PPPL PRINCETON PLASMA PHYSICS LABORATORY
A Collaborative National Center for Fusion & Plasma Research
U.S. DEPARTMENT OF ENERGY
WEEKLY
JANUARY 13, 2014

At PPPL THIS WEEK

WEDNESDAY, JAN. 15

PPPL Colloquium
4:15 p.m. ◆ MBG Auditorium
The Global Carbon Cycle and Earth's Climate
David Archer, University of Chicago

SATURDAY, JAN. 18

Science on Saturday Lecture
9:30 a.m. ◆ MBG Auditorium
Physics of Cancer
Prof. Wolfgang Losert, University of Maryland

UPCOMING EVENTS

January 22
PPPL Colloquium
4:15 p.m. ◆ MBG Auditorium
Addressing Big Data Challenges in Simulation-based Science
Manish Prashar, Rutgers University

January 22-29
Business Clothing Drive
8-9 a.m & 12:30-1:30p.m. ◆ A116

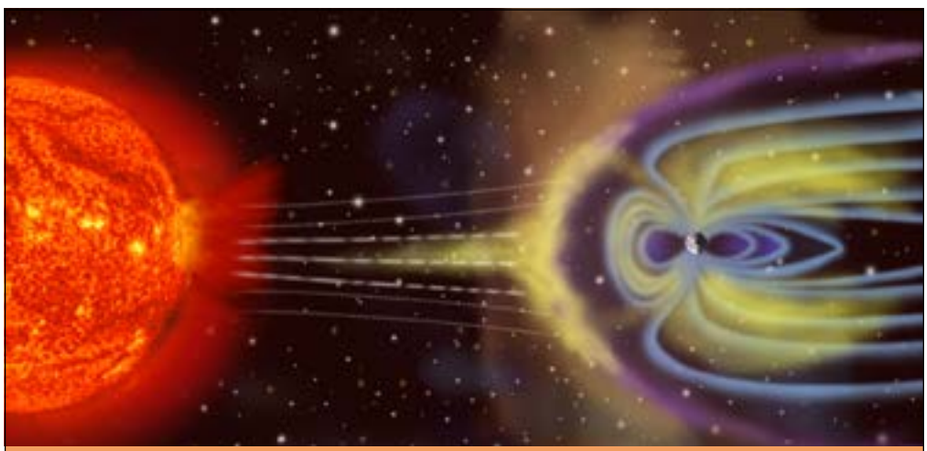
January 25
Science on Saturday Lecture
9:30 a.m. ◆ MBG Auditorium
The Atmosphere as a Laboratory: Aerosols, Air Quality, and Climate
Peter DeCarlo, Drexel University

January 29
PPPL Colloquium
4:15 p.m. ◆ MBG Auditorium
The Usefulness of Useless Knowledge: The History of the Institute for Advanced Study
Christine DeBella, Institute for Advanced Study

INSIDE...

New center to study volatile space weather and violent solar storms

By John Greenwald



Computer simulation of the solar wind in contact with the Earth's magnetosphere. The streaming wind compresses the magnetosphere on the side of the Earth that is nearest the sun, and stretches the magnetosphere into a long "tail" as the wind blows past the Earth and farther away from the sun.

Researchers at Princeton University and PPPL have launched a new center to study the volatile heliosphere — a complex and frequently violent region of space that encompasses the solar system. This region is carved out by the solar wind — charged plasma particles that constantly stream from the sun — and gives rise to space weather that can disrupt cell phone service, damage satellites and knock out power grids.

Such stormy weather results from solar flares and coronal mass ejections — huge solar eruptions that periodically hurl millions of tons of electrically charged plasma particles into the heliosphere. Eruptions that slam into the magnetosphere — the magnetic field that surrounds the earth and extends some 75 million miles into space — can trigger disturbances called geomagnetic storms. One notable outburst blacked out the Canadian city of Montreal and most of the province of Quebec for 12 hours in 1989.

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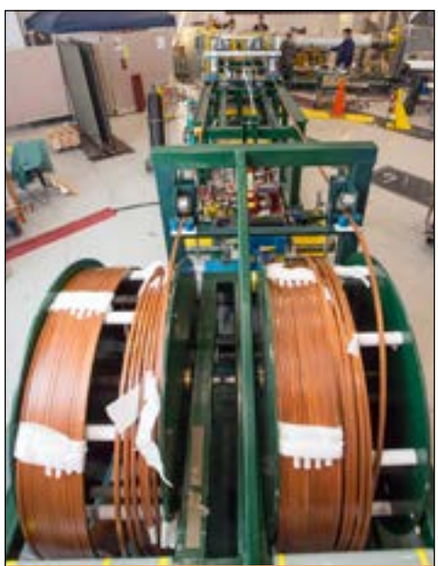
Winding up the NSTX-U center stack



Two spools of copper conductors are pulled tightly in a machine before being wound onto the center stack in the background.

Work began last week on a crucial step in the $94 million National Spherical Torus Experiment Upgrade (NSTX-U) when technicians began winding copper conductors to create a solenoid around the four quadrants that will make up the center stack of the spherical tokamak.

The copper conductors are placed on devices designed and constructed at PPPL that hold them taut by applying 1,000 pounds of force. The conductors are then wrapped in insulation and wound tightly onto the center stack.

"It looks like technically it's going superbly," said Laboratory Director Stewart Prager, who visited the coil winding facility last week to watch the work in progress. "It's fantastic the way they've invented and assembled this complex winding apparatus."

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PPPL Wins DOE 2013 Sustainability Award

The Princeton Plasma Physics Laboratory recently received a 2013 Sustainability Award for Improved Performance from the U.S. Department of Energy.

"DOE called this the award for greatest improvement," said Robert Sheneman, head of the Environmental Services Division. "I think that's a reflection of the commitment the Lab has made and the hard work of the people involved in our efforts to reduce our energy footprint, control our greenhouse gas emissions and our water use and the sustained and robust recycling program. Those are just a few of the areas where the Lab is far exceeding the national goals."

The Laboratory had a recycling rate of about 76 percent in fiscal year 2013, a 7 percent increase from the previous year. It recycled 73 percent of all construction and demolition materials. PPPL also composted more than 15 tons of material, an increase of 50 percent. PPPL's contract with its cafeteria vendor requires that all plates, bowls, cups, lids, and even take-out clamshells be recyclable. PPPL also has an aggressive green purchasing program and buys green products whenever possible, including green cleaning products. Almost half of PPPL vehicles use bio-based alternative fuels.

The Laboratory also significantly reduced the amount of greenhouse gases it produces, not only by reducing the amount of waste going into landfills but also through a 75 percent reduction in greenhouse gas emissions since 2008. The Laboratory has cut non-experimental energy use by 48 percent over the past decade.

"This is really a Laboratory-wide recognition," Sheneman said. "It's really everyone doing their part that makes a difference. Everyone plays a role. They play a role by using task lighting instead of overhead lighting, by making sure they don't use lights they don't need, by putting recycling in the right bins. It's the simple stuff."

Pictured below are staff members who are instrumental in PPPL's sustainability program. Front row left to right: Mike Viola, head of Facilities and Site Services; Leanna Meyer, environmental scientist; Margaret Kevin-King, Building and Grounds supervisor; Fran Cargill, branch head of Material Services; back row left to right: Ron Templon, head of Procurement; Ed Jenkins, contract technical representative; Robert Sheneman, head of the Environmental Services Division; and Tim Stevenson, head of Project Management.

Annual business clothing drive Jan. 22 to Jan. 29

Please join Princeton University and PPPL's annual drive and donate gently used business attire for men and women who are reentering the workforce and cannot afford a business wardrobe. The clothes will be distributed by several Mercer County organizations. PPPL will also be collecting used eyeglasses as well as unwanted stuffed toys that will be used to create dog toys. Items can be dropped off in Room A116 between 8 a.m. and 9 a.m. and 12:30 and 1:30 p.m. from Jan. 22 to Jan. 29.

NSTX-U coil winding

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The insulated conductors will be wound 880 times around the center stack to create four separate layers before the final coil winding process is finished this spring. The solenoid will then be sealed and insulated through the vacuum pressure impregnation (VPI) process, which will involve placing the solenoid in a vacuum-sealed mold and injecting it with a liquid epoxy. The combined solenoid and center stack will next be inserted into an Inconel (a nickel-chromium alloy) casing, which will be covered with graphite tiles to protect against high plasma temperatures. The completed center stack will become the core of the NSTX-U.

"It's looking good so far," said team leader James Chrzanowski. "Now I can say confidently we are in the winding mode and this is going to be going on for several months."

Technician Buddy Kearns examines the tape machines that apply insulation to the copper conductors.

Technicians apply clamps to the insulated conductors before guiding them onto the stack where they are wound tightly by the winding device at the far left. From left to right: technician Andy Carpe; Mike Anderson, senior lead in charge of the coil winding; technicians Dave Moser and Steve Bartzak.

New Center

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The newly formed Princeton Center for Heliospheric Physics aims to sharpen the capacity to predict solar eruptions and to deepen understanding of the plasma flows and magnetic forces that emanate from the sun. "All this is the domain of heliospheric physics," said Amitava Bhattacharjee, head of the Theory Department at PPPL and co-director of the new center with PPPL physicist Jay Johnson.

The center combines the resources of Princeton's Department of Astrophysical Sciences and PPPL and facilitates collaboration between them. For example, the joint enterprise will bring together Princeton work on an explosive phenomenon called magnetic reconnection with PPPL research on the subsequent acceleration of plasma particles caused by waves in the plasma, which takes place in the inner magnetosphere — the section closest to Earth. Such processes underlie geomagnetic storms and related phenomena known as substorms. "Having these complementary efforts within the center provides us with the essential tools for better understanding of space weather," Johnson said.

Contributors to the center include Princeton astrophysicists James Stone and Anatoly Spitkovsky, whose focus on plasma dynamics beyond the solar system is closely related to issues that heliospheric scientists face. "We plan to share knowledge, computational tools and results in a way that will benefit all parties," said Stone. "We are lucky to have this new center right next door at PPPL." Further tying together such efforts is the website helio.pppl.gov that PPPL physicist Eun-Hwa Kim designed and manages.

Key center projects include:

- Development of a computer code to model as precisely as possible the physics behind the role of magnetic reconnection in geomagnetic storms. Current codes can't provide detailed descriptions of the movement of charged particles during reconnection events, in which the magnetic fields in plasma break apart and reconnect with the force of millions of tons of TNT. "It has become clear that while these models are powerful, important effects are missing," Bhattacharjee said.

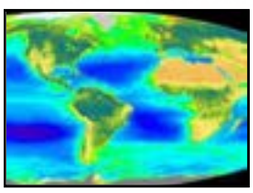
Funds for this project come from a five year, $3.5 million grant from the National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) to five institutions, with the new center receiving $1.25 million, the largest single slice. Each institution is to model a different aspect of space weather in what NSF termed "a theoretical and computational grand challenge." Participants in addition to Princeton include the University of New Hampshire, the University of California-San Diego, Los Alamos National Laboratory and NASA's Godard Space Flight Center.

- Studies of the interaction between the solar wind and the magnetosphere that affect the Earth. This interaction redistributes mass and energy throughout the magnetosphere and can whip up disturbances that pose a danger to spacecraft and to the human exploration of space. The dynamics of these processes in the inner magnetosphere — the near-Earth portion of the field — is a key focus of researchers in the PPPL theory group who are members of the center.
- Research on heliospheric topics ranging from solar radio bursts that can disrupt cell phone service to the turbulent transport of plasma particles in the magnetosphere to the behavior of plasma waves in the magnetic field that surrounds the planet Mercury. Broad funding for the center's work on such topics comes from NSF and NASA.

Bolstering the center's research will be its ability to tap into other projects at PPPL. For example, the Magnetic Reconnection Experiment (MRX) at PPPL has produced reconnection under laboratory conditions for nearly two decades. Such data will enable center researchers to test the power of their codes to predict the outcome of MRX experiments. "If we can do that well," said Bhattacharjee, "it will give us confidence that our codes are good for predictive capability for reconnection outside the realm of the laboratory."

PhD Comics
WWW.PHDCOMICS.COM

COLLOQUIUM



The Global Carbon Cycle and Earth's Climate

DAVID ARCHER
University of Chicago

Wednesday, January 15

4:15 p.m. (Coffee/Tea at 4 p.m.) • MBG Auditorium

2014 Science on Saturday

Princeton University Plasma Physics Laboratory Lecture Series

Physics of Cancer

PROF. WOLFGANG LOSERT
Associate Professor, and Director, Partnership for Cancer Technology, University of Maryland, Dept. of Physics and Institute for Physical Science and Technology

Saturday, January 18

9:30 a.m. • MBG Auditorium

Café at PPPL Menu

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

— MARK GAZO, Chef Manager

	MON. 13 JAN.	TUE. 14 JAN.	WED. 15 JAN.	THU. 16 JAN.	FRI. 17 JAN.
COMMAND PERFORMANCE CHEF'S FEATURE	 Fried Chicken with Mashed Potatoes, Gravy & Veggies	 Cheese Tortellini Pomodoro with Salad	 Taco Salad Bowl with Your Toppings	 Apple Cranberry Stuffed Pork Loin	 Lemon Garlic Shrimp and Grits
EARLY RISER	Apple Pancakes with Cider Syrup	Chicken, Spinach, Mushroom & Cheddar Omelet with Potatoes	Strawberry Shortcake French Toast	Grilled Cheese with Bacon, Ham & Fried Egg	Cinnamon Coffee Bundt Cake served with Fruit Salad
COUNTRY KETTLE	Tomato Basil Bisque	Beef Noodle	French Onion	Rustic Italian Tortellini Soup	Vegetarian Split Pea
GRILLE SPECIAL	Roast Beef Melt on French Bread with Baked Beans	Kielbasa & Kraut Torpedo served with Fries	Cajun Catfish Po' Boy with Slaw, Remoulade Sauce & Hush Puppies	Chicken Cacciatore with Peppers, Onions & Mushrooms on Torpedo	Philly Style Portobello Cheese Sandwich
DELI SPECIAL	Chopped Veggie Antipasto Wrap	Chopped Chicken Caesar Sammie	BLT with Avocado, Smoked Ham & Mayo on Whole Grain Toast	Classic Tuna Club Sandwich with Hard Cooked Egg	Chicken Carbonara Torpedo with Bacon, Mushrooms, Mozzarella
PANINI	Italian Sausage, Pepperoni, Peppers, Onions & Mozzarella	Peppers & Egg with Potatoes Torpedo in Melted Cheese	Honey Dijon Grilled Chicken with Fresh Spinach on a Baguette	Eggplant Parmesan with Fresh Mozzarella Cheese on Ciabatta	Hot Open-Faced Roast Beef over Texas Toast with Mashed Potatoes
VALUE MEAL $5	Blueberry Pancakes with Sausage, Hash Browns, & 12 oz. Beverage	BLT with Housemade Potato Chips & 12 oz. Beverage	2 Stuffed Shells, Side Salad, Garlic Bread & 12 oz. Beverage	Hot Ham & Cheese on a Bun with Chips & 12 oz. Beverage	Chicken Tenders with French Fries & 12 oz. Beverage

MENU SUBJECT TO CHANGE WITHOUT NOTICE

VEGETARIAN OPTION

CLICK HERE FOR A PRINTABLE WEEKLY MENU

WEEKLY

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