PPPL U.S. DEPARTMENT OF ENERGY
PRINCETON PLASMA PHYSICS LABORATORY
WEEKLY
MONDAY, JULY 23, 2012

At PPPL THIS WEEK

MONDAY, JULY 23

GFDL Events and Seminars

2 p.m. - 3 p.m. ◇ GFDL Smagorinsky Seminar Room

Short Lived Climate Pollutants: A Second Front in Climate Change Mitigation

V. Ramanathan

www.gfdl.noaa.gov/events

(Gov't, Univ. or 2 other forms of I.D. needed)

THURSDAY, JULY 26

NSTX-U Diagnostic Planning Meeting

1:30 p.m. - 4 p.m. ◇ B-318

FRIDAY, JULY 27

DIII-D Science Meeting

1 p.m. ◇ B-233

ATTENTION ALL EVENTS PLANNERS AND PUBLICIZERS:

Please note that Lab events MUST be posted to the "Research" calendar on Google Mail in order to be listed in the "At PPPL This Week" list of events.

The deadline for listings in the WEEKLY (which comes out on Mondays) is Thursday at noon. Please remember to post these items in advance with detailed title, speaker and speaker affiliation as well as the date, place and time.

PPPL'ers want to know about your event!

Thanks very much!

Bob Ellis Rides the Wave

By Patti Wieser

Bob Ellis installs wires on the ECH launcher for the KSTAR tokamak in South Korea. The launcher is the small metal structure on his left, with graphite plates and wires dangling at the bottom. The wires are thermocouples for measuring the temperature of the mirrors.

Photo by: Dr. Mi Joung (KSTAR)

Bob Ellis has been coming to work at PPPL since he was a young child. The 1960s were a heady time at the Laboratory when researchers brimmed with optimism and ideas, congregating in offices for conversations and conducting experiments in lab areas.

Ellis's first recollection at PPPL is being about six and listening to scientists — including his father — talk excitedly about fusion concepts and plasma physics. Today, Ellis is a principal engineer at PPPL who specializes in the design of radiofrequency (RF) equipment and diagnostic systems for fusion energy experiments. Earlier this spring, he was named the Head of Alcator C-Mod collaborations for PPPL.

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Science Educators Take Zero-G Experiments to PPPL Parking Lot

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Bob Ellis

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"There were a lot of neat things around," Ellis recalled of the visits during which he accompanied his father, physicist Robert Ellis, to the Matterhorn Building on the B-site of Forrestal Campus. Spiral coils and round metal parts piqued his curiosity as he sat at his father's desk or watched while the senior Ellis plugged in cords and ran experiments.

In 1981, two decades later — "on a whim" — the younger Ellis applied for a position at PPPL, a diploma in hand from Princeton University's School of Engineering, along with the knowledge gained from postgraduate work at Princeton. He planned on being at PPPL for three years in a scenario he had devised named the "three, three, and three." The idea was to work at three different places for three years each and then settle down at one institution for the duration of his engineering career.

"But there kept being really interesting things here. So I never did the three, three, and three thing," Ellis said.

His first task at PPPL was to complete a finite element stress analysis of the vacuum vessel of the S-1 spheromak, a type of fusion experiment. "After I got done with that, I started designing the water cooling system for the spheromak, and S-1 was turned over to a physicist named Bob Ellis," said Ellis. It was the only time he worked for his father. The young engineer installed the water system — all the main pipes — used for cooling the spheromak magnets, which confine and shape plasma, a super hot gas of charged particles used as the fuel for fusion experiments.

"One of the reasons I wanted to come here was because I wanted to build stuff. I always thought that's what engineers were really supposed to do," Ellis said. "Maybe water systems are not the most glamorous job, but you learn your craft as an engineer doing that type of work."

Eventually, he moved into diagnostics — tools that measure characteristics of plasma — and the design of wave launchers for heating fusion plasmas.

Ellis installed some of the day-one diagnostics for the Tokamak Fusion Test Reactor (TFTR), finishing up conduits for voltage loops when the machine was coming on line at PPPL during the 1980s. "It was a good way to get introduced to what some of the diagnostic systems were supposed to do," he said. "My work also involved some analysis and oversight of the design and fabrication of the Thomson scattering system." The scattering system measures electron temperature and density in fusion plasmas. While the diagnostic was not used for the initial experiments, the work had to be completed before operations began.

Toward the end of TFTR operations, the engineer designed one of three antennas that deliver RF waves to heat and drive an electric current in fusion plasmas. "That was my introduction to the world of radiofrequency work," said Ellis, who received a master's degree in mechanical engineering from the New Jersey Institute of Technology in 1998.

Soon he was collaborating, first on the Alcator C-Mod experiment at MIT, next on the KSTAR tokamak in South Korea, and eventually on the Joint European Torus (JET) in Culham, England. On the last, he worked with PPPL physicist Doug Darrow on a diagnostic for measuring escaping alpha particles. These positively charged alpha particles impart energy to the plasma, heating it.

"Doug was in charge of the effort on that and asked if I would do the engineering. That was a really nice experience, and very interesting," Ellis said. "It gave me a chance to see how a different country, and a different lab, operates. At JET, there are challenges because all the installations of equipment and diagnostics need to be done by remote handling since there is a combination of tritium and beryllium in the JET vacuum vessel."

Darrow described Ellis as a "very knowledgeable and capable mechanical engineer" who worked with him designing the "lost alpha" diagnostic for JET. "Bob was the perfect person for the job as he was able to keep in mind both the long view of the project goals and the immediate demands of the design process. He was able to take in stride the rather demanding expectations for forces and temperatures the JET design rules required and his disarming chuckle came forth at a number of points when words for a particular engineering concept proved to be different on the opposite sides of the Atlantic," Darrow said. "His good nature also proved valuable as parts were being delivered late from suppliers, yet there was a fixed final installation deadline to meet at JET. Bob kept everything moving steadily until the device was crated, shipped, and delivered to JET."

The JET experience makes Ellis the first PPPL engineer to have designed and built a system installed by a robot. "This is important expertise for PPPL as fusion research moves into the ITER era, where in-vessel systems will be exclusively installed and maintained by robotic means," Darrow noted.

Randy Wilson, Head of the ITER and Tokamaks Department at PPPL, praised Ellis for his collaborative work and new assignment at Alcator C-Mod. PPPL continues to be the home base for Ellis, who travels often to the collaboration site at MIT.

"Bob has a long history of involvement with the collaboration, including work on RF antennas and other diagnostics, as well as his present involvement with the hot outer divertor design," said Wilson. "Bob has en-

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Bob Ellis

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thusiastically taken up his new duties and proven effective in working with both his PPPL and MIT colleagues."

Bruce Lipschultz, a senior research scientist on MIT's Alcator C-Mod, wrote, "Bob is a pleasure to work with for his depth of knowledge and his sparkling personality. He has an excellent grasp of the underlying engineering concepts such that when we discuss things he can make quick calculations that show whether the idea makes sense or not. In joint projects he is very supportive and a good communicator."

As the years passed, the challenges increased and the tasks varied. He faced many challenges: the dimensional controls on the National Compact Stellarator Experiment at PPPL; the high power, high fields and high currents of C-Mod at MIT; the moving components of DIII-D at General Atomics; the brutal environment of JET, which meant that diagnostics had to be extremely rugged, but, at least on one, still be able to use super-thin foil detectors; and the steady-state components of KSTAR in South Korea. "They all have their challenges," Ellis remarked, lauding the value of working with others on projects. "Being part of some of those collaborations and bringing expertise in certain areas makes a big, big difference."

The collaborations and his three decades at the Lab mark a career rich with diverse work. "I've been able to work in areas as different as plasma heating and diagnostics, and the projects are quite different," Ellis said. "It's never felt as though I've been doing the same thing for 30 years or so and certainly things are a lot different than when I was tagging along with my father."

Ellis recently received the PPPL Distinguished Engineering Fellow Award in recognition of his innovative and engineering accomplishments. "Bob is a versatile engineer well known throughout the national and international fusion community," said Michael Williams, PPPL Associate Laboratory Director for Engineering and Infrastructure. "His development of electromagnetic wave launchers for tokamaks in the U.S. and South Korea, and of techniques to meet National Compact Stellarator Experiment dimensional requirements, among other contributions, has distinguished his engineering talents." "You'll find no one with greater integrity than Bob, which carries on the legacy of his father," added fellow PPPL engineer Irving Zatz, who has worked with Ellis since the latter's first day. Zatz was also acquainted with the senior Ellis.

Parents as Influences

Ellis recalled how his parents, now both deceased, were pivotal influences in his life. His father — a plasma physics pioneer who was a key member of the Project Matterhorn team and headed experimental projects at PPPL for many decades — inspired him to gravitate toward science and technology, and his mother, a teacher with a Ph.D. in Germanic languages, instilled in him an appreciation of language and the arts. "I've always gravitated toward the mechanical side of engineering," said Ellis, who is equally at ease performing chamber music as a violinist in a professional quartet.

Bob Ellis inspects wiring on a mock-up of the DIII-D and KSTAR ECH Launchers.

Outside the office, he enjoys spending time with his wife, Connie, playing music and bicycling. "I played violin seriously until I crushed part of my left hand in a bicycle racing accident in college," Ellis said. He kept up with bike racing and coached the sport at Princeton University for many years. Now Ellis bikes "enough to keep healthy" and picked up the violin again some years ago, his injuries long recovered.

Japanese calendars dot the walls of his office in the first floor of the Engineering Wing, reflecting his fondness for travel and the three months he spent working on a Japanese tokamak, JT-60. "There is no instant gratification in this business. You have to wait to see how a diagnostic did and give it a couple of years of service to see if it's still going strong," Ellis said. "Everything you design has to survive in a challenging environment. If you do something that actually works and helps out the fusion program, it's definitely rewarding."

As he enters his fourth decade at PPPL, it's as if he's riding a wave, bridging fusion's past with the present and the future, his collaborative efforts spanning the U.S., Europe, and Asia. And Ellis has an important wish: To be around when one of fusion's major goals is realized.

"I'd certainly like to see breakeven in my lifetime," Ellis said. "Whether I'm working that long is another question altogether. But you know it'd be neat to turn on CNN and hear about it, and recognize some of the people who are in the control room."

Science Educators Take Zero-G Experiments to PPPL Parking Lot

By Patti Wieser

Area teacher-scientists and science educators conducted experiments in a simulated reduced-gravity environment at PPPL's upper parking lot on July 18. With the help of the Plainsboro Fire Department and PPPL's Site Protection Division, the researchers performed free-fall drop tests, releasing a container filled with iron filaments from about 100 feet to observe the filings in reduced gravity. One fall included a magnet to investigate its effect on the iron filings under the same conditions. The free fall produces an environment similar to zero gravity.

The container, buffered with Styrofoam and aimed at a cushioned landing, was dropped by PPPL's Jamie Alkhateeb from the ladder of Plainsboro Fire Engine 49. The scientists are involved in a workshop program at PPPL called CLOμDS, or Classroom Leadership Operative in μ-gravity Discovering Science.

"The goal of the drop test was to determine how to best disperse the iron filings while in zero gravity," said Stephanie Wissel, a postdoctoral research fellow in PPPL's Science Education Program and an organizer of the experiments. She said the team found that as the box fell, it rotated, allowing the particles to flow enough to trace out the magnetic field lines.

"You don't need zero gravity to see the effect of magnets on iron filings, but the smooth flow of the particles enabled more filings to trace out the field lines further away from the magnet," Wissel explained. "The results of this experiment show us that we need to develop a way to smoothly disperse the iron filings in our microgravity experiment, either through a rotating drum, a blower, or another method."

Thanks to All

Wissel thanked everyone at PPPL and the Plainsboro Fire Department for their help (listed on page 5). The experimental team — the educators from the Franklin Institute in Philadelphia and other teachers in the CLOμDS program — will take the experience back to their classrooms and to the museum floor. "This drop test advances their understanding of their system, and reminds us all that even though science is an incremental process, we can learn much while still having fun," she said. "We've had considerable time to reflect on how to bring the process of science into the classroom, especially the persistence and diligence it sometimes requires."

In photo at top right, PPPL's Jamie Alkhateeb drops the experiment from the ladder of Plainsboro Fire Engine 49.

In center photo, PPPL's Stephanie Wissel (left) and Howard Caruso get ready for the drop test.

In photo at bottom right, The CLOμds team reviews initial results of one of the drop tests with Wissel (in red hard hat).

PPPL Helpers for the Drop Test

Jamie Alkhateeb
Andy Carpe
Howard Caruso
John DeLooper
Spence Holcombe
Bob Lamb
Jerry Levine
Ani Malool
Aliya Merali
Deedee Ortiz
Kevin Rhoades
Keith Rule
Marissa Schaefer
Sandy Shaw
Emily Silber
Bill Slavin
Elle Starkman
Dolores Stevenson
Dorothy Strauss
Darren Thompson
Marianne Tyrrell
Mike Viola
Doug Wallack
Patti Wieser
Fran White
Kelli White
Stephanie Wissel

The following firefighters from Plainsboro Fire Department Station 49 were on site Tuesday and Wednesday supporting the CLOμDS experiment:

Matt Casterline
Matt Collins
Rich Dizminski
Matt Hagood
Darren Salked
Dave Seip

Here is a full listing of the membership of the PPPL ADVISORY COMMITTEE featured in the July 16 PPPL WEEKLY: Ronald Parker, chair; Steve Cowley, science committee co-chair; Sibylle Guenther, science committee co-chair; Jay Marx, operations committee co-chair; Dave Anderson; Jack Anderson; Bill Dorland; Karen Downer; Curtis Hillegas; Patricia McBride; Chris McCrudden; Tim Meyer; Don Rej; Kem Robinson; Ned Sauthoff; James Stone; Tony Taylor; Hiroshi Yamada. William Madia, an original committee member, stepped down from the committee and from his position as operations committee co-chair earlier this year because of the press of other business.

PPPL Café Menu

BREAKFAST ..... 7 a.m. • 10 a.m.
CONTINENTAL BREAKFAST..... 10 a.m. • 11:30 a.m.
LUNCH ..... 11:30 p.m. • 1:30 p.m.
SNACK SERVICE ..... until 2:30 p.m.

	MONDAY JULY 23	TUESDAY JULY 24	WEDNESDAY JULY 25	THURSDAY JULY 26	FRIDAY JULY 27
COMMAND PERFORMANCE CHEF'S FEATURE	 ORIENTAL CHICKEN & BROCCOLI OVER RICE	 STRAWBERRY FIELDS SALAD	 SHRIMP, CRAB, RICOTTA STUFFED SHELLS	 HONEY MUSTARD CRUSTED PORK CHOPS	 BROCCOLI, RICE, CHEDDAR CHEESE AND CHICKEN CASSEROLE
EARLY RISER	Oatmeal Raisin Pancakes w/ Turkey Sausage	The XL Meat Lover Omelet w/ Home Fried Potatoes	Breakfast Burrito Featuring Ham	Old Fashioned Breakfast	Sausage, Egg & Cheese on a Fresh Baked Croissant
COUNTRY KETTLE	Chicken Noodle	Pasta Fagioli	Mulligatawny	Cream of Ham and Potato	Borscht
GRILLE SPECIAL	Italian Sausage Sandwich with Fries	Cheese Steak with Bacon, Onion, Tomato, Spiral Fries	2 Chili Cheese Dogs with Fries	The Fatcat Hoagie	The Ranch Chicken Cheesteak
DELI SPECIAL	Toasted Open Faced Ham and Provolone Hoagie	2 Slices of Pizza with a 20 Ounce Soda	Classic American Hoagie	Egg Salad and Bacon Wrap	Waldorf Chicken Salad Wrap
PANINI	Roast Beef, Pepper Jack, Tomato, Banana Pepper	Pepperoni, Provolone	Eggplant, Zucchini, Squash, Portobello, Red Pepper and Provolone	Chicken Parmesan	Ham, Pineapple, Swiss, Tomato and Spicy Mayo

MENU SUBJECT TO CHANGE WITHOUT NOTICE

CLICK HERE FOR A PRINTABLE WEEKLY MENU

WEEKLY

Editor: **Patti Wieser** ◆ Copy Editor/Graphic Designer: **Gregory Czechowicz**
Photographer: **Elle Starkman** ◆ Webmaster: **Chris Cane**

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Deadline for calendar item submissions is noon on Thursday. Other stories should be submitted no later than noon on Wednesday.
Send to: pwieser@pppl.gov ◆ Comments: commteam@pppl.gov ◆ **PPPL WEEKLY** is archived on the web at: http://www.pppl.gov/ppplweekly.cfm