday questions, such as, "How do I fix a setting in the Word program?"

"Users here have various levels of knowledge about computers and software. Some only know what they need to know to do their job, which is usually all they need," Minervini observes. Some computer problems are perpetually perplexing, and take months to unravel, while others can be answered in a sentence or two over the phone. One that has stymied him for more than a month is a malfunctioning printer (he's still trying to work out the problem). A simpler one to rectify involved paper that had been leaning on the control key of an individual's keyboard. "Some problems are tricky to find solutions for and others you can spot immediately or answer on the phone," he says.

Other interests: "I live with my family at the beach in Manasquan, so I do a lot of running and surfing. For the last five years, I've run the five-mile Turkey Trot in Manasquan, which is the weekend before Thanksgiving every year," Minervini says. He especially enjoys spending his leisure time with his wife, Cassie, and their two-year-old son, Ryan. "Most of my free time is spent keeping up with Ryan and answering his 'why?' questions," says Minervini, a movie and TV trivia buff.

As a kid growing up in Spotswood, New Jersey, Minervini thought he'd go into advertising because it sounded fun to make commercials. In college, his interest in advertising led him to graphic design, which pointed him toward computers. He continues doing graphics as a hobby, designing special events invitations and CD covers for family and friends. For his son's baptism, he took a Van Halen album cover, scanned it and reduced it to CD size, placed his son's face on the cover, and replaced the text with the event title. "I burned CDs with songs that all included 'baby' in them, and gave the CDs to all the guests." ●

Meade and Schmidt Receive DOE Distinguished Associate Awards



Dale Meade (left) and John Schmidt accept the DOE Distinguished Associate Awards from N. Anne Davies during their joint retirement luncheon.

On July 29, colleagues, friends, and family of Dale Meade and John Schmidt gathered at Carlucci's Grill in West Windsor to wish the two well in their retirement. Meade and Schmidt announced their retirements in May. Meade, who was at PPPL for a total of 34 years, was Program Head of the PPPL Off-site Research Department and led the Next Step Options Activity. Schmidt, who came to PPPL in 1969, was Project Head of the Off-site Research Department. Accolades were bestowed on them during the retirement party, as well as awards from N. Anne Davies, Associate Director for Fusion Energy Sciences at the Department of Energy (DOE) Office of Science. Davies presented each with a DOE Distinguished Associate Award, signed by Samuel Bodman, Secretary of Energy. Congratulations on the awards, Dale and John, and best wishes in your retirement! ●

The DOE Distinguished Associate Award citation for Dale Meade:

"In recognition of your outstanding career in fusion research that includes major accomplishments in leading the Poloidal Divertor Experiment, bringing the Tokamak Fusion Test Reactor into a state of readiness to conduct high power deuterium-tritium experiments, designing a next-step burning plasma physics experiment, and through your boundless energy and advocacy materially advancing fusion research toward the goal of being an effective power source for the Nation and the world."

The DOE Distinguished Associate Award citation for John Schmidt:

"In recognition of your successful career of more than thirty-six years at the Princeton Plasma Physics Laboratory. You have made outstanding contributions to fusion research and demonstrated the ability to lead diverse teams of scientists and engineers in producing designs of groundbreaking fusion experiments, including the overwhelmingly successful Tokamak Fusion Test Reactor that completed its mission in 1997, the National Spherical Torus Experiment that is currently producing exciting scientific results at PPPL, and the KSTAR Experiment that is being built in Korea based on the design of the Tokamak Physics Experiment effort that you led."