

At PPPL THIS WEEK

MON.-FRI., MARCH 18 - 22

**Princeton University
Spring Break**

WEDNESDAY, MARCH 20

**American Red Cross
Blood Drive**

8 a.m. - 1 p.m.

Lower end parking lot

PPPL Colloquium

4:15 p.m. ♦ MBG Auditorium

Are Mushrooms the Next Polymers?
Growing Plastic Replacements with
Fungi

Gavin McIntyre, Ecovative Design LLC

Refreshments at 4 p.m. in the LSB Lobby

THURSDAY, MARCH 21

**TED Talk Conference on
"Future Utopias"**

2 p.m. ♦ St. Peter's University,
Jersey City, N.J.

Creating a Star on Earth: the Path to
Fusion Energy

Andrew Zwicker, Head, PPPL Science
Education

FRIDAY, MARCH 22

**Young Women's Conference
at Princeton University**

9 a.m. - 2 p.m.

UPCOMING EVENTS...

April 8-12

9 a.m. - 5 p.m. ♦ Princeton Center
for Theoretical Science
407 Jadwin Hall

**Stability, Energetics, and
Turbulent Transport in Astro-
physical, Fusion, and Solar
Plasmas: Unifying Theoretical
and Computational Tools**

Guest speakers include Stewart Prager

April 18

PPPL Celebrates Earth Day

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Major NSTX-U milestone: first center-stack quadrant completed

By John Greenwald

"If we had a script, I couldn't think of a better outcome." That's how Ron Strykowski, head of the NSTX Upgrade, described recent results for a critical stage of the project's construction. Riding on the outcome were months of work on the first quadrant of toroidal field conductors for the tokamak's new center stack, which forms the heart of the \$94 million upgrade.

The crucial stage called for sealing and insulating the first quadrant through a volatile process known as vacuum pressure impregnation (VPI). Preparing the nine 20 foot-long, 350-pound copper conductors for this step required the coordinated efforts of engineers and some dozen skilled technicians. The multiple tasks included soldering cooling tubes into the conductors under the direction of Steve Jurczynski, and sandblasting, priming and wrapping the units with fiberglass tape in operations led by Mike Anderson.

All these efforts were on the line during the VPI procedure. "When everything's said and done, you must join the conductors and provide mechanical and electrical strength," said Jim Chrzanowski, who leads the center-stack construction team. "VPI does both those things and it's a very delicate process."

Technicians led by Buddy Kearns began the process by injecting liquid epoxy into a carbon steel, vacuum-sealed mold that engineer Bruce Paul designed. The first quadrant lay inside. Workers gradually raised the temperature to combine the epoxy with the fiberglass tape to create a composite insulating material.

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The Center-stack team with finished first quadrant. First row from front: Guy Grow, Bruce Paul, John Trafalski, Bill White, Mike Mardenfeld. Second row: Steve Raftopoulos, Jim Chrzanowski, Dave Moser, Westley Reese, Mike Anderson, Doug Westover, Hans Schneider. Third row: Tom Meighan, Buddy Kearns, Robert Tucker, Colin McFarlane, Charlie Sands, Jim Benchoff, Steve Jurczynski, Bob Clark. Not pictured: Joe Bartzak.

NSTX-U Milestone

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The critical moment came when the process neared 100 degrees Centigrade—the temperature at which water boils and the epoxy generates heat and turns solid in what is called an exothermic reaction. The danger was that a sudden runaway reaction could cause the epoxy to burn itself up and destroy the project. Adding to the uncertainty was the fact that PPPL had never before used this particular epoxy. “We held our breath and were on pins and needles,” recalled engineer Steve Raftopolous.

These anxious minutes passed without incident. The now-solid epoxy cured at 100 degrees for 10-to-12 hours, and at 170 degrees for a similar period. Workers then opened the mold and examined the quadrant. “As soon as we lifted the lids off the mold everyone felt better,” said Anderson.

What the team found was gratifying. The process produced uniform insulation throughout the quadrant with just a few cosmetic blemishes. And the insulation easily passed electrical tests. While the composite material needed to show a resistance of at least 1 billion ohms to keep the current in each conductor separate, the insulation measured 20 billion ohms and did so between all nine conductors. “That’s as good as it gets,” Strykowski noted.

The near-perfect results bode well for the three remaining center-stack quadrants. “The fact that the first one came



Fresh from the VPI mold: The pressurized treatment produced a uniform application of insulation that showed 20 times more electrical resistance when tested than the minimum amount required.

out so well is an incentive to do the other three the same way,” said Kearns. “It gives us a more comfortable feeling that we can get this done successfully.”



Guided into position: The completed first quadrant is moved into place to await the remaining three sections of toroidal field conductors that will join it in the NSTX-U center stack.



Mission accomplished: The successful procedure capped months of demanding preparations and close teamwork. The cooling tubes in the foreground were soldered along the length of each conductor.

A fast new method for measuring hard-to-diagnose 3D plasmas

By John Greenwald

Scientists at PPPL and the National Institute for Fusion Science (NIFS) in Japan have developed a rapid method for meeting a key challenge for fusion science. The challenge has been to simulate the diagnostic measurement of plasmas produced by twisting, or 3D magnetic fields in fusion facilities. While such fields characterize facilities called stellarators, otherwise symmetric or 2D facilities such as tokamaks also can benefit from 3D fields. Researchers led by PPPL physicist Sam Lazerson have now created a computer code that simulates the required diagnostics, and have validated the code on the Large Helical Device stellarator in Japan. Called “Diagno v2.0,” the new program utilizes information from previous codes that simulate 3D plasmas without the diagnostic measurements. The addition of this new capability could, with further refinement, enable physicists to predict the outcome of 3D plasma experiments with a high degree of accuracy.

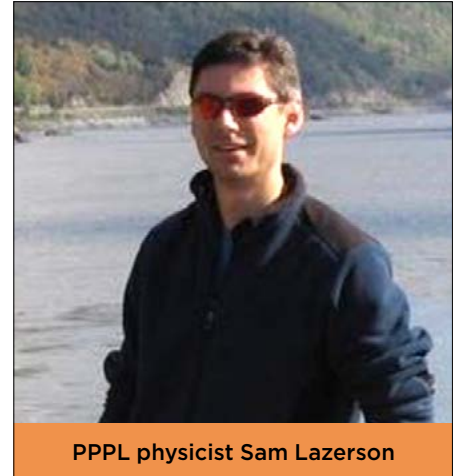
Lazerson and coauthors Satoru Sakakibara and Yasuhiro Suzuki of NIFS have published their paper online in the February issue of [Plasma Physics and Controlled Fusion](#). The journal also is using a Lazerson graphic of a simulated plasma on the cover of its print edition.

The researchers employed a mathematical technique called “virtual casing” to develop the new code for 3D fusion plasmas that are in equilibrium. Such plasmas are held steady by the balance between the inward pressure of the magnetic fields that confine them and the outward pressure exerted by the plasma. Virtual casing enabled the researchers to efficiently calculate magnetic diagnostic

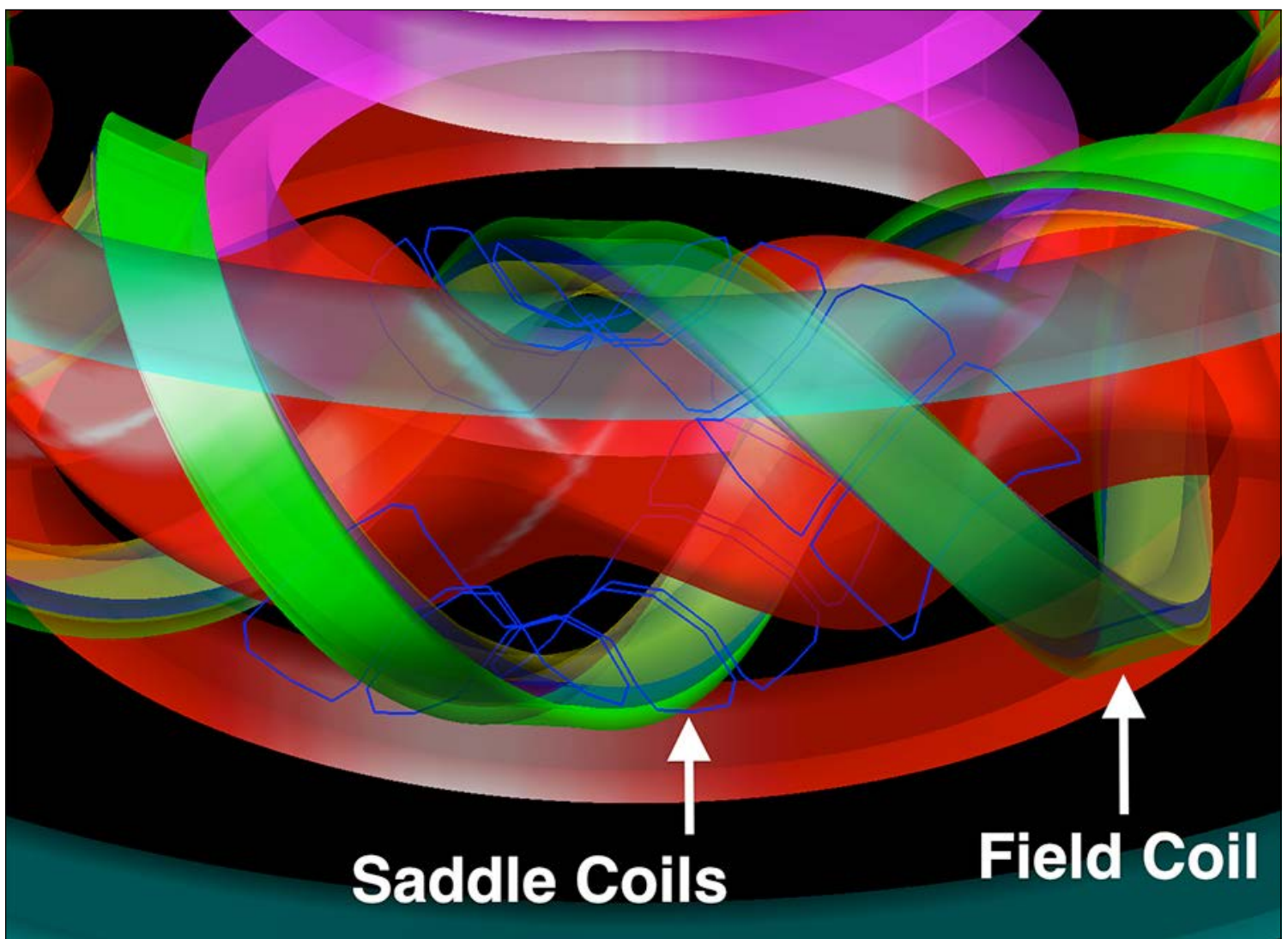
signals given a simulated plasma. This was achieved by recognizing that the magnetic field at the edge of the simulated plasma was all that was necessary to calculate the magnetic diagnostic signals.

The new code can be used with both the Variational Moments Equilibrium Code (VMEC) and the Princeton Iterative Equilibrium Solver (PIES). VMEC simulates a plasma that contains a set of smoothly nested magnetic field lines. In PIES simulations, the fields inside the plasma can break up into islands and be chaotically distributed. The new code’s versatility thus enables it to simulate diagnostic measurements for both types of simulated plasmas.

Researchers are currently refining their code to reconstruct conditions that experimenters seek to create in fusion plasmas. Reconstructing these conditions calls for creating multiple iterations of the code through massive parallel processing until the simulated measurements of the plasma precisely match the conditions measured in the experiment. Experimenters armed with this knowledge could then predict how the conditions they create in actual plasmas could affect the diagnostic outcome. ☺



PPPL physicist Sam Lazerson



A simulated plasma in the Large Helical Device showing the thin blue saddle coils that researchers used to make diagnostic measurements with the new computer code.

Graphic Credit: Sam Lazerson

Kim Tafe appointed lead contracting officer

By Jeanne Jackson DeVoe

Kim Tafe, a contracts specialist in the U.S. Department of Energy's Princeton Site Office since 2005, has been named the lead contracting officer, a position previously held by Raymond Kimble, who retired in February after 40 years at PPPL.

"I'm excited for the challenge," Tafe said. "It's a great opportunity. There are a lot of changes – there's a lot happening here."

In her eight years with the Business Team, Tafe has had numerous roles in business operations, including M&O contract administration, subcontracts, small business, WFO and international and inter-agency agreements. "Throughout her tenure, she has also provided invaluable site office leadership for security, cyber security, counterintelligence and foreign visits and assignments programs," Princeton Site Office Manager Maria V. Dikeakos said in announcing the promotion.

Before working for the DOE, Tafe held numerous positions with contracting officers working with the U.S. Department of Defense at several Air Force bases where her husband Walt was serving, including Panama, Italy, Germany and Joint Base McGuire-Dix-Lakehurst in New Jersey. Her husband retired in 2003 as a Command Chief Master Sergeant after 30 years with the Air Force. Both are active with the Burlington County Military Affairs Committee, a non-profit organization that acts as a liaison between the Joint Base McGuire, Dix, Lakehurst leadership and the civilian community.

The parents of two adult daughters, Kim and Walt live in Eastampton Township, outside of Mount Holly. An avid reader, Tafe listens to book tapes on her commute to PPPL. In their spare time, she and her husband enjoy outdoor activities such as boating, walking and going to the beach. ☞



Lead contracting officer Kim Tafe

PPPL wins state Recognition Award for worker safety

PPPL's strong safety record has earned it a Recognition Award from the Governor's Occupational Safety & Health Awards Program for having a low incidence of away-from-work lost time due to a work-related injury or illness.

The state also bestowed the Commissioner's Continued Excellence Award on the Plasma Science and Technology Department for working seven consecutive years (303,323 hours) without any lost time due to work-related injury or illness.

"We're very proud of our safety record," said Phil Efthiomion, head of the department, "and it's due to the conscientiousness of all the scientists working in the department who follow safety procedures and take safety as a personal requirement."

The awards will be presented at an upcoming Governor's Occupational Safety and Health Awards Program Area dinner this spring. ☞



Andrew Zwicker

Andrew Zwicker to give TED Talk on Fusion

Andrew Zwicker, head of Science Education, will give a TED talk on "Creating a Star on Earth: the Path to Fusion Energy," at a TED Talk Conference on "Future Utopias: Realistic Ways to Better our Society," on March 21 at 2 p.m. at Saint Peter's University's Roy Irving Theatre in Jersey City.

The talks will be posted on the Web after the conference. Other topics include "Utopias in Space," and "Love: A Natural Sciences Framework with Social Applications."

Zwicker was also the keynote speaker at a conference of the New Jersey Section of the American Association of Physics Teachers at Princeton University on March 15, where he discussed "Fusion 2013 – Just How Close Are We to Creating a Star on Earth." ☞



American Red Cross

**Princeton Plasma Physics Laboratory
American Red Cross Blood Drive**

Wednesday, March 20

8 a.m. - 1 p.m.

Lower End Parking Lot

Call Tricia Berran x3200 for an appointment or sign up online at www.redcross.org
Enter sponsor code: 022762



COLLOQUIUM



**Are Mushrooms the Next Polymers?:
Growing Plastic Replacements with Fungi**

GAVIN MCINTYRE

Ecovative Design LLC

Wednesday, March 20

4:15 p.m. (Coffee/Tea at 4 p.m.)
M.B.G Auditorium, Lyman Spitzer Building

**Young Women's Conference
at Princeton University**



March 22 • 9 a.m. - 2 p.m.
Frick Chemistry Building, Main Campus

A Spring Reminder:

**Out with the old and in
with the (sort of) new!**



Spring is a time for new beginnings so here's a gentle reminder that PPPL has a new logo that's not so new anymore. In fact, it's really more of a toddler than a newborn baby since it came out more than a year ago! Please do a little spring cleaning on all of your PPPL internal web pages and replace the old logo with the new one. You can find copies of the logo at <http://www.pppl.gov/logo> or contact [Greg Czechowicz](#) for more information.



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

	MONDAY MARCH 18	TUESDAY MARCH 19	WEDNESDAY MARCH 20	THURSDAY MARCH 21	FRIDAY MARCH 22
COMMAND PERFORMANCE CHEF'S FEATURE	 SPAGHETTI WITH MEATBALLS & SAUSAGE	 CHICKEN ENCHILADAS WITH SPANISH RICE	 BBQ CHICKEN WITH CORN ON THE COB	 ROAST PORK LOIN WITH SWEET POTATOES 🍎	 ROASTED VEGETABLE COUS COUS (V) 🍎
EARLY RISER	Southwest Breakfast Burrito	Cranberry Pancakes	Eggs Florentine over English Muffin	Corned Beef Hash & Eggs	Zucchini, Onion & Swiss Omelete
COUNTRY KETTLE	Pasta e Fagiole (V) 🍎	Cream of Potato (V)	Beef Stroganoff Soup	Stuffed Pepper Soup	Tomato Florentine (V) 🍎
GRILLE SPECIAL	Chicken Cheesesteak with Peppers & Onions with Fries	Bacon Cheddar Burger	Chicken Wings Served with Fries	Corned Beef Reuben	Grilled Cheese & Tomato served with Chips (V)
DELI SPECIAL	Chef Salad Wrap	Turkey & Avocado Wrap with Roasted Pepper Hummus	Spring Chicken Salad Wrap	Bologna & American Cheese on a Kaiser Roll	Seafood Salad Croissant (V)
PANINI	All American BBQ Chicken Panini	Pork Roll & Swiss Cheese with Caramelized Onions & Dijon	Roast Beef & Swiss Melt with Cole Slaw	Chicken, Mushroom & Swiss on Garlic Texas Toast	Crab Cake Melt with Cole Slaw

MENU SUBJECT TO CHANGE WITHOUT NOTICE

[CLICK HERE FOR A PRINTABLE WEEKLY MENU](#)

WEEKLY

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