

At PPPL THIS WEEK

WEDNESDAY, JUNE 18
PPPL Colloquium

4:15 p.m. ♦ MBG Auditorium

 Nuclear Famine: The Threat to
Humanity from Nuclear Weapons
Alan Robock, Rutgers University

THURSDAY, JUNE 19
PPPL Patent Award Dinner

6:00 p.m. ♦ Prospect House

UPCOMING EVENTS
June 25
PPPL Colloquium

4:15 p.m. ♦ MBG Auditorium

 Cosmic Microwave Background (CMB)
Dr. Renee Hlozek, Princeton University

July 4
Lab Closed

Independence Day Holiday

July 9-11
**Theory and Simulation of
Disruptions Workshop**
PPPL

August 8
Annual PPPL Bluefishing Trip

5 p.m. ♦ Belmar Marina

Aboard the 80' Suzie Girl

Reserve by July 25



Inside...


 Summer
Students

page 4



Colloquium

page 5



Café Menu

page 5

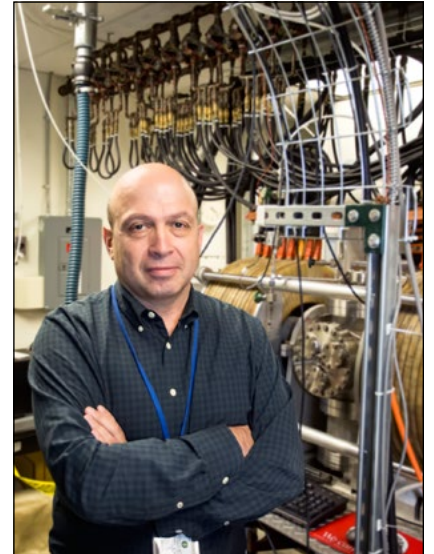
PPPL gets \$4.3 million to explore role plasma plays in synthesizing nanoparticles

By John Greenwald

PPPPL has received some \$4.3 million of DOE Office of Science funding, over three years, to develop an increased understanding of the role of plasma in the synthesis of nanoparticles. Such particles, which are measured in billionths of a meter, are prized for their use in everything from golf clubs and swimwear to microchips, paints and pharmaceutical products. They also have potentially wide-ranging applications in the development of new energy technologies.

"Plasma is widely used as a tool for producing nanoparticles, but there is no deep understanding of the role that plasma plays in this process," said physicist Yevgeny Raitses, the principal investigator for the project. "Our goal is to develop an understanding that can lead to improved synthesis of these particles."

continued on page 2



Yevgeny Raitses

PhD Comics' guide to fusion makes the complex understandable

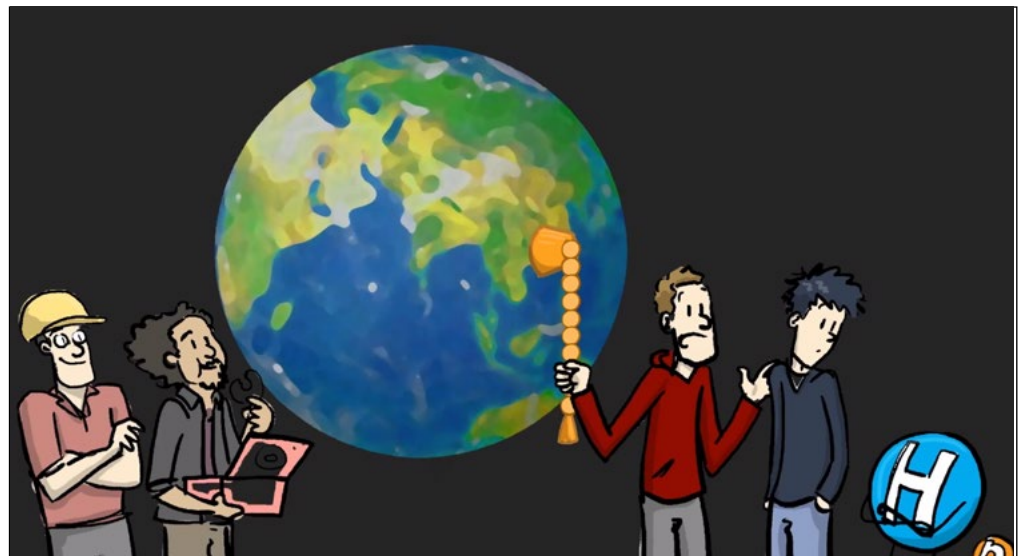
By Jeanne Jackson DeVoe

The eight-minute video, "Fusion Energy Explained," created by PhD Comics' Jorge Cham, which features interviews and cartoon characters of PPPL physicists, got more than 33,500 "hits" on YouTube in just three days after being posted on June 9.

Andrew Zwicker, head of Science Education, and Arturo Dominguez, a postdoctoral fellow in Science Education, explain some of the basics of magnetic fusion, while Stefan Gerhardt, a principal research physicist, gives a tour of the National Spherical Experiment in a live video and as a cartoon character. The video can be seen on the [PhD Comics site](#), on [YouTube](#) and on the [PPPL website](#).

Cham said he was very satisfied with the final result. "I feel great about it," he said. "I tried a few different new animation tricks and it all came together well."

continued on page 3



Cartoon characters representing PPPL physicists who were interviewed by Jorge Cham, of PhD Comics, for the video "Fusion Energy Explained," appear in front of an image of the Earth as Andrew Zwicker explains how fusion could change the world.

Nanoparticles

continued from page 1

The new funds will expand research in a nanotechnology laboratory that PPPL launched in 2012 with PPPL Laboratory Directed Research and Development (LDRD) funds. The facility studies the complex interactions that occur when hot, electrically charged plasma gas is used as a synthesizing agent to produce material such as carbon nanotubes — items that are tens of thousands of times thinner than a human hair, yet stronger than steel on an ounce-per-ounce basis. These interactions must be precisely controlled to ensure the quality and purity of such material.

Many collaborators worked on the funding proposal for the new research. Key contributors included physicists Igor Kaganovich and Brent Stratton, who led the plasma theory and diagnostic sections of the proposal, respectively, and will continue to lead these project areas. Also essential were physicists Edward Startsev and Benoit LeBlanc, who worked on the theory and diagnostic parts of the proposal, respectively, and physicist Andrei Khodak, who contributed computer modeling.

Key collaboration also came from Predrag Krstic, a professor in the Institute for Advanced Computational Science at Stony Brook University, and Mikhail Shneider a senior research scientist in the Mechanical and Aerospace Department at Princeton University. Krstic is an expert on the atomistic computer modeling of materials; Shneider has invented new laser diagnostics for plasma applications.

Major contributors also include Bruce Koel, a Princeton professor of chemical and biological engineering, who will help characterize nanomaterials that come from the PPPL laboratory; Roberto Car, a Princeton professor of chemistry who will contribute to the atomistic modeling; Michael Keidar, a George Washington University professor of engineering and an expert on plasma nanotechnology; and Mohan Sankaran, an associate professor of chemical engineering at Case Western Reserve University and an expert on the plasma-based synthesis of nanoparticles.

Philip Efthimion, head of the Plasma Science and Technology Department at PPPL, provided guidance and support for the funding proposal. Olga Tishinin, a PPPL budget analyst, also provided key support.

Wide-ranging of applications

In discussing the new research, PPPL Director Stewart Prager noted that, “The synthesis of nanoparticles is a challenging and exciting field with wide-ranging applications. This project combines our expertise in plasma science with the material science capabilities of Princeton University and other institutions.”



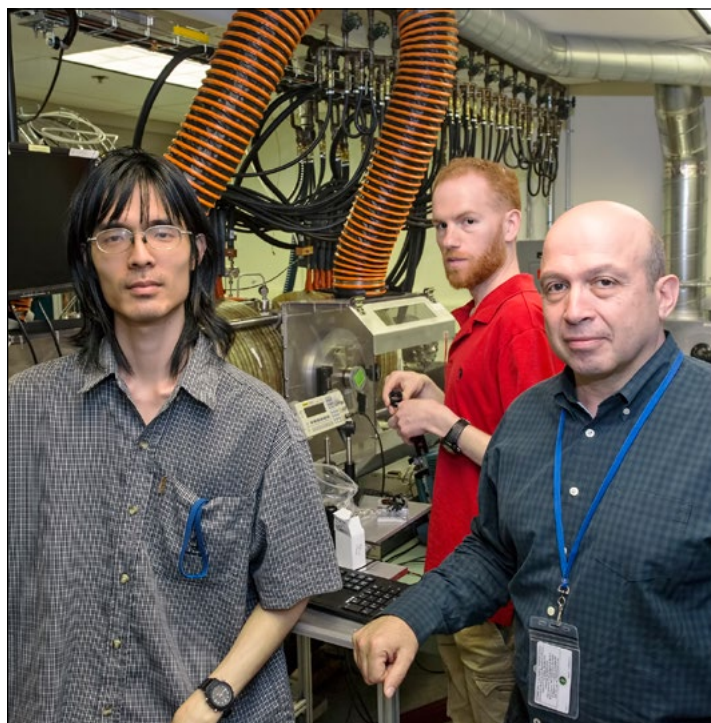
Jonathan Ng, a second-year graduate student, in the laboratory.



James Mitrani is doing research for his thesis in the nano laboratory.

The expanded research “fits right into our core competency,” said Adam Cohen, PPPL deputy director for operations, who teamed with Prager to champion the initial development of the nanolaboratory, which was assembled with guidance from engineer Charles Gentile, and the new funding. “We’ve gained knowledge of plasma from our fusion research,” Cohen said, “and this enables us to grow into a whole new research opportunity.”

PPPL is managed by Princeton University for the U.S. Department of Energy’s Office of Science. DOE’s Office of Science is the single largest supporter of basic research in the physical sciences in the United States, and is working to address some of the most pressing challenges of our time. For more information, please visit science.energy.gov.



Raites, right, with graduate students in the nanotechnology laboratory: Ng, left, and Mitrani, center.

PhD Comics

continued from page 1

The three physicists featured in the video were also happy with the video. “I love it!” said Dominguez. “I’ve been hearing from a lot of people that I was born to become a cartoon!”

“Jorge’s creativity is what puts it into a different realm,” said Zwicker. “It’s awesome because of him. It’s nice that we were part of it and I think we did a good job being clear but Jorge is the one who pushed it into a different arena.”

“It makes people smile”

“It makes people smile,” Zwicker added. He said he and Dominguez showed the video to their mothers, and they both had the same reaction. “My mom and Arturo’s mom said, ‘I think I almost understand what you do now, for the first time ever!’”

Cham said he came to the Lab in November at the urging of Director of Communications Kitta MacPherson. “I jumped at the opportunity,” he said. “I knew there was an interesting story and some very cool concepts behind getting (magnetic fusion) to work that would be great to explain.”

He said he enjoyed meeting physicists and graduate students during his November visit. “The optimism and desire to change the world was really great,” he said.

For their part, the researchers were impressed with Cham’s ability to synthesize complex information. “He got the message very well,” said Gerhardt. “It’s pretty impressive, I have to say, for him to zoom in one day, and do this.”

Cham, who has a PhD from Stanford University in mechanical engineering, is well known for his cartoon “Piled Higher and Deeper” (PhD for short) about the life of graduate students. His website gets more than 6.5 million unique visitors a year.

Cham also produces a dozen videos a year on topics ranging from the Dead Sea Scrolls to “A Brief Interview with Stephen Hawking.” The videos use live video, cartoons, or a combination of both like the PPPL video. Cham is also a popular speaker on college campuses with his talk on, “The Power of Procrastination.” He gave about a dozen talks at universities around the country and in Saudi Arabia and the UK over the past six months.

Cartoons are hand drawn

Cham hand draws his cartoons, including most of those in the PPPL video. (The segments that show particles interacting were done by Jasper Palfree from MinuteLabs.) The drawing is “the easy part for me,” Cham said. “The more time consuming parts are the audio editing and animation.”

The interviews with Dominguez, Zwicker and Gerhardt “were great and did a lot of the hard work,” Cham said. The challenge, he said, was deciding how much to explain about plasma and fusion. “I had the feeling the public probably don’t know what either fusion or plasma is but getting



The Zwicker character with two animated hydrogen particles. Cham draws most of the animations by hand. (Screen shot courtesy of PhD Comics, www.phdcomics.com/TV)

two satisfying explanations in one video is hard,” he said in an email from a family vacation in Panama, where both he and his wife grew up.

In the video, Zwicker explains the promise of fusion energy. “Either this is too good to be true or you’re left with, ‘This is crazy! This is the most important thing we can be doing scientifically!’” he says at the beginning of the video.

The video uses cartoons of two hydrogen particles with feet to show how they combine in fusion. Dominguez describes how the two particles repel each other when they get close together unless their nuclei get close enough to touch each other and “have this nuclear strong force take over. It’s an attractive force that’s stronger than electric repulsion,” he explains as a heart appears over the fused particles.

Zwicker and Dominguez take turns narrating how fusion works. “The big question becomes: What is the right container?” Zwicker says. The Laboratory is working on the answer by “making a magnetic bottle,” he says.

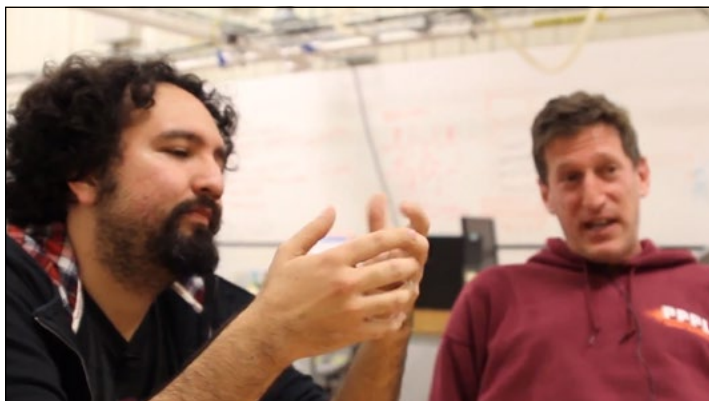
A cartoon image of Dominguez explains that a magnetic field traps plasma and keeps it from hitting the wall of a tokamak. The process is similar to how the jelly in a jelly donut is trapped inside the donut and doesn’t touch the outside glaze, he says.

Gerhardt then explains how NSTX-U works in a live video tour of the device that also features cartoon illustrations of the device. Gerhardt walks Cham and the audience through how the device creates plasma and heats it up.

Ends on an upbeat note

The video ends on an upbeat note. “If we’re right, it changes the planet as we know it because it’s a completely new paradigm and a source of energy,” Zwicker says. “I mean, don’t you want to be part of something that changes the world? That’s the bottom line.”

That argument has apparently convinced Cham. He says he is rooting for magnetic fusion to become a reality. “I hope you guys succeed!” he said. “The planet needs it!” 📺



Dominguez, left, and Zwicker, right, in a live shot of their interview. The two mostly appear as cartoon characters throughout the video. (Screen shot courtesy of PhD Comics, www.phdcomics.com/TV)



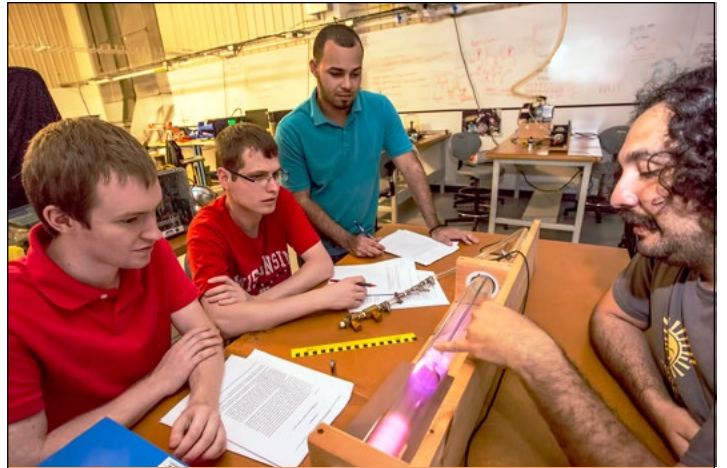
Gerhardt is featured giving Cham a tour of the National Spherical Torus Experiment (NSTX-U) in which he explains how the device creates a plasma. (Screen shot courtesy of PhD Comics, www.phdcomics.com/TV)

Summer students plunge into the world of plasma at PPPL

PPPL welcomed 13 SULI students, 1 CCI student and 15 NUF students this week. The students spent a week learning about plasma physics at PPPL. Ten of the NUF students will go to General Atomics for the summer and the 19 other students from all three programs will remain at PPPL to do research for the summer.



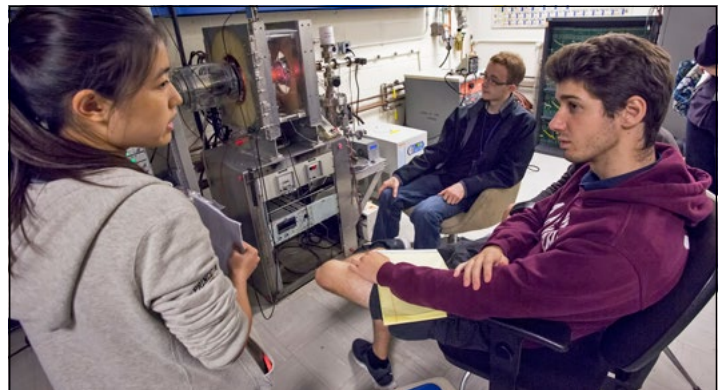
Graduate student Jonah Squire, front right, shows students how to control a plasma. Left to right: Sarah Newbury, Harvard; Yao Wen, Princeton University; Jelani Hardwick, University of Alabama; David Keating, University of California at Berkeley.



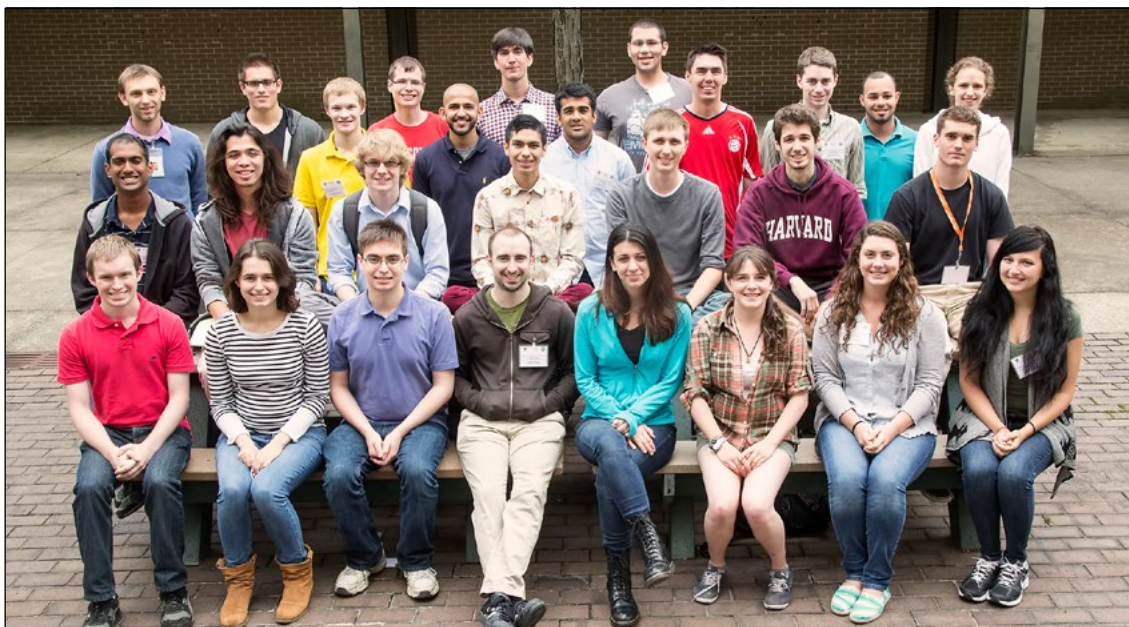
Arturo Dominguez, right, a postdoctoral fellow in Science Education, shows students how to create a plasma in the Science Education Laboratory. From left to right: Gregory Szalowski, Georgia Tech; Andy Alt, University of Wisconsin-Madison; Carl Sosa-Rivera, Universidad Politecnica de Puerto Rico.



Physicist Bob Kaita gives the students a tour of PPPL, starting with the stellarator model.



Ge Dong, left, a graduate student at PPPL, works with Ian Ochs, of Harvard, right; and Elijah Kolmes, center, of Princeton.



Summer students attending a week-long introductory course in plasma physics at PPPL.

World Cup Celebration at PPPL

PPPL'ers took a moment out of their regular workday during the afternoon of June 12 when they gathered in the LSB lobby to watch the televised opening of the FIFA World Cup soccer tournament in Brazil and enjoy some popcorn and cookies. Some stayed to watch the opening match, in which Brazil beat Croatia 3-1.



COLLOQUIUM

NUCLEAR FAMINE: THE THREAT TO HUMANITY FROM NUCLEAR WEAPONS

ALAN ROBOCK, RUTGERS UNIVERSITY

Wednesday, June 18

4:15 p.m. (Coffee/Tea at 4 p.m.) • MBG Auditorium

2014 Annual PPPL Bluefishing Trip Aboard the 80ft "Suzie Girl"



FRIDAY, AUGUST 8, 2014

Departure: 5pm SHARP!

Location: Belmar Marina Hwy. 35, Belmar, NJ 07719

Cost: \$75 Per person • All inclusive
Money due by Friday July 25. NO REFUNDS.

Cost includes everything:
Rods, Bait, Fish Cleaning, Food, Beverages, Prizes etc.
ALL YOU NEED TO DO IS SHOW UP!

Contact Andy Carpe ext. 2118 acarpe@pppl.gov
Bob Tucker Jr. ext. 3190 rltucker@pppl.gov

Site Protection Division • TIP • OF • THE • WEEK •

Cigarette Disposal / Mulch Fires

During the recent clean-up event at PPPL for Earth Day, volunteers found many cigarette butts throughout the Laboratory grounds.

This is a safety concern and a potential fire hazard — especially in the spring and summer months when the outdoors has a tendency to be dry. Mulch and dry ground around our buildings present a greater potential to catch fire from discarded cigars and cigarettes. Mulch fires and wildfires can spread quickly, threatening building, property, natural resources and human lives.

Please be sure to completely extinguish your cigar or cigarette when you are finished and place the butt in one of the designated containers.

Remember that PPPL provides and requires a smoke-free environment. Smoking is not permissible in any Laboratory building, near fresh air intakes, in Laboratory vehicles or within 25 feet of any building entrance. Large outdoor ashtrays are available in appropriate, smoking-permissible areas adjacent to building entrances. Always use these ashtrays for disposal of cigarette butts. Contact Facilities via the Work Order Request System if you see that an ashtray has become degraded or unusable, or is nearing capacity.

Always call the emergency number (Ext. 3333) when a fire is discovered — even if the fire is out. Mulch fires can smolder and burn for hours undetected and cause a major fire.



BROCK Café 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*

COMMAND PERFORMANCE
CHEF'S FEATURE

	MON. JUNE 16	TUE. JUNE 17	WED. JUNE 18	THU. JUNE 19	FRI. JUNE 20
COMMAND PERFORMANCE CHEF'S FEATURE	 Ranch Chicken Macaroni & Cheese	 Cheese Ravioli with Vegetables in a Pink Vodka Sauce	 Home-style Meatloaf, Mashed Potatoes & Vegetable	 Roast Pork Fried Rice served with an Egg Roll	 Broiled Tilapia & Shrimp with Baked Potato & Vegetable
EARLY RISER	Oatmeal Raisin Pancakes with Turkey Sausage	Western Omelet with Home Fries	Pork Roll, Egg & Cheese on a Croissant	Steak, Onion & Cheese Omelet with Home Fries	Banana Walnut Pancakes with Bacon
COUNTRY KETTLE	Buffalo Chicken Soup	Vegetable Soup	Turkey Corn Chowder	Cream Of Mushroom	Manhattan Clam Chowder
GRILLE SPECIAL	Fat Cat Hoagie with Onion Rings	Denver Western Sandwich with Black Bean, Quinoa & Mango Salad	Create Your Own Omelet Bar served with Home Fries	Grilled Turkey Pastrami Reuben with Fries	Scrambled Egg, Bacon, & Cheddar on Torpedo with Home Fries
DELI SPECIAL	Grilled Vegetables with Provolone and Balsamic Vinegar	Toasted Roast Beef & Cheddar Hoagie	The Pilgrim with Cranberry Compote & Watermelon Salad	Grilled Tuna Caesar Salad Wrap	Turkey, Roasted Eggplant, Red Peppers, Provolone & Spicy Mayo
PANINI	Ham, Turkey, Swiss, Tomato, Banana Pepper & Honey Mustard	Tuna Melt with Tomato & Cheddar	BBQ Turkey Burger with Pepperjack, Tomato & Chipotle Mayo	Focaccia Bread with Avocado, Jack Cheese, Tomato & Red Onion	Ham, Muenster Cheese, Bacon, Tomato & Spicy Mayo

MENU SUBJECT TO CHANGE WITHOUT NOTICE

 VEGETARIAN OPTION

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

WEEKLY Editor: **Jeanne Jackson DeVoe** ♦ Layout and graphic design: **Gregory J. Czechowicz**
Photography: **Elle Starkman** ♦ Writer: **John Greenwald** ♦ Web: **Chris Cane**

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 Thursday. Other stories should be submitted no later than noon on Wednesday. Comments: commteam@pppl.gov ♦ **PPPL WEEKLY** is archived on the web at: <http://w3.pppl.gov/communications/weekly/>.