

## Calendar of Events

### WEDNESDAY, JUNE 15

#### PPPL Colloquium

4:15 p.m. ♦ MBG Auditorium

[Wendelstein 7-X: Highlights from the First Operational Phase of the New Optimized Stellarator](#)

Dr. Oliver P. Ford, Max-Planck Institut für Plasmaphysik, Greifswald/Garching, Germany

### UPCOMING

#### MONDAY, JUNE 20

#### Mandatory All-Hands Safety Meeting

1-2:30 p.m. ♦ MBG Auditorium

See [page 3](#) and [page 5](#) for details.

#### JUNE 28-30

#### US-PRC Magnetic Fusion Collaboration Workshop

#### WEDNESDAY, JUNE 22

#### PPPL Colloquium

4:15 p.m. ♦ MBG Auditorium

[Liquid Metal Batteries for Large-scale Energy Storage](#)

Professor Hojong Kim, Pennsylvania State University

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## A celebration of PPPL inventors at recognition event

By Jeanne Jackson DeVoe

A patented device to pasteurize eggs in the shell, a fusion-powered rocket engine, and a device to detect drones were just a few of the inventions by PPPL inventors and their colleagues who were recognized at PPPL's annual Inventor Recognition Dinner on June 8.

The event, at Princeton University's Prospect House, honored 42 inventors for 20 inventions during fiscal year 2015, which ended last September. The inventors included PPPL physicists, engineers, technicians, interns, and graduate students, as well as collaborators from Princeton University, the U.S. Department of Agriculture, and Princeton Satellite Systems, a small company in Plainsboro. One group of inventors received a patent, three groups have patent applications, and 16 filed invention disclosures, the first step in the patent process. Stewart Prager, PPPL's director, presented each inventor with a certificate, and each will receive a cash reward.



Showing off their patent for a new device to pasteurize eggs are left to right: Christopher Brunkhorst, Andrew Bigley, formerly of the U.S. Department of Agriculture; and David Geveke, Department of Agriculture.

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## Grierson and Haskey probe source of rotation that stabilizes fusion plasmas

By John Greenwald

A key puzzle in fusion research is what causes the plasma fuel in tokamaks to rotate even when no external source of momentum is injected into the plasma by the operations team. Comprehending the source of this intrinsic rotation will be crucial for modeling the behavior of plasma in future tokamaks like ITER, the international facility under construction in France to demonstrate the feasibility of fusion power. Such modeling is essential because rapid rotation can stabilize plasma and enhance the ability of fusion to take place.

Now physicists at PPPL, who are working on the DIII-D National Fusion Facility that General Atomics operates for the DOE in San Diego, have taken a major step toward identifying the source. Led by Brian Grierson and Shaun Haskey, they are using new detailed measurements made through Grierson's 2015 DOE Early Career Award to map the flow of ions of the hydrogen isotope deuterium, the main fuel ions, at the edge of the plasma.

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# Inventor Recognition Dinner

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“Inventions are the lifeblood of the Lab,” said Laurie Bagley, head of Technology Transfer at PPPL, who organized the event. “It’s where we are going forward. These inventions further not only the science of fusion but all the technologies coming out of the Lab.”

PPPL engineer Chris Brunkhorst and two partners from the U.S. Department of Agriculture were recognized for their patent on a device to pasteurize raw eggs in the shell using radio



Laurie Bagley, head of Technology Transfer and the organizer of the event, at the podium.

frequency waves. Brunkhorst along with David Geveke, a research chemical engineer and lead scientist at the USDA and Andrew Bigley, an engineer technician who retired from the USDA a few years ago, created a device that can destroy microorganisms such as Salmonella in eggs without harming the delicate egg white. The patent was the 27th patent PPPL inventors received between 1994 and 2014. Brunkhorst received the New Jersey Hall of Fame “Innovators Award” in 2015. (PPPL inventors who received patents over the past year will be recognized next year).

“Getting a patent is the culmination of a lot of work. It’s a real thrill to be recognized,” Brunkhorst said. “And the patent award dinner is always a pleasurable experience. Not only is it a nice meal in beautiful surroundings, but it’s also good to get together with your fellow inventors and see just what it is we accomplished here in the Lab.”

The patent applications include one by PPPL physicist Samuel Cohen, and Michael Paluszek and Gary Pajer from Princeton Satellite Systems, for a fusion-powered rocket engine that would be faster and less expensive than traditional jet engines. The engine could be used to transport up to 10,000 kilograms of payload on space missions to planets in our solar system and in “extra-solar system destinations.”

Another patent application, for an invention by physicists Hantao Ji, Philip Efthimion, Eric Edlund, Erik Gilson, and former deputy director for operations Adam Cohen, is for an advanced centrifuge. The device spins faster to speed up the rate that materials are separated and increase the amount of separation. It has an inner cylinder that speeds faster than the outer cylinder. Rings on the top and bottom surfaces control the flow of materials inside the inner chamber.

Graduate student Vasily Geyko and physicist Nathaniel Fisch also applied for a patent for a technology that uses gas spinning and a flywheel to improve the efficiency of traditional engines.

PPPL inventors filled out invention disclosure forms, the first stage of the patent process, for 16 inventions. These include several inventions related to plasma physics and fusion energy, such as a new type of x-ray crystal spectrometer invented by Manfred Bitter, Ken Hill, Philip Efthimion and Luis Delgado-Aparicio, that uses a new class of focusing crystal surfaces. Physicist Richard Majeski invented a method to remove tritium and deuterium from liquid lithium in fusion reactor applications.

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Masa Ono, left, and Nat Fisch. (Photo by Larry Bernard)



Inventors outside Princeton University’s Prospect House: Front row from left: Andrei Khodak, Charles Gentile, John Dong, Richard Majeski, Michael Gomez, Ali Zolfaghari; second row: Hans Schneider, Greg Tchilinguirian, Nat Fisch, Cara Bagley, a SULI intern last summer; Michael Paluszek, of Princeton Satellite Systems; Masa Ono, Irving Zatz, Igor Kaganovich, and Philip Efthimion; third row: Peter Titus, Gary Pajer, of Princeton Satellite Systems; Kevin Lamb, Vasily Geyko, a PPPL graduate student; Douglass Darrow, Christopher Brunkhorst, David Geveke, of the U.S. Department of Agriculture, and Andrew Bigley, formerly of the U.S. Department of Agriculture. Not pictured: Adam Cohen, Benjamin Tobias, Christopher Tully, Dennis Mansfield, Erik Gilson, Eric Edlund, Gretchen Zimmer, Hantao Ji, James Mitrani, Jay Johnson, Kenneth Hill, Lane Roquemore, Luis Delgado-Aparicio, Manfred Bitter, Matthew Chu Cheong, a former intern at PPPL; Novimir Pablant, Peter Porazik, Samuel Cohen, Yevgeny Raitses, and Yosef Razin.

## ES&H head Jerry Levine previews all-hands safety meeting

A mandatory all-hands meeting scheduled for 1 to 2:30 p.m. on Monday, June 20, in the MBG auditorium will focus on safety issues. Jerry Levine, head of Environment, Safety and Health, gives a preview and discusses what it's all about in the following interview.



Jerry Levine

### Q: Why are we having a safety all-hands meeting?

A: Last October, a fatal accident occurred at the Florida State University National High Magnetic Field Laboratory. This accident was tragic and had a profound effect on the staff of that Laboratory, as well as on the accident investigators. Betsy Dunn, Director of Environment, Safety & Quality Assurance at Argonne National Laboratory, led the team that investigated the accident, and has agreed to come to PPPL to speak to us about it. She has already traveled to some other DOE Labs to give her account.

### Q: What do you want employees to get out of this meeting?

A: This event has broad implications for our work, and hearing Betsy's account will stimulate us to think about how something like this could happen here and what we can do about it. PPPLers will be asked to consider risks in each of our own workplaces based on Betsy's talk, and to meet within their work groups to discuss these risks and how to mitigate them.

### Q: Why is what happened at Florida State relevant here?

A: This event involved serious deficiencies in hazardous energy controls, equipment designs, and work planning, all of which are relevant to our work at PPPL. In addition, I believe the causes of this accident will stimulate thoughts on broader topics that affect us all, such as adequacy of job training, roles and responsibilities, workplace complacency, and more. I urge everyone to attend this meeting. We can all learn from it. 📍

## Inventor Recognition Dinner

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Several inventions were not related to fusion energy. Kevin Lamb devised a drone detection technology. The device can also capture data used by the drone operator to ensure that a particular area is secure and can pinpoint the location of the operator.

Another invention by Princeton University's Chris Tully and PPPL engineer Charles Gentile was a technique to identify materials in high resolution using X-ray fluorescence. One use of the technology could be to authenticate paintings.

Bagley said she hopes to see more inventors honored at the dinner in years to come. "We would like to grow the number of invention disclosures, which could potentially result in more patent applications," she said. "The more, the better."

Bagley encourages everyone at PPPL with a good idea for an invention to think about whether it is novel, useful, and non-obvious, and fill out an invention disclosure form, the first step in the patent process. [The form is available here.](#) More



Michael Gomez, left, with Cara Bagley, and Ali Zolfaghari. (Photo by Larry Bernard)

resources for inventors, including and Inventor's Guide to Technology Transfer at Princeton is available on [Princeton University's Office of Technology Licensing site.](#) 📍

## Robotics coaches needed for all-girls robotics teams

**PPPL's Science Education team is looking for volunteer coaches for a new all-girls FIRST Lego League Robotics team (ages 9 to 13) and the new FIRST Tech Challenge Team (ages 13 to 18) being organized in collaboration with the YWCA-Princeton.**

**Please call Shannon Greco ASAP to volunteer:  
[sgreco@pppl.gov](mailto:sgreco@pppl.gov), 609-243-2208.**

## Inspiring young scientists at Hispanic youth conference

Science Education's Arturo Dominguez taught Hispanic high school students about circuits and electromagnets in a career exploration workshop at an annual conference for Hispanic youth on Friday, June 3, at Princeton University.

Dominguez, along with Atiba Brereton (filling in for Luis Delgado-Aparicio who was unable to attend) demonstrated how electromagnets work and showed students how to build their own at the conference. The event was sponsored by HISPAA (Hispanics Inspiring Students' Performance and Achievement), which aims to inspire Hispanic students to go to college and pursue a profession. The conference pairs mentors like Dominguez with 150 New Jersey high school students. It was co-sponsored by Princeton University's Office of Human Resources and co-hosted by Verizon and the Verizon Hispanic Support Organization. 📷



Students create a circuit that will eventually light a lightbulb. (Photo by Atiba Brereton)



Dominguez catches a ring in an electromagnet demonstration. (Photo by Atiba Brereton)

## Grierson and Haskey

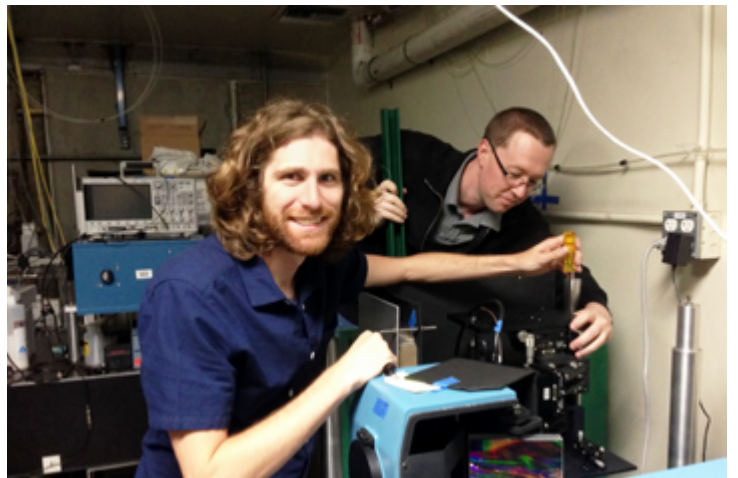
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Scientists have commonly used impurity ions that are kicked up when plasma touches the walls of a tokamak to determine the plasma rotation, because the atomic physics behind such impurity measurements is relatively simple. However, theoretical indications are that the main ions should rotate much faster than the impurities at the plasma edge, making impurity measurements an inadequate substitute for measuring the main ions in the edge.

Grierson and Haskey have for the first time performed detailed measurements of the flow of main ions at the edge of the plasma in the DIII-D tokamak, and have shown that the theoretical predictions of a large difference in flows are indeed qualitatively correct. A major challenge now is to understand how these flows behave under different plasma conditions and to predict what they will be in ITER.

One process thought to initiate intrinsic flow of the main ions is called "ion orbit loss," in which some ions escape from their orbits around magnetic field lines. This loss of ions stirs up rotation in the remaining ions at the edge of the plasma; the physics of this mechanism is still not well understood.

"Dramatic examples of stirring up the earth's atmosphere by the release of heat are tornados and hurricanes", says Grierson. "Understanding how the random motion of air molecules leads to swirling air currents is not unlike the challenge of understanding how the motion of plasma particles leads to the swirling of the edge plasma, which is then transported to the bulk of the plasma through viscosity."



PPPL physicists Shaun Haskey, left, and Brian Grierson install a spectrometer component and align cameras used to make main-ion measurements at the edge plasma in the DIII-D tokamak. (Photo by Colin Chrystal)

The new findings, which Grierson and Haskey presented last week at the 2016 High Temperature Plasma Diagnostics Conference in Madison, Wisconsin, demonstrate the importance of measuring the flow of main ions, and how such measurements can be used to test emerging theories of plasma rotation. The physicists will now check theoretical models of plasma flow that are made on the DIII-D tokamak, using tools such as the XGC codes at PPPL, to see which best explain the new measurements. 📷

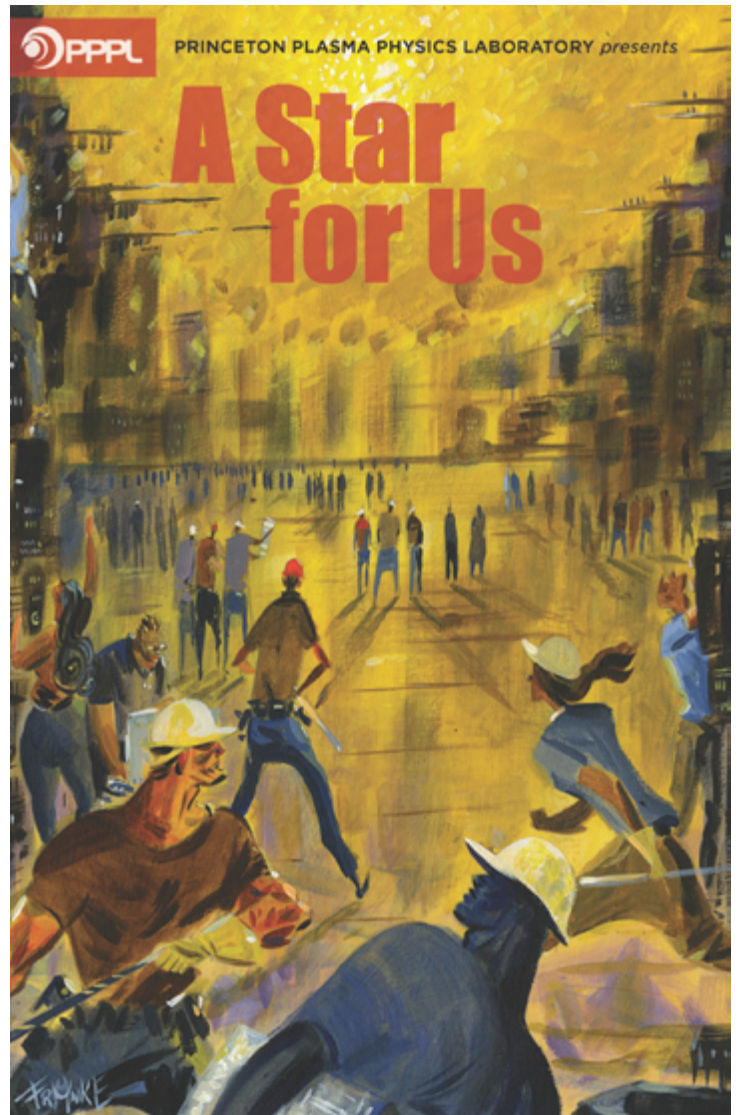
## PPPL fusion comic book wins national award

“A Star for Us,” the glossy PPPL comic book that describes the prospect and power of fusion energy, has won a 2016 Circle of Excellence Silver Award from the Council for Advancement and Support of Education (CASE). The award honors the outstanding quality, impact and innovation of a publication that brings widespread recognition to an educational institution. The comic book won in the category of Promotional Publications.

The PPPL Office of Communications commissioned “A Star for Us,” which was written by Sajan Saini, a lecturer in the Princeton University writing program, and illustrated by artist Frank Espinosa. The duo worked closely with members of the Communications staff on the visual and written content. Judges hailed the result as a “great concept and stylistic choice” filled with “nice quality illustrations.”

PPPL submitted the entry under the auspices of Princeton University, which manages the Laboratory. The University won two Circle of Excellence citations: A Gold Award in the category for Individual Fund Raising Publications and a Silver Award in the category for Fundraising—Flash Campaigns.

CASE, one of the largest international associations of educational institutions, serves more than 3,600 universities, colleges, schools and related organizations worldwide. The 2016 Circle of Excellence contest drew more than 3,350 entries in almost 100 categories, with judges selecting 322 winners. [D](#)



## Mandatory all-hands safety meeting on Monday, June 20

**There will be a mandatory all-hands safety meeting on Monday, June 20 from 1 to 2:30 p.m. in the MBG Auditorium.**


Betsy Dunn, director of Environment, Safety & Quality Assurance at Argonne National Laboratory, will discuss a fatal accident that occurred last October at the Florida State University National High Magnetic Field Laboratory. Dunn led the team that investigated the accident. There will be time for questions and answers and staff will participate in an exercise based on the discussion.

**Everyone at the Laboratory is expected to participate, so please plan accordingly.**

## College interns kick off internships with introductory course in plasma physics

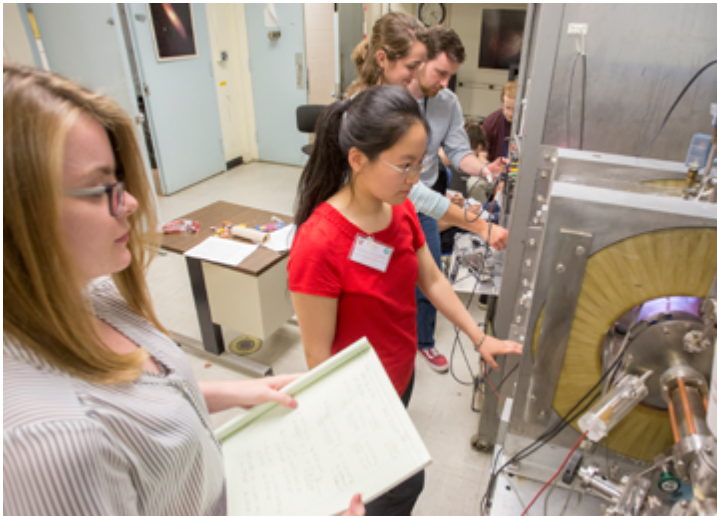
PPPL was host to about 60 student interns last week who kicked off their internships with a week-long course in plasma physics. They heard lectures by top physicists and did hands-on experiments in laboratories in which they created plasmas.

“It’s going great. The speakers have been fantastic,” said Arturo Dominguez, Science Education senior program leader, who organized the course. “The students are participating a lot and asking a lot of good questions.”

Most of the students are part of PPPL’s Student Undergraduate Laboratory Institute (SULI), a selective program in which students from universities all over the country take part in a 10-week research internship in which they work on research projects with scientists. The program will send nine students to General Atomics, while around 50 will work at PPPL. PPPL also hosts a few student interns from the Community College Internship and several college interns working in the Engineering Department. 



Tahiri Nunez, of the New Jersey Institute of Technology, records experiment results in the Science Education Laboratory.



Alexandra Bosh, from the Virginia Polytech Institute and State University, records results as Jessica Chen, of Brown University, observes a plasma. Behind them are Rachel Broughton, of the Rose-Hulman Institute of Technology, and graduate student Kris Meehan.



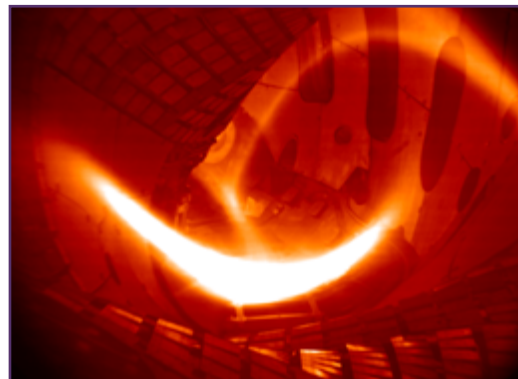
Interns from Princeton University seem mesmerized by the plasma they created. From left to right: Joe Abbate, Chris Jagoe, and Dylan Mavrides.



Student interns taking part in the plasma physics workshop last week pose in the LSB lobby.

# COLLOQUIUM

## Wendelstein 7-X: Highlights from the First Operational Phase of the New Optimized Stellarator



**Dr. Oliver P. Ford**

Max-Planck Institut für Plasmaphysik, Greifswald/Garching, Germany

**Wednesday, June 15**

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

**BROCK**

**MARK GAZO**  
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 June 13	Tuesday June 14	Wednesday June 15	Thursday June 16	Friday June 17
<b>COMMAND PERFORMANCE Chef's Feature</b>	<b>Chicken Fried Chicken Steak</b> with Country Gravy, Okra, Mashed Potatoes & Biscuit	<b>Grilled Steak Fajita</b> with Onions, Peppers, Tomatoes & Honey Chipotle Sauce served with Rice & Beans	<b>COMMAND PERFORMANCE Create your own Carla's Ravioli Bar</b>	<b>Fried Chicken</b> with Cheesy Mashed Potatoes & Vegetable	<b>Outdoor BBQ</b> Grilled BBQ Chicken Breast, Hot Dogs, Salmon Burgers, Corn, Cowboy Beans with Beef, Potato Salad, Watermelon, Iced Tea & Water
Early Riser	<b>Kielbasa</b> & 2 Eggs any style	<b>Coconut Banana Pancakes</b>	<b>Steak &amp; Eggs</b> with Seared Tomatoes	<b>2 Eggs any style</b> with Corned Beef Hash	<b>Veggie Omelet</b> with Home Fries
Country Kettle	<b>Cream of Cauliflower Soup</b>	<b>Split Pea Soup</b>	<b>Chicken Gumbo</b>	<b>Potato Leek</b>	<b>Manhattan Clam Chowder</b>
Grille Special	<b>BURGERLICIOUS My Big Fat Greek Turkey Burger</b> Grilled Turkey burger with melted feta cheese, tomato, red onion, banana peppers & spinach topped with cucumber sauce on a grilled whole wheat roll	<b>Grilled Salmon Burger</b> with Lettuce & Tomato	<b>Italian Meatball Calzone</b>	<b>Grilled Portobello Mushroom</b> with Red Pepper, Spinach & Feta Cheese on Naan	<b>Grilled Seafood Salad</b> & Cheese on Texas Toast
Deli Special	<b>American French Bread Hoagie</b> with Cooked Salami, Bologna & American Cheese	<b>Buffalo Chicken &amp; Mushroom Quesadilla</b> with Bleu Cheese	<b>New Orleans Muffaletta</b>	<b>Fried Ravioli</b> served with Grilled Vegetables	<b>Glazed Ham</b> on a Ciabatta Roll
Panini	<b>French Bread Panini</b> with Fresh Mozzarella, Pesto, Peppers & Provolone	<b>Italian Panini</b> with Prosciutto, Provolone, Salami, Banana Peppers, Tomatoes & Red Onion on Focaccia	<b>Cajun Chicken</b> on a Kaiser Roll with Peppers, Onions, Pepper Jack, Tomato & Chipotle Mayo	<b>Baja Chicken Panini</b> with Pepper Jack, Pico de gallo Cheddar & Chipotle Ranch Wrap	<b>Turkey Chipotle Club</b> with Bacon, Tomato, Smoked Gouda & Chipotle Ranch

MENU SUBJECT TO CHANGE WITHOUT NOTICE

VEGETARIAN OPTION

**WEEKLY**

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

The PPPL WEEKLY is published by the [PPPL Office of Communications](#) on Mondays throughout the year 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](mailto:commteam@pppl.gov) ♦ PPPL WEEKLY is archived on the web at: <http://w3.pppl.gov/communications/weekly/>.