

THIS WEEK

MAY 15-18

**Extent of Condition Review
Committee meeting**

WEDNESDAY, MAY 17

Colloquium

4:15 p.m. ♦ MBG Auditorium
**Plasmas for Reconfigurable
Radio-Frequency Systems**
Sergey Macheret, Purdue University

FRIDAY, MAY 19

Public Tour

10 a.m.
[Register here.](#)

UPCOMING

TUESDAY, MAY 23

Invention Discovery Day
11:30 a.m.-12:30 p.m. ♦ MBG
Auditorium
[See page 8 for details.](#)

THURSDAY, MAY 25

American Red Cross Blood Drive
8 a.m.-1 p.m. ♦ Lower Parking Lot
[See page 7 for details.](#)

MONDAY, MAY 28

**Laboratory Closed
for Memorial Day**

JUNE 4-8

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

MONDAY, JUNE 12

SULI & CCI students arrive

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Engineering Dept. changes align staff with tasks

By Jeanne Jackson DeVoe

Valeria Riccardo, head of the Engineering Department, announced a new structure of the department last week with the goal of reflecting the actual jobs of PPPL engineers.

The Laboratory’s leadership recognized the need to update the organization since before Riccardo joined PPPL in December, she told Engineering staff at a May 8 meeting in the MBG Auditorium. The reorganization was a notable outcome in the U.S. Department of Energy’s year-end “report card” last year.

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PPPL scientists further understanding of heat loss in fusion devices

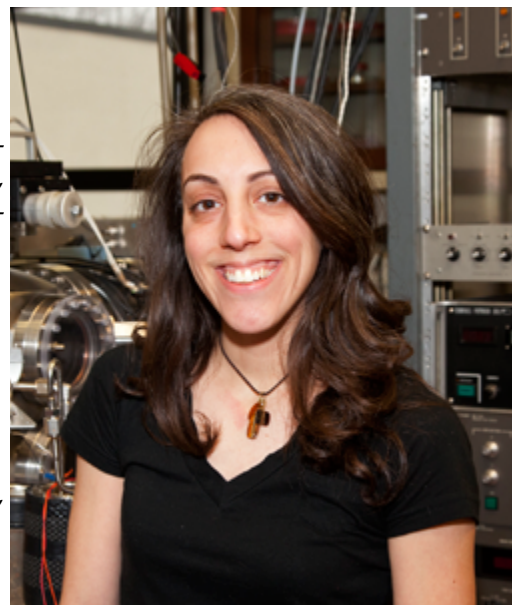
By Raphael Rosen

Everyone knows that the game of billiards involves balls careening off the sides of a pool table — but few people may know that the same principle applies to fusion reactions. How charged particles like electrons and atomic nuclei that make up plasma interact with the walls of doughnut-shaped devices known as tokamaks helps determine how efficiently fusion reactions occur. Specifically, in a phenomenon known as secondary electron emission (SEE), electrons strike the surface of the wall, causing other electrons to be emitted. Those secondary electrons cool the plasma’s edge and dampen the plasma’s overall performance.

Scientists at PPPL have been studying SEE for decades, and in the past year have made important advances that further their understanding. Most recently, two of the physicists — Marlene Patino, a graduate student at the University of California, Los Angeles, and Angela Capece, a professor at the College of New Jersey — have focused their efforts on researching how SEE is affected by different wall materials and structures.

Understanding SEE is crucial because the behavior of the secondary electrons could affect the performance of future fusion machines. “When heat losses become large, the fusion machine is less able to produce power,” Capece said.

In her SEE research, Capece studied how electrons interacted with lithium, a wall material that could improve the ability of tokamaks to confine plasma. Other scientists interested in lithium have created computer models that simulate how lithium interacts with electrons from the plasma, but those models have not taken into account how easily lithium bonds with other trace elements in the plasma, like oxygen, to form new molecules like lithium oxide. Those new molecules interact with electrons differently than pure lithium would.



Physicist Angela Capece

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“Facts & Snacks” brings fun to learning about publishing regulations

By Jeanne Jackson DeVoe

More than 30 PPPLers learned last week that the Laboratory is evaluated by its sponsor based on how many PPPL first authors submit their peer-reviewed manuscripts to the U.S. Department of Energy (DOE) before final publication.



Laurie Bagley, right, head of Tech Transfer, Patents & Publications, right, discusses publications guidelines, along with administrator Aileen Pritch. (Photo by Elle Starkman)

The requirements may not be scintillating but the people who attended the presentation by PPPL's Publications Office had fun learning about them. They won candy for answering trivia questions correctly and, as promised, there were plenty of snacks available.

But the message was serious: “Our Lab gets graded on whether you submit your manuscript and therefore it could affect our funding,” said Laurie Bagley, head of Technology Transfer, Patents & Publications, who presented the program along with administrator Aileen Pritch on May 9.

The DOE required PPPL to increase the number of papers submitted in a notable outcome of its annual “report card” two years ago, Bagley said. The Lab has significantly increased the number since then, but many PPPL researchers still don't follow the regulations, she said. This is often because they either don't know about them or don't understand them, she added.

The PPPL publication and patent clearance process requires first authors to submit a manuscript of their paper to the [PPPL Publications Office](#), along with a publication and patent clearance approval form.

After the paper has gone through peer review but before it is actually published, authors should then submit the final, peer-reviewed accepted manuscript (PRAM) to PPPL's Publications Office for submittal to the DOE. This allows the DOE to publish papers a year or more after publication in a journal without violating the publisher's copyright. Maria Huber, accounts payable manager, said authors should submit the publication invoice to PPPL's accounting office and discussed procedures for doing so.


The first PPPL author is responsible when there are several authors. This is true even in cases in which the first PPPL author is not the first author of the paper, Pritch explained. She suggested PPPL authors who collaborate on articles with researchers at other national laboratories contact their collaborators to try to reach some arrangement about who should submit. While the first author from a national laboratory is responsible for doing this, PPPL gets points deducted if the article isn't submitted regardless of who the first author is, so it's important to coordinate. PPPL researchers who work with collaborators outside the DOE complex should notify them from the outset that they require access to the manuscript to comply with DOE requirements, Pritch said.

One problem that often comes up is that an author may not know that the publisher has sent a PRAM because the author is not the first author or because the publisher doesn't label it as such, Pritch said.

PPPL librarian Jane Holmquist said she searches each week for notices of new PPPL publications. But that does not give the Publications Office access to the peer-reviewed accepted manuscript. Only the authors of the paper have access to this version.

One way authors can track their published articles and make it easier for PPPL to track them is to apply for an identifying number from [ORCID](#), a website that helps track manuscripts linked to specific researchers. [A video on ORCID is available here.](#)

PPPL's publication and clearance approval form is available under [PPPL Forms](#) on the internal site and soon will be available as a Google form.

For a copy of the “Facts & Snacks” PowerPoint on PPPL publications, email Aileen Pritch at apritch@pppl.gov. 



Physicist Luca Comisso wins a candy bar after answering a trivia question correctly. (Photo by Elle Starkman)

A Saturday exploring PPPL with Obscura Day tours

About 60 visitors from New York, Pennsylvania and New Jersey toured the Laboratory on Saturday, May 6, as one of 185 events in 36 states and 25 countries that celebrated unusual and interesting places during Obscura Day.

[Obscura Day](#) is hosted by the website [Atlas Obscura](#), which specializes in providing information about undiscovered places and stories.

Many visitors, like Scott Esslinger, from Abingdon, Pennsylvania, said they were happy to travel miles to see the Laboratory. "It was exceptional," he said. "It was very interesting. It's a whole new way of looking at the world that I never knew about."

The visitors were treated to tours that gave them a behind-the-scenes look at some of PPPL's less well-known experiments like the Lithium Tokamak Experiment (LTX), where they were hosted by Dennis Boyle and the Magnetic Reconnection Experiment (MRX), hosted by Jonathan Jara-Almonte. Some visitors got to don nitrile gloves to dip their hands in liquid gallium at the Magnetorotational Instability (MRI) experiment, where they were hosted by Erik Gilson. They stopped by the Hall Thruster Experiment, hosted by Jacob Simmonds and Ivan Romadanov, as well as the National Spherical Torus Experiment-Upgrade (NSTX-U) Control Room and the Science Education Laboratory.

Tour guides were: Arturo Dominguez, Atiba Brereton, Clayton Myers, and Jacob Schwartz. The event was organized by Jeanne Jackson DeVoe and Dominguez.

"It was very, very cool," said Bob Denson, of East Brunswick. "I love this stuff!" 📷

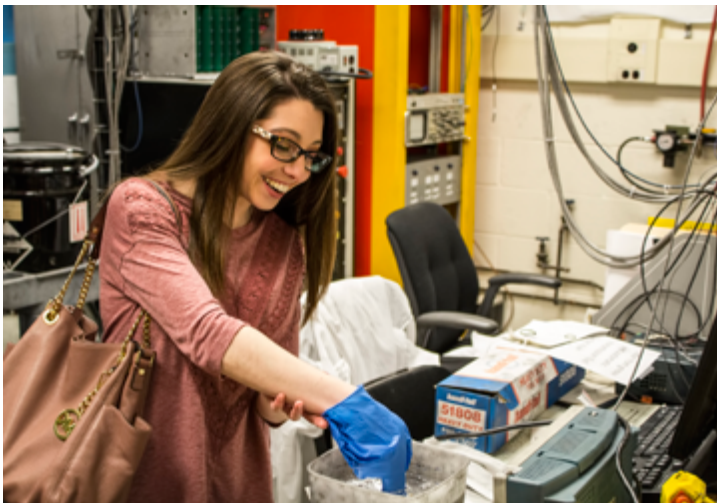
Photos by Jeanne Jackson DeVoe.



Tour guide Arturo Dominguez talks to visitors in front of the DC discharge demonstration in the LSB Lobby.



Atiba Brereton shows visitors live video of the NSTX-U cell in the NSTX-U Control Room.



A visitor dips her gloved hand in liquid gallium used in the Magnetorotational Instability (MRI) experiment.



Jonathan Jara-Almonte shows visitors the Magnetic Reconnection Experiment (MRX).



Erik Gilson discusses the Magnetorotational Instability (MRI) experiment.



Visitors peer through spectrometers to see the spectra of various elements in the Science Education Laboratory as tour guide Atiba Brereton looks on.

Engineering restructure

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“Valeria has done an excellent job making sure that the reorganization reflects the jobs that our engineers do every day that are so vital to the entire PPPL organization and are essential to the NSTX-U Recovery Project,” said Terry Brog, PPPL’s interim director. “The new organization enables more discipline-specific collaboration, as well as more project-specific collaborations. It really should optimize staff performance, career development, and project execution.”



Valeria Riccardo

Stacia Zelick, PPPL’s interim director for operations, also applauded the change. “Valeria’s restructure of the Engineering Department is a critical yet challenging step toward achieving operational excellence,” Zelick said. “She has identified improvements that will integrate our engineers’ talents and create a more harmonious structure.”

Riccardo said the new structure was based on a vision of the department’s current and long-term roles, as well as an understanding of what the jobs of engineers and technicians entail. The group has more than 180 staff members.

“I started with the people who work together – driven either by the project they’re working on or by their skills,” Riccardo said. “Engineers and technicians were grouped considering the tasks they do and the people they work with, or will work with when the NSTX-U Recovery Project is completed.”

The new structure groups engineers according to function whereas in the previous organizational structure, engineers performing the same function were spread over several branches, Riccardo said. She pointed out that while the groups’ composition changed, the job description of most engineers did not.

Riccardo noted that the previous organizational chart changed very little over the past 15 years despite changes in the roles covered by various areas of the organization. The new structure is meant to be flexible and can be “tweaked” as the needs of the organization change, she said.

Neumeyer & Feder named as deputies

Under the new structure Charles Neumeyer and Russell Feder will be the two new deputy department heads. Neumeyer



Russell Feder

is the engineering director of the NSTX-U Recovery Project. Feder is head of U.S. ITER Diagnostics and will lead a group of integration engineers. Both will assist Riccardo with running the department, preparing the strategic plan and budgets.

The new structure includes a technical authority, temporarily covered by Riccardo, who will establish a high level of

technical oversight of engineering projects at PPPL by defining and maintaining engineering processes and procedures, and ensuring that the results of all PPPL engineering activities are technically sound and conform to those processes. The Extent of Condition Review Committee recommended such a position in March, which it called “chief engineer”.

It also moves the Operations Center, which was previously under the Electrical Division, to a more central position as the Engineering Documentation Center to reflect the overall

engineering support it provides. Cheryl Such will continue to manage the center.

The technical authority, the head of the CAD group, and head of the Design Group positions will be posted, Riccardo said.

Alex Nagy, the deputy head of PPPL/General Atomics Collaboration, will head a new Engineering Collaborations Office. Tim Stevenson will continue to cover the Project Management Office until a decision is made on whether to move the office to a different area of the Lab’s organization. Stevenson will remain the head of the Heating group.

Engineer Hans Schneider asked at the meeting why the Controls & Data Acquisition Group is not in Engineering. While this group of engineers collaborates on many tasks with parts of the Engineering Department in the NSTX-U and ITER projects, it is part of the Information Technology Department. Riccardo explained that this has been brought to her attention from several parts of the organization but she decided to park this issue to focus on reshaping the existing Engineering staff, which is the main objective of the restructuring.

The structure of the NSTX-U Recovery Project team, headed by Rich Hawryluk, and the ITER Diagnostic team, is not affected by the Engineering Department changes.

Here are the groups and group leaders:

The Innovation Group, headed by Charles Gentile, supports Plasma Science and Technology and other smaller experiments and proof of principle activities. The group may be renamed.

The Design Group, temporarily headed by Doug Loesser, provides designs and engineering for new and upgraded PPPL large facilities and is now focused on critical areas of the NSTX-U Recovery.

The Integration Group, headed by Feder, provides design and systems engineering services in support of ITER Diagnostics and develops systems studies for fusion power plant concepts.

The Analysis Group, which will continue to be headed by Pete Titus, provides engineering analysis for engineering projects.

The CAD Group, temporarily headed by Lew Morris, who is retiring soon, does computer-aided design for engineering projects.

The Fabrication Group, headed by Larry Dudek, manages construction. Erik Perry will continue to head the Tech Shops and the Construction team.

The Power Systems Group, temporarily headed by Al von Halle, operates, maintains and upgrades AC power systems, motor generators and electrical power conversion systems.

The Electronics Group, headed by von Halle, is in charge of electronic equipment services for new and upgraded PPPL experiments.

The Heating Systems Group, headed by Tim Stevenson, is responsible for the design and operation of radio frequency and neutral beam systems and any other technology related to plasma heating systems.

[The new Engineering organizational chart is available here.](#)

Photos by Elle Starkman.



Charles Neumeyer

Secondary electron emission

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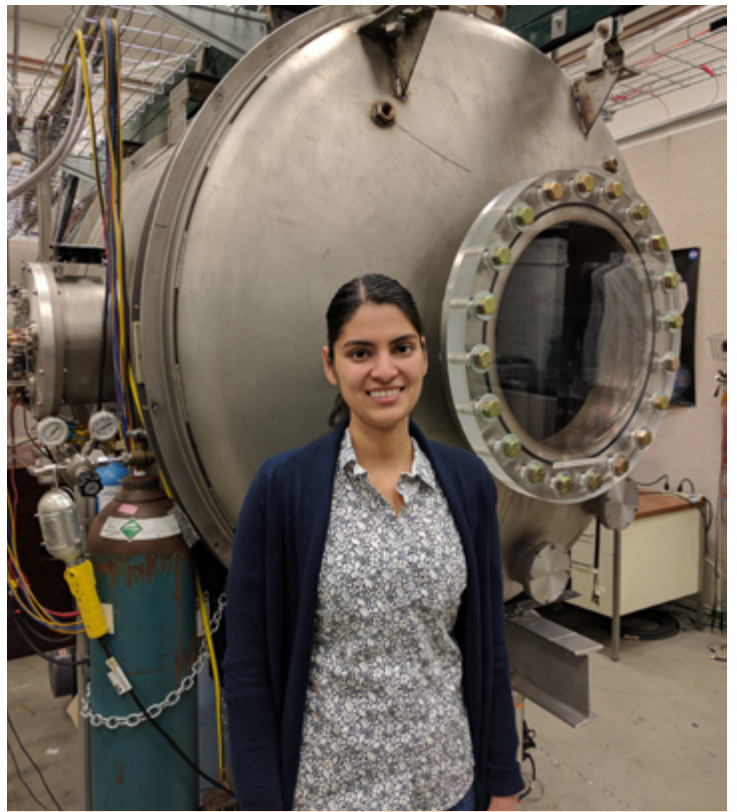
Specifically, when electrons strike lithium oxide on a tokamak wall, many more secondary electrons are released into the plasma than for non-lithium wall materials like tungsten and carbon. If a tokamak has a lining made of graphite, one electron striking it with a particular amount of energy may produce one secondary electron. On the other hand, if an electron with the same energy strikes a lining made of lithium oxide, from one to three secondary electrons could result.

This discrepancy is crucial. “When incorporating SEE into models of fusion devices, it is important to account for the reactivity of lithium and that it will form lithium oxide in a tokamak environment,” Capece said.

Capece ultimately found that, in general, it becomes easier for an electron to release a secondary electron when the oxygen content in lithium linings rises. Her research quantified exactly how the amount of oxygen bound to the lithium in the wall changes the amount of secondary electrons that can enter the plasma. While an increased SEE yield could drive up heat loss, many variables at the edge of the plasma could modify the impact.


Patino studied SEE from a different perspective. She researched tiny structures, known as “fuzz,” that form on tungsten linings when they have been bombarded by helium nuclei. She observed that in comparison to smooth tungsten, tungsten with fuzz can reduce SEE by 40 percent to 60 percent. These findings were significant because past researchers’ studies involved manufactured microstructures, while in this study the tungsten fuzz grew by itself. Moreover, unlike with manufactured structures, the reduction of SEE does not depend on the angle at which the electrons approach the wall, both because the secondary electrons are trapped by the fuzz and the fibers in the fuzz are distributed randomly. “This lack of dependence on incident angle is important for walls in plasma machines since the electrons will impact the walls at large oblique angles,” Patino said.

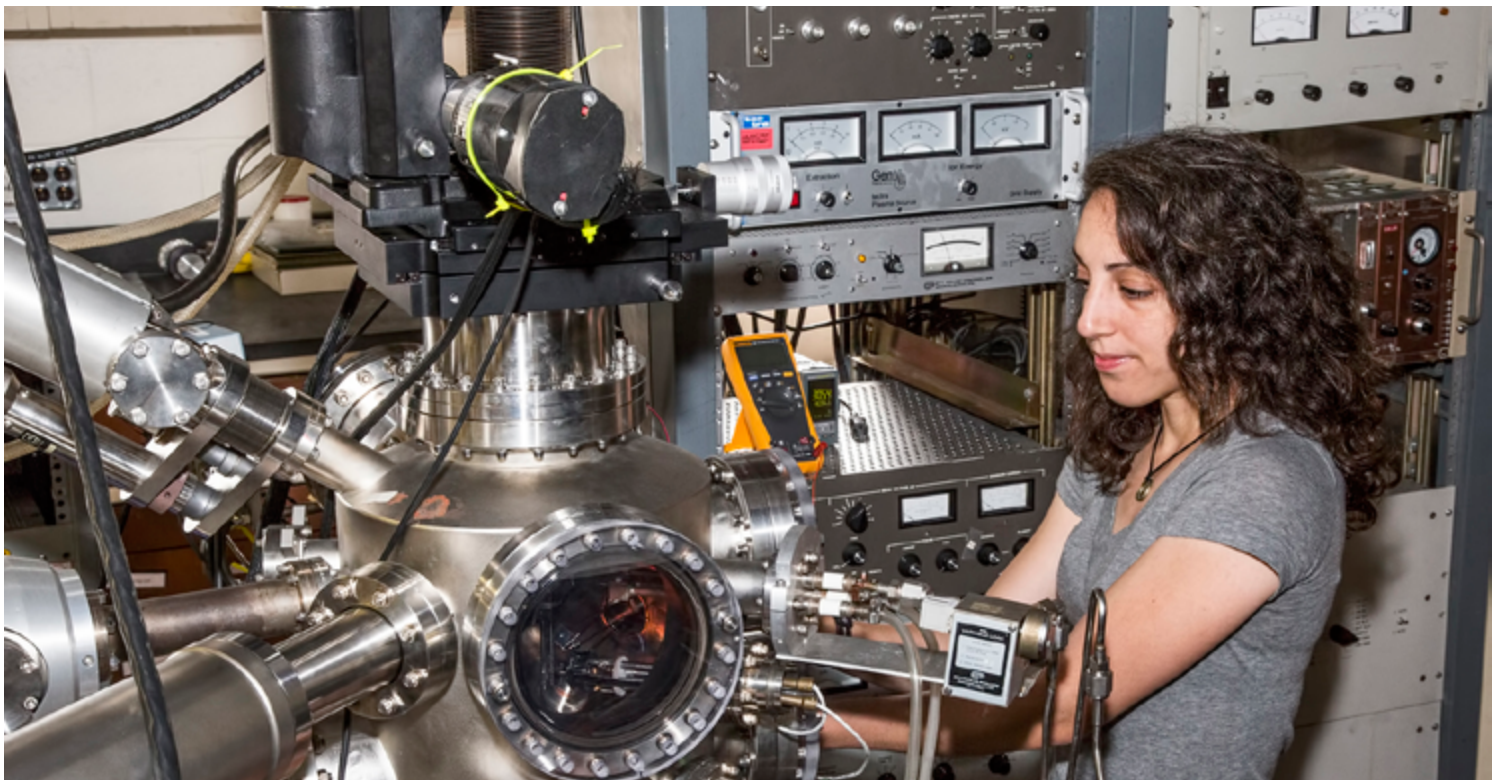
Her work was published in the November 2016 issue of *Applied Physics Letters*. Capece’s was published in the July 2016 issue of the same journal. Their research was funded by the DOE’s Office of Science (Fusion Energy Sciences). Patino’s work also received funding from the Air Force Office of Scientific Research (AFOSR).



Graduate student Marlene Patino in UCLA’s Plasma and Space Propulsion Laboratory (Photo by Cesar Huerta)

SEE first attracted the attention of PPPL scientists through both experimentation and theoretical research into plasma thrusters, devices that could one day propel spacecraft to distant cosmic objects. “PPPL researchers came up with the idea of using surface-architected materials such as carbon velvet to suppress SEE and thereby improve the performance and longevity of the plasma thrusters,” said Yevgeny Raitses, a principal research physicist at PPPL and principal investigator on both Patino’s and Capece’s projects.


Previous SEE research at PPPL has involved a number of collaborators. These include PPPL principal investigators Raitses and Igor Kaganovich, together with Dmytro Sydorenko of the University of Alberta; Professor Andrei Smolyakov of the University of Saskatchewan; Professors Bruce Koel and Nat Fisch of Princeton University; and Professors Richard Wirz and Nasr Ghoniem of the University of California-Los Angeles. Their research has been funded by the AFOSR and the DOE’s Office of Science (Fusion Energy Sciences). 



Angela Capece in PPPL’s Surface Science and Technology Lab (Photo by Elle Starkman)

ExxonMobil technologists visit PPPL

More than 20 technologists from ExxonMobil visited PPPL for a tour on May 8. Led by tour guide John DeLooper, the group visited the NSTX-U Control Room, NSTX-U and other sites. The group was taking part in the 55th annual Longer Range Research Meeting at Princeton University from May 8 to 11. The PPPL tour was one of several laboratory tours, most of which took place on the main Princeton University campus.

ExxonMobil is a charter member of Princeton E-filiates Partnership, a corporate member program in Princeton University's Andlinger Center for Energy and the Environment. The conference brought together more than 200 top technologists in ExxonMobil's Research & Engineering to discuss a variety of energy topics. 



Tour guide John DeLooper shows the ExxonMobil group the NSTX-U Control Room. (Photo by Raphael Rosen)

COLLOQUIUM

Plasmas for Reconfigurable Radio-Frequency Systems


Sergey Macheret
Purdue University

Wednesday, May 17
4:15 p.m., M.B.G. Auditorium, Lyman Spitzer Building

Transport & Confinement group meets at PPPL

PPPL hosted a meeting of the Transport & Confinement Topical Group of the International Tokamak Physics Activity (ITPA) organization May 1 through 3. PPPL physicist Walter Guttenfelder helped host and organize the meeting. Attendees came from China, South Korea, the United Kingdom, Germany, Spain, Japan, the Netherlands, Switzerland, Finland, and Italy. Some attendees — from France, Sweden, and Belgium — attended remotely. U.S. organizations represented at the meeting included MIT, General Atomics, Oak Ridge National Laboratory, Lehigh University, and the College of William and

Mary. Topics discussed included particle transport during pellet fueling, neural nets and transport models, and various confinement regimes.

The ITPA meets twice a year in countries that are member parties of ITER. Representatives identify and research key issues at the meetings that the international community believes are crucial to ITER's success. During meetings, representatives also coordinate joint activities and experiments at different laboratories throughout the world. 



Members of the Transport & Confinement Topical Group of the International Tokamak Physics Activity gather at PPPL. (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

Invention Discovery Day

Tuesday, May 23

11:30 a.m.-12:30 p.m.

MBG Auditorium

Come celebrate innovation at PPPL with inventor talks, trivia, snacks, and a raffle for Plasma Hutch prizes!

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 15	Tuesday May 16	Wednesday May 17	Thursday May 18	Friday May 19
COMMAND PERFORMANCE Chef's Feature	Honey-Barbecued Ribs with Potato Salad and Baked Beans	Tricolor Tortellini Alfredo with Chicken served with Garlic Bread	Caprese Chicken with Orzo Pilaf	GUEST CHEF MENU "Mario Batali" Polpettona Ripiena, Sweet Corn and Onions with Lemon Basil and Brand New Potatoes alla Savonesa	Fish and Chips
Early Riser	Bacon, Egg and Cheese English Muffin	Mexican Breakfast Burrito	Potato, Roasted Pepper & Sundried Tomato Casserole with 2 Eggs any style	Cinnamon-Raisin Pancakes with Homemade Apple Compote	French Toast Sticks
Country Kettle	Manhattan Clam Chowder	Vegetable	Chicken Noodle	Tomato Soup	Chili Bean
Deli Special	Spring Chicken Salad Wrap	Asiago Roast Beef with Grilled Onion, Tomato & Horseradish on Pumpernickel	California BLT with Avocado and Sprouts	Turkey Sloppy Joe	Spicy Tuna Sushi Wrap
Grill Special	Grilled Vegetable Quesadilla	Chipotle BBQ Pulled Pork Sandwich with Fries and Slaw	Cheese Calzone with Marinara Sauce	Burgerlicious Buffalo Turkey Burger	Teriyaki Chicken Cheesesteak
Panini	Smoked Ham and Gouda Melt with Apple-Caramelized Onion	Baja-Fried Flounder Hero with Crunchy Slaw and Pico de Gallo	Pastrami and Swiss on Marble Rye	Chipotle Roast Beef Melt on Focaccia	Breaded Chicken Cutlet with Ham, Swiss Cheese, Lettuce & Honey Mustard Ciabatta

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY

VEGETARIAN OPTION

WEEKLY

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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/>.