

THIS WEEK

WEDNESDAY, JAN. 25

PPPL Colloquium
4:15 p.m. ♦ MBG Auditorium
[Fusion Nuclear Science Facility \(FNSF\): Its Motivation and Program to Move to Fusion Power Plants](#)
Charles Kessel, PPPL

THURSDAY, JAN. 26

Deadline for enrolling in Duo Authentication
([See page 2](#))

“Protecting Our Families in a Rapidly Changing Environment”
6-7:30 p.m. ♦ Friend Center, Princeton University

SATURDAY, JAN. 28

Science on Saturday
9:30 a.m. ♦ MBG Auditorium
[The Physics of Cancer](#)
Robert Austin, Princeton University

UPCOMING

WEDNESDAY, FEB. 1

PPPL Colloquium
4:15 p.m. ♦ MBG Auditorium
[Are You Living In A Simulation?](#)
Silas Beane, University of Washington Seattle

FRIDAY, FEB. 3

Public Tour
10 a.m. ♦ LSB Lobby

SATURDAY, FEB. 4

Science on Saturday
9:30 a.m. ♦ MBG Auditorium
[Imperative of Vaccination Nationally and Globally](#)
Adel Mahmoud, Princeton University

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First NSTX-U review committee looks at instruments & controls

By Jeanne Jackson DeVoe

The National Spherical Torus Experiment-Upgrade (NSTX-U) Recovery Team began the first of 12 reviews of the device’s systems last week as reviewers examined the computer systems that operate and control the device and allow scientists to retrieve data from experiments.

The design verification and validation reviews (DVVRs), taking place from January through April, are aimed at identifying any serious potential problems that might “compromise the performance or reliability of NSTX-U.” The findings of the 12 individual committees will become part of a corrective action plan that will be submitted to the U.S. Department of Energy (DOE).

The Recovery Team began the process after a series of problems emerged with the NSTX-U, including a failed coil that forced the shutdown of the device last summer. An interim report is due to the DOE at the end of March.

“It’s been very valuable so far,” said Charles Neumeyer, the NSTX-U Recovery Project engineering director. “We’ve uncovered some important things. Having external opinions is very valuable.”

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Conference gives undergraduate women skills, inspiration to pursue physics careers

By Jeanne Jackson DeVoe

Meg Urry was the first tenured physics professor at Yale University and was often the only woman in her physics classes, including her graduate class at MIT, but she still heard a fellow student complain that women were unfairly given advantages over their male colleagues. “That’s when I realized there was something fishy going on,” she said.



Josee Vadrine-Pauléus, a professor in the Department of Physics and Electronics at the University of Puerto Rico-Humacao campus, gives a workshop on negotiation. (Photo by Elle Starkman)

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PPPL physicists make first-ever direct observation of collisional plasmoid instability during magnetic reconnection in a laboratory setting

By Raphael Rosen

Physicists at PPPL have for the first time directly observed a phenomenon that had previously only been hypothesized to exist. The phenomenon, plasmoid instabilities that occur during collisional magnetic reconnection, had until this year only been observed indirectly using remote-sensing technology. In a paper published in the August 2016 issue of *Physical Review Letters*, PPPL physicists report that they created the phenomenon in a laboratory setting where they could measure it directly and confirm its existence on the electron scale, which describes the range of motion of electrons and how quickly they move. This research was funded both by the DOE's Office of Science and NASA's Heliophysics Division.

Plasmoid instabilities create magnetic bubbles within plasma, superhot gas whose atoms have separated into electrons and atomic nuclei. The magnetic bubbles then cause fast magnetic reconnection, when a plasma's magnetic field lines break apart and join together again, releasing large amounts of energy. Before now, physicists at NASA and other institutions had only been able to directly confirm the existence of these instabilities in *collisionless* plasmas, like those surrounding Earth in the upper atmosphere, in which the plasma particles do not collide often.

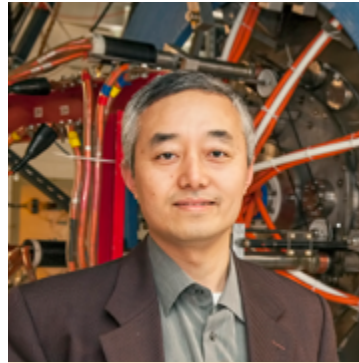
Scientists had not been able to confirm the existence of plasmoid instabilities in *collisional* plasmas, in which the particles frequently collide, because such plasmas occur in outer space, far from Earth. Collisional plasmas like those on the surfaces of stars are so far away that scientists have difficulty measuring them directly. But physicists at the Massachusetts Institute of Technology and elsewhere had predicted their existence years ago.

Scientists have obtained, however, indirect evidence of plasmoid instabilities in outer space. Using telescopes and spectroscopes, as well as fusion facilities like PPPL's former flagship device known as the National Spherical Torus Experiment (NSTX), which has since been upgraded, scientists took photographs and analyzed light that hinted at the existence of the instabilities. But without *direct* measurements, they were unable to confirm that the instabilities existed.

"These findings are significant because data gathered in past magnetic reconnection experiments involving collisionless plasma does not apply to the large, collisional plasmas found throughout space," said Hantao Ji, a professor at Princeton

University's Department of Astrophysical Sciences, distinguished fellow at PPPL, and co-author of the paper. "Scientists have long had difficulty studying these plasmas because it's hard to create the necessary conditions on Earth, and we can't just stick probes directly into stars. Now we have a glimpse into their workings."

During the research, lead author and graduate student Jonathan Jara-Almonte and the team used a PPPL device known as the Magnetic Reconnection Experiment (MRX).




Hantao Ji (Photo by Elle Starkman)

Unlike in past experiments, Jara-Almonte and his team used a plasma made out of argon atoms, rather than hydrogen, deuterium or helium. Using argon, they found, allowed them to produce conditions for collisional reconnection within the plasma more easily.

Along with confirming the existence of plasmoid instabilities in collisional plasmas undergoing reconnection,

the research showed that instabilities can arise even when a plasma does not conduct electricity well, a condition known as having a low Lundquist number that scientists thought would hinder plasmoid development. This was a surprising finding, since scientists have long predicted that plasmoids would form only when a plasma conducts electricity well.

"The bigger picture is that these results raise some questions about plasmoid instability theory that haven't been answered yet," said Jara-Almonte. "The results raise questions about what is really happening in other systems."

The MRX experiment also confirmed that plasmoids speed up the rate at which reconnection occurs — the first time the effect has been observed in a collisional environment. Understanding how fast reconnection occurs is important because it can affect Earth in dramatic ways. When reconnection happens on the surface of the sun, enormous blobs of plasma shoot into space and can collide with Earth's magnetic field, creating geomagnetic storms that threaten communication satellites and electricity grids. 

PPPL has moved to Duo authentication for Google Apps

You must enroll by Jan. 26 or be locked out of your account.

Need help or have questions? The Help Desk is offering assistance. For detailed instructions of this process, please go to https://ppplprod.service-now.com/kb_view.do?sysparm_article=KB0010510.

Organizational survey to all staff scheduled this week

By Jeanne Jackson DeVoe


All staff at PPPL can express their views about PPPL's culture and organization in a Laboratory-wide survey being sent to the more than 500 people working at the Laboratory today as part of an organizational diagnosis of PPPL.

The organizational diagnosis was the brainchild of Dave McComas, Princeton University vice president for PPPL. "The survey is an important tool that will give us a deep look into this organization to understand what's working well and identify what's not working well," McComas said. "I urge everyone here to participate and to be really blunt about their feedback. This is an opportunity for everyone to make their voices heard."

"They're going to attempt to determine if we have any culture issues, diversity issues, inclusion issues that the Laboratory needs to address," said Terry Brog, interim director of PPPL. "I'm hoping the survey will uncover some of the challenges that we face. We need to improve performance and culture

has a huge impact on performance. This is an opportunity for all staff to move the culture of our Lab forward."

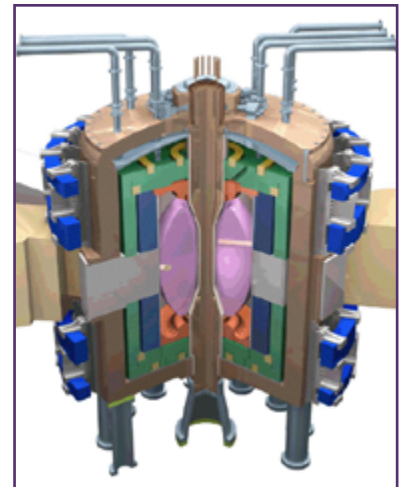
"It's really important that you participate," said Ruth Orenstein, president of Princeton Consulting Resources Inc., which is doing the organizational diagnosis. "The value of doing this is for everyone in the organization to have a shared understanding of the way in which PPPL is viewed and to participate in making recommendations about what changes are desirable."

PPPLers will have until Feb. 1 to complete the survey. Princeton Consulting will have a series of feedback meetings after which a final report will be given to Dave McComas. McComas has pledged to share the final report and an all-hands meeting is tentatively planned for mid-March to discuss the results with staff. Staff should look for an email this week with a link to the survey. 

COLLOQUIUM

What is the Fusion Nuclear Science Facility, What Does it Do, Why do We Need It...
The Critical First Step Toward Power Plants

Charles Kessel
PPPL



Wednesday, Jan. 25

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

LGBT Employee Resource Group hosts legal discussion

The LGBT Employee Resource Group at Princeton University is sponsoring a talk with local lawyer Bill Singer entitled, "Protecting Our Families in a Rapidly Changing Environment," on **Thursday, Jan. 26 from 6-7:30 p.m.** at the Princeton University Friend Center.

DVVR

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Identifying gaps

Engineers in charge of each system have been gathering documents related to their system's design, such as drawings and calculations, and preparing a system design description. Then they compare the design to the actual construction of the system by examining the system and related documents. The engineers then identify any gaps or issues between the design and the construction and present their findings to the DVVR committee, each of which includes PPPL members and external reviewers. The committee identifies any gaps or issues they see.

"The scope of this, I want to emphasize, is to include technical issues that might compromise the reliability of the NSTX-U upgrade," Neumeyer told the central instrumentation and control (I&C) DVVR review committee. Neumeyer noted that, "The causality of problems is not within the scope of this review." The results from the DVVRs will be a major input to the corrective action plan that will be reviewed by an external Extent of Condition Review Committee.

Les Hill, the head of the Infrastructure and Operational Improvements (IOI) project, is heading a separate effort as head of the Extent of Cause Review Committee. It is charged with examining the cause of previous issues as well as any issues identified through the DVVRs.

In addition to PPPL staff, the Instrumentation and Control DVVR Committee includes Steven Hartman, data acquisition group leader at Oak Ridge National Laboratory Neutron Sciences; Larry Hoff, Computing and Controls Department manager, Michigan State University Facility for Rare Isotope Beams; Jim Irby, principal research engineer, MIT Plasma Science and Fusion Center; and Brian Nelson, research professor at the University of Washington who has collaborated with PPPL.

Identifying "primary issues"

During the DVVR meeting, Stefan Gerhardt, the deputy engineering director of the Recovery Team, recorded the gaps and issues identified by the members. Neumeyer and the review committee prioritized them, ranking any issue that would have a severe cost or schedule impact on the NSTX-U or would affect its mission as a "primary issue." Issues that would have an impact on the reliability, longevity, or performance of the device but do not need immediate attention were ranked as secondary. Some issues were also deemed minor issues or out of the scope of the review because they relate to the extent of cause review.

"We're collecting data," Neumeyer said. "Once we have the data in hand, we'll know how to deal with it."




Al von Halle shows the external reviewers PPPL's electrical system during a tour. Left to right: Stefan Gerhardt, deputy engineering director for the NSTX-U Recovery Project; Steve Hartman, of the Oak Ridge National Laboratory Neutron Sciences; Bill Davis, PPPL; Larry Hoff, of Michigan State University Facility for Rare Isotope Beams; Brian Williams, of the University of Washington, and Frank Malinowski, PPPL. (Photo by Jeanne Jackson DeVoe)

Greg Tchilinguirian, the responsible engineer for the I&C system, presented the DVVR for the CODAC group, which is in charge of the system. Tchilinguirian said the DVVR process involved the entire team working to compile a huge amount of data for a 100-page report. "This was a valuable effort," Tchilinguirian told the committee. "We had a sense of urgency. Everyone gets the big picture now. We're trying to figure out the challenges and how we're going to address them."

The I&C system is vital during NSTX-U operations when 500 people a day connect to the system, Tchilinguirian said. Tim Stevenson, deputy head of NSTX-U operations, said researchers access data from the system when NSTX-U is operating and even when it isn't. "In addition to our research staff working around the clock, we have collaborators around the globe," said Stevenson. "Research never stops and data mining has been really popular while we're down. The CODAC area is a particularly important area that's 24-7 and cannot be down."

Used on every other system

One major part of the system is the Experimental Physics and Industrial Control System, or EPICS. This is the "backbone of IC," Tchilinguirian said. The EPICS system is a control system used on every other system on NSTX-U except the magnets, including the MDSplus system. That is why 11 of the 12 NSTX-U responsible engineers on the DVVRs were part of the review committee. Among the many functions EPICS controls is the central clock that connects NSTX-U to the Control Room and the Control Room displays. However, the system relies on Computer-Aided Measurement and Control (CAMAC) hardware, which has been in service for many years. 



A group photo of attendees at the DVVR. Seated are: Steve Hartman, Oak Ridge National Laboratory Neutron Sciences; Larry Hoff, Michigan State University Facility for Rare Isotope Beams; Mike D'Agostino, John Dong, Charles Neumeyer, engineering director of the NSTX-U Recovery Team, and Greg Tchilinguirian, who gave the presentation. Standing, left to right: Frank Malinowski, Brian Williams, University of Washington; Scott Weidner, Princeton University assistant vice president for engineering at PPPL; Feng Cai, Paul Henderson, Neway Atnafu, Paul Sichta, Scott Doskoczynski, John Wertenbaker, Fanghao Yang, Bill Davis, Xin Zhao, Al von Halle, Roman Rozenblat, Mark Cropper, Frank Hoffmann, Matt Reinke, Marc Sibilia, Hans Schneider, and Stefan Gerhardt, the deputy NSTX-U Recovery Project engineering director. (Photo by Elle Starkman)



A career panel with, left to right: Tabbetha Dobbins, Rowan University Department of Physics and Astronomy; Joan Smith, Google; Jamie Hutchinson, Solvay; and Katerina Visnjic, Princeton University Physics Department. (Photo by Elle Starkman)

Urry spoke at the 2017 APS Conference for Undergraduate Women in Physics (CUWiP) Mid-Atlantic Regional Conference at Princeton University. She told students that she is still often the only woman in the room even though her department now has six out of 52 female faculty members – the highest number of the top 50 physics departments in the U.S. “That’s crazy, right?” Urry said. “If we were offered the same opportunities and had the same treatment, women would be half the faculty in every subject.”

Urry, a professor of astrophysics at Yale whose research focuses on active galaxies that host supermassive black holes in their centers, was one of the plenary speakers at the conference, which focused on giving young women the tools to stay in physics and other STEM fields. More than 200 women attended the Jan. 13 to Jan. 15 conference.

Addressing unconscious bias

Urry noted that the percentage of women in the U.S. graduating from college with physics degrees has remained flat at 20 percent for the past decade. Women in physics and other fields are affected by unconscious bias, Urry said. She cited one study that found participants who were given the resumes of equally qualified men and women were more likely to pick resumes with men’s names on them.

The Princeton CUWiP Conference was one of nine conferences nationwide and one in Canada that took place simultaneously. Other host institutions included Harvard University, Virginia



David Yaeger, an assistant professor of psychology of the University of Texas, Austin, at a workshop on “Combating imposter syndrome and bias and developing a growth mindset.” (Photo by Elle Starkman)

Polytechnic Institute, and the University of California, Davis. The conference was offered free aside from a \$45 registration fee and travel expenses. It was funded by the DOE’s Office of Science and the National Science Foundation through grants to the American Physical Society.

Shannon Swilley Greco, a Science Education program leader at PPPL, organized the conference with Lyman Page, chair of the University’s Physics Department, and graduate student Laura Chang. Greco told the young physicists that she hopes the conference will inspire them to stay in a physics or STEM field. “I don’t ever want anyone to leave the field they loved because they felt ill-prepared,” she told the young physicists, “or because they just had so much doubt that they were afraid they weren’t where they were supposed to be, or that they were made to feel unwelcome or uncomfortable.”

The conference kicked off on Friday, Jan. 13, with a tour of University research laboratories, including the Andlinger Center, Geosciences, and PPPL. More than 60 people attended the PPPL tour, which visited PPPL’s National Spherical Torus Experiment-Upgrade test cell and control room. “I love it!” said Bernadette Haig, a student at Fordham University. “This is new stuff for me, so it’s really cool!”

“Don’t get discouraged”

Women on a career panel made up of women at Google, Solvay, and Princeton and Rowan universities, advised the young women to be persistent. “The golden rule is don’t get discouraged,” said Katerina Visnjic, a senior lecturer in the Princeton Physics Department, who is redesigning the introductory physics curriculum. “When you see scientific results presented, that is the last 1 percent of the work that went into that. It doesn’t reflect the 99 percent that didn’t work.”

The conference offered a variety of workshops on topics from “Mental health,” and “Out in STEM,” to “Negotiation and other Professional Skills.” In the workshop on “Combating imposter syndrome & bias and developing a growth mindset,” David Yaeger, an assistant professor of psychology at the University of Texas, Austin, said intelligence is just one factor that predicts an individual’s success. “Intelligence itself is malleable especially in your developing stage,” Yaeger added. “Every time you do a hard mathematical proof, your brain actually changes.”

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The “How to be an ally” workshop focused on how to be an ally to under-represented groups. “If you have privilege, use that privilege,” said Geraldine Cochran, dean of the Douglass Project for Rutgers Women in STEM. “If you are only looking at job candidates who have graduate degrees from Harvard and Princeton, why not look at people who did really well but have not gone to undergraduate institutions like that?”

Developing a work-life plan

Students attending a workshop on work-life balance were encouraged to think about developing a work-life plan that builds in time for outside activities and simply having fun. “How are you going to find ways to motivate yourself that help you feel fulfilled? And what is a full life apart from what you imagined a successful life is?” asked Amada Sandoval, director of the Princeton University Women’s Center.

Nergis Mavalvala, a physics professor known for her role in the confirmation of gravitational waves at the Laser Interferometer Gravitational-Wave Observatory, broadcast her keynote speech from Harvard, with all 10 conferences broadcasting video greetings from their audiences. The Princeton group did a wave.

Among the numerous “Hot Topics in Physics” speakers was Fatima Ebrahimi, a PPPL physicist, who discussed her research studying a phenomenon in magnetic reconnection that could be used to start fusion devices called tokamaks and might also yield insights into magnetic reconnection, the process that triggers solar flares, the Northern Lights, and



Organizer Shannon Swilley Greco, a Science Education senior program leader at PPPL, speaks to the audience. (Photo by Elle Starkman)


other astrophysical phenomena. “If you know plasma physics, there’s no boundary,” Ebrahimi told students. “You can do detailed analysis in the lab but then you can move on and answer fundamental questions in astrophysics.”

Several students presented their research in a poster session at the end of the day on Jan. 14. On Jan. 15, the final day of the conference, Katja Nowack, an experimental condensed matter physicist at Cornell University, discussed her research. The conference concluded with a Career and Research Expo at the Frick Chemistry Laboratory Building.

CUWiP Plus at PPPL

A group of about 20 students attended a CUWiP Plus session at PPPL, where they spent Sunday afternoon and Monday morning learning about plasma physics led by physicist Arturo Dominguez, a Science Education senior program leader. A second group learned about astrophysics through a giant radio antenna and a trip on Sunday to the Princeton University Imaging and Analysis Center.

Participants in the conference said they enjoyed meeting other female physicists. “I wanted to come to the conference because there are only eight women in my year in physics,” said Katherine Guido, a student at the Stevens Institute of Technology in Hoboken, New Jersey. “I thought it would be really cool to talk to other women physicists.”

“I think it’s amazing,” said Jessica Irving, an associate professor in the University’s Geosciences Department. “I’ve never been to a meeting like this before – a meeting full of women who are excited about science.” 



Young women present their research at a poster session at Frick Chemistry Laboratory. (Photo by Elle Starkman)



More than 200 students and speakers attending the 2017 APS Conference for Undergraduate Women in Physics Mid-Atlantic Regional Conference pose outside Jadwin Hall at Princeton University. (Photo by Elle Starkman)

Ronald E. Hatcher

Science on Saturday LECTURE SERIES

Jan. 28

The Physics of Cancer

Robert Austin, Princeton

Feb. 4

Imperative of Vaccination Nationally and Globally

Adel Mahmoud, Princeton

Feb. 11

Meat, Monkeys, and Mosquitoes: A One Health Perspective on Emerging Diseases

Laura Kahn, Princeton

Saturdays at 9:30 a.m., MBG Auditorium

Volunteers wanted for Mercer Science and Engineering Fair

Organizers of the Mercer Science and Engineering Fair are looking for scientists and engineers to volunteer as judges of fourth to twelfth-grade science projects during the fair in March at Rider University.

Students from Mercer County schools show off their original science projects at the fair from March 12 to March 15. Judging takes place March 12 to 13.

Additional information about the fair is available at <https://mercersec.org/about/msef>.

To volunteer, go to <http://mercersec.org/help/BecomeAJudge> or contact volunteers Kevin Lamb, klamb@pppl.gov or Hans Schneider, hshneid@pppl.gov.

Application opens for presenters at 2017 Princeton Research Day

Applications are being accepted through Feb. 20 for non-faculty researchers at Princeton University, such as undergraduates, graduate students and postdoctoral researchers, to present at the second annual 2017 Princeton Research Day on May 11. The application is available at <https://researchday.princeton.edu>.

[The link to the Research Day website is available here.](#)

[The link to the application is available here.](#)

Contribute to Princeton University's Business Clothing Drive

Please contribute to Princeton University's annual clothing drive to collect business attire for men and women, benefitting Dress for Success, HomeFront's Suitably Dressed, UIH's Operation Fatherhood, and Isles.

The University is also collecting unwanted stuffed toys for donations to Glad Dogs Nation, which creates safe dog toys from old, unwanted stuffed animals. To learn more about Glad Dogs Nation visit www.gladdogsnation.com

Items can be brought to 350 Alexander St. between 8 and 9 a.m. and 12:30 and 1:30 p.m., weekdays, Jan. 25 through Feb. 1.

Volunteers are needed during collection hours. For more information, or to volunteer to assist with the clothing drive, contact Erin Metro in Community and Regional Affairs at emetro@princeton.edu or 609-258-5144.

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 January 23	Tuesday January 24	Wednesday January 25	Thursday January 26	Friday January 27
COMMAND PERFORMANCE Chef's Feature	Sushi Made to Order	Taco Bar Tuesday served with Rice and Beans	Teriyaki Roast Pork Loin served with Vegetable Fried Rice and an Egg Roll	Sloppy Joe with Tater Tots	Shrimp Basket
Early Riser	Blueberry Pancakes	Scrapple and Eggs	Tater Tot Breakfast Bake	Ham, Egg & Cheese French Toast	Bacon, Spinach & Mozzarella Quesadilla with Cilantro Cream
Country Kettle	Cream of Broccoli	Minestrone	Chicken Pot Pie	Cream of Mushroom	Beef and Rice
Deli Special	Egg Salad Club Sandwich Wrap	Hawaiian Ham with Pineapple Slaw	Lemon Rosemary Turkey Sandwich	American Hoagie with Ham, Bologna, and American Cheese	Capicola, Pepperoni, Salami, and Fresh Mozzarella Flatbread with Spicy Pepper Pesto Mayo
Grill Special	My Big Fat Greek Turkey Burger	Made-to-Order Grill	Sweet and Sour Salmon Burger on a Whole Wheat Roll with Lettuce, Tomato and Grilled Scallion	Grilled Margherita Sandwich	Philly-Style Cheesesteak Calzone
Panini	Spicy Crab Salad Wrap	Chicken Breast, Fontina Cheese, Pesto Mayonnaise & Tomato on Ciabatta Bread	Buffalo Chicken Sliders served with Fries	Meatball, Pepper and Onion Sandwich	NY Street Dog— 2 Sabrett Hot Dogs with Sauerkraut, Red Onions & Mustard served with Fries

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY

VEGETARIAN OPTION

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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/>.