

THIS WEEK

TUESDAY, MAY 23

Invention Discovery Day
11:30 a.m.-12:30 p.m. ♦ MBG Auditorium
[See page 3 for details.](#)

THURSDAY, MAY 25

American Red Cross Blood Drive
8 a.m.-1 p.m. ♦ Lower Parking Lot
[See page 2 for details.](#)

UPCOMING

MONDAY, MAY 29

**Laboratory Closed
for Memorial Day**

WEDNESDAY, MAY 31

Colloquium
4:15 p.m. ♦ MBG Auditorium
Putting a price on carbon
Charles Komanoff, Carbon Tax Center

FRIDAY, JUNE 2

Princeton Reunion Tours of PPPL
10 a.m. & 1:30 p.m.

JUNE 4-8

**IEEE Symposium on Fusion
Engineering (SOFE)**
Shanghai

MONDAY, JUNE 12

SULI & CCI students arrive

The PPPL Weekly will not be published on Monday, May 29 due to the Memorial Day holiday. The next issue will be on June 7.

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New plasma stability model could help predict and avoid disruptions

By Raphael Rosen



Physicists Steve Sabbagh and Jack Berkery in front of the National Spherical Tokamak Experiment-Upgrade (NSTX-U) (Photo by Elle Starkman)

Physicists at PPPL have helped develop a new computer model of plasma stability in doughnut-shaped fusion machines known as tokamaks. The new model incorporates recent findings gathered from related research efforts and simplifies the physics involved so computers can process the program more quickly. The model could help scientists predict when a plasma might become unstable and then avoid the underlying conditions.

This research was reported in a paper published in *Physics of Plasmas* in February 2017, and received funding from the DOE's Office of Science (Fusion Energy Sciences).

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Concrete floor of C-Site MG Building almost complete as IOI project continues

By Jeanne Jackson DeVoe

Work should be completed by the end of this month on a crucial steel-reinforced concrete section of the first floor deck of the C-Site Motor Generator (MG) Building, as PPPL's Infrastructure Operational Improvements (IOI) project continues.

Workers recently completed the concrete slab on the basement of the southeast quadrant of the building, which will hold large machines from technical shops that eventually will be moved from the RESA building. Excavating that area proved challenging when workers discovered rock underneath the floor that had to be removed before the pillars could be installed.

Completing the slab will be "a major milestone for us," said Les Hill, head of the IOI project. "It means that all the excavation work and all the unknowns we encountered with the excavation are in the rearview mirror."

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Plasma stability model

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The plasma stability code was written in part by Jack Berkery, a research scientist in the Applied Physics and Applied Mathematics Department at Columbia University who has been associated with PPPL for almost 10 years. He is working on this project with Steve Sabbagh, a senior research scientist and adjunct professor of applied physics at Columbia who



Physicist Steve Sabbagh
(Photo by Elle Starkman)

has collaborated with PPPL for almost three decades. Both Berkery and Sabbagh are part of the Columbia group at PPPL.

The new research is the latest in the physicists' combined effort to develop a larger and more capable plasma-stabilizing computer program known as the Disruption Event Characterization and Forecasting (DECAF) code that will predict and help avoid disruptions.

Within tokamak plasmas, many forces balance to create a stable equilibrium. One

force is an expanding pressure created by the intrinsic properties of the plasma — a soup of electrically charged particles. Another force is produced by magnets that confine the plasma, preventing it from touching the tokamak's inner walls and cooling down.

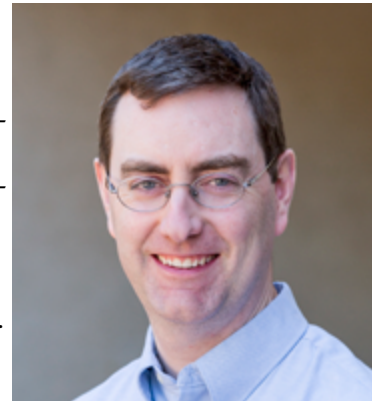
Plasma physicists and engineers want the plasma to be under as much magnetic pressure as possible because high pressure means that the plasma particles are interacting more frequently, increasing both the chances that fusion reactions will occur and the amount of heat produced by the tokamak. Past research by Berkery and Sabbagh on machines, including the National Spherical Torus Experiment-Upgrade (NSTX-U) at PPPL, has shown that high plasma pressure can be contained in a stable way if other properties of the plasma, like the way in which it rotates, have particular characteristics.

"Ideally, you want to operate tokamaks at high pressure because to get good fusion performance, you want to have the highest pressure you can," Berkery continued. "Unfortunately, when you do that, instabilities can arise. So if you can find a way to stabilize the plasma, then you can operate your tokamak at a higher pressure."

The updated program was written to predict the conditions that would best contain the high-pressure plasma. The program, though, is only one component of the DECAF code, which includes many modules that each monitor different aspects of a plasma in an effort to determine when the plasma is becoming unstable. "For years, we've been investigating which conditions lead to instability and how we can try to avoid those conditions," Berkery said.

The code gathers information that includes the plasma's density, temperature, and the shape of the plasma's rotation. It then calculates which combinations of these conditions produce a stable plasma, simultaneously uncovering which combinations of conditions produce an unstable plasma. The new code specifically looks for signs of an oncoming unstable state known as a resistive wall mode. A plasma enters this state when forces causing the plasma to expand are stronger than the forces confining the plasma. The plasma's intrinsic magnetic fields then expand outward and strike the interior of the tokamak's walls.

Sabbagh, Berkery, and other researchers are now in the process of adding more modules to DECAF, increasing its ability to predict instabilities. They are also planning to use DECAF to help guide a rotation-control system on a tokamak like NSTX-U. The system would prevent the plasma from becoming unstable by producing stability-conducive plasma rotation profiles. 📍



Physicist Jack Berkery
(Photo by Elle Starkman)

American Red Cross Blood Drive

Thursday, May 25
8 a.m.-1 p.m.

The blood mobile will be parked next to the warehouse near Mod 6 in the Lower Parking Lot. The check-in point will be the Mod 6 Conference Room.

Appointments are still available! Please call the OMO at ext. 3200 or go to redcrossblood.org and enter sponsor code PPPLPrinceton. You can make a difference! Your blood donation matters!

Thank you!

—American Red Cross, Occupational Medicine Office and Human Resources

IOI update

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It also means that contractors can bring in heavy equipment such as boom and sizzle lifts (two kinds of mobile scaffolds) to begin major work on the rest of the building. Contractors will install insulation in the walls and will install heating, ventilation, and air conditioning (HVAC) systems and high-efficiency lighting in the ceilings. "Getting this floor done in its entirety really opens up our ability to get a lot of other things done," Hill said.

Work will begin after Memorial Day on installing a new roof. The project will be done in sections and will be completed in about six weeks. Most of the work on the building should be completed by December, Hill said.

Meanwhile, work is also moving along in the Lyman Spitzer Building (LSB) Annex where all the mechanical and electrical work has been completed. Workers are starting to tape and spackle walls on the third floor and will move down to the second and first floors. "We're really starting to evolve into the finishing details," Hill said.

An important step in the LSB Annex will be installing a computer network system, Hill said. Work has also begun on purchasing office furniture for the Annex. The project will be "substantially completed" by September or October, he said.

Hill said he is pleased with the progress of both projects. "When I look back to where we were when we mobilized this contract in November, if I thought for a moment that by mid-May we'd be starting taping and spackling and we would be on the cusp of getting the first floor of the C-Site MG Building completely decked over, I would have been ecstatic," he said. "But you won't see me doing backflips until it's over." 📷



The new concrete deck in the C-Site MG Building. (Photo by Elle Starkman)



The second floor of the Lyman Spitzer Building (LSB) Annex. (Photo by Elle Starkman)

Invention Discovery Day aims to bring out your inner inventor

Tuesday, May 23
11:30 a.m.–12:30 p.m.
MBG Auditorium

Past, present, and future inventors and all those interested in celebrating innovation at PPPL are invited to attend Invention Discovery Day. The event, sponsored by the Technology Transfer and Publications Office, will feature a trivia contest and a Ted talk video. PPPL inventors Charlie Gentile and Kevin Lamb will discuss their inventions. Snacks will be provided but please feel free to bring your own lunch! Audience members can get their photos taken as Einstein and enter a raffle to win Plasma Hutch gift certificates.

For more information, please contact Aileen Pritch, apritch@pppl.gov.

PPPL's take part in Princeton University's Research Day



Graduate student Charles Swanson presents a fusion-powered plasma thruster that could be used in space vehicles at the second annual Princeton Research Day on May 11 at Princeton University. The technology is based on the Princeton Field-Reversed Configuration (PFRC) fusion reactor invented by PPPL physicist Samuel Cohen and developed as a rocket by Princeton Satellite Systems as the Direct Fusion Drive (DFD). The presentation was one of 140 by undergraduates, graduate students, postdoctoral researchers and other campus researchers in numerous fields at the University. [A story on Research Day on the Princeton University website is available here.](#) (Photo by Laurie Bagley)

BROCK

NICK PETTI
Chef Manager



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.

	Monday May 22	Tuesday May 23	Wednesday May 24	Thursday May 25	Friday May 26
COMMAND PERFORMANCE Chef's Feature	Chicken Francese over Pasta	Carved London Broil with Mashed Potatoes and Vegetable	Green Chili Chicken Burrito with Rice and Beans	Super Salad	Vegetable Chili over Rice with Cornbread
Early Riser	Bacon, Egg & Cheese Croissant	Biscuits with Sausage Gravy	Mango & Blueberry Pancakes served with Choice of Breakfast Meat	Turkey Bacon, Egg and Cheese Sandwich	2 Eggs, 2 Pancakes, Choice of Breakfast Meat & Potatoes
Country Kettle	Vegetable Noodle	Cream of Mushroom	Beef Barley	Tuscan Chicken and Pasta	Seafood Chowder
Deli Special	California Wrap	Caesar Turkey Wrap	Ham and Smoked Gouda with Pineapple Slaw	Portobello Mushroom & Fontina Cheese with Roasted Peppers on Ciabatta	Chicken, Mozzarella, Red Onion, Basil, Arugula and Balsamic Tomatoes on French Bread
Grill Special	Pico De Gallo Black Bean Burger with Avocado Sour Cream and Fries	Teriyaki Chicken Cheesesteak with Asian Slaw	Lamb Burger	Monte Cristo	Roast Vegetable Stromboli
Panini	Tomato, Fresh Mozzarella, Spinach and Pesto Flatbread	Spicy Italian Grinder	Cheddar, Bacon, and Apple Panini	Grilled Ham and Cheese on Texas Toast	Foot-long Chili Dog

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY

VEGETARIAN OPTION

WEEKLY Editor: **Jeanne Jackson DeVoe** ♦ Layout and graphic design: **Kyle Palmer** ♦ Photography: **Elle Starkman** ♦ Science Editor: **John Greenwald** ♦ Science Writer: **Raphael Rosen** ♦ Webmaster: **Chris Cane** ♦ Communications Director: **Larry Bernard**

The PPPL WEEKLY is published by the [PPPL Office of Communications](#) on Mondays throughout most of the year and biweekly during the summer, except for holidays.

DEADLINE for calendar item submissions is noon on WEDNESDAY. Other stories should be submitted no later than noon on TUESDAY.

Comments: commteam@pppl.gov ♦ PPPL WEEKLY is archived on the web at: <http://w3.pppl.gov/communications/weekly/>.