PPPL PRINCETON PLASMA PHYSICS LABORATORY
A Collaborative National Center for Fusion & Plasma Research
U.S. DEPARTMENT OF ENERGY
WEEKLY
MONDAY, JANUARY 21, 2013

PPPL scientists win time on world's fastest supercomputers

By John Greenwald

Three teams led by scientists at PPPL have won major blocks of time on two of the world's most powerful supercomputers. Two of the projects seek to advance the development of nuclear fusion as a clean and abundant source of energy by improving understanding of the superhot, electrically charged plasma gas that fuels fusion reactions. The third project seeks to extend understanding of a process called magnetic reconnection, which is widely believed to play a critical role in the explosive release of magnetic energy in phenomena like solar flares that can disrupt cell phone service and black out power grids.

"This is great for the Laboratory," PPPL Director Stewart Prager said of the highly competitive, three-year awards. "Getting this kind of computing time allows the solution of complex equations and critical issues that wouldn't be possible otherwise."

The three-year awards come from a DOE program to accelerate scientific discovery called Innovative and Novel Impact on Computational Theory and Experiment (INCITE). The awards provide allocations of millions of computer core—or processor—hours. For example, 100 million core hours would equal roughly 100 million hours—or 11,000 years—on a desktop computer powered by a single processor.

The PPPL recipients:

A nationwide center headed by PPPL physicist C.S. Chang that is developing computer codes to simulate the dazzlingly complex conditions at the edge of magnetically confined plasmas in donut-shaped devices called tokamaks. Chang's team, the Center for Edge Physics Simulation (EPSI), won 100 million core hours a year on Titan, a Cray XK7 machine that is housed at the DOE's Oak Ridge National Laboratory and has been proven to perform over 17 quadrillion—or million billion—calculations a second, making it the world's fastest supercomputer, according to the November, 2012, TOP500 list.

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Arturo Dominguez: A passion for teaching about magnetic fusion

By Jeanne Jackson DeVoe

Arturo Dominguez is a man who clearly has zeal for the mission of teaching young people — and anyone else who will listen — about the bright future of magnetic fusion.

As the newest member of the Science Education staff, where he is a postdoctoral fellow, Dominguez is full of enthusiasm for a job that allows him to combine his love of physics research with his passion for educating people about how plasma physics will lead to a renewable energy source.

"There's a big disconnect between what we know about plasma and fusion and what the general community knows about it," he said. "There's a big learning gap that we really need to fill. I think that's what got me into science education."

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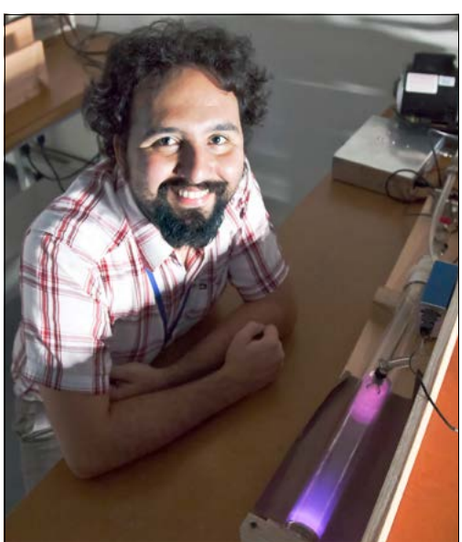


Physicist Arturo Dominguez, the newest member of the Science Education staff, in the laboratory.

At PPPL THIS WEEK

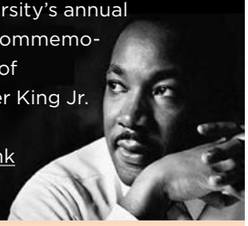
MONDAY, JANUARY 21

Martin Luther King Jr. Day

1 p.m. - 3 p.m. ◆ Richardson Auditorium

Princeton University's annual celebration to commemorate the legacy of Dr. Martin Luther King Jr.

Click here for link



WEEK OF JAN. 21

Look for the safety culture survey in your email box!

WEDNESDAY, JANUARY 23

GFDL Events and Seminars
2 p.m. ◆ Geophysical Fluid Dynamics Laboratory (GFDL)

Smagorinsky Seminar Room

Visualizing the ocean's overturning with surface 14C measurements

Robbie Toggweiler, Geophysical Fluid Dynamics Laboratory

www.gfdl.noaa.gov/events

(Gov't, University or 2 other forms of I.D. needed)

PPPL Colloquium
4:15 p.m. ◆ MBG Auditorium

Ensemble modeling of climate-carbon cycle interactions

John Krasting, Geophysical Fluid Dynamics Laboratory

Refreshments at 4 p.m. in the LSB Lobby

Click here for link

THURSDAY, JANUARY 24

CPPG Theory Seminar
10:45 a.m. ◆ T-169

Accelerating scientific knowledge in DOE science

Scott Klasky

SATURDAY, JANUARY 26

Science on Saturday
9:30 a.m. ◆ MBG Auditorium

Disastrous equations: the role of mathematics in understanding tsunami

J. Douglas Wright, Department of Mathematics, Drexel University

UPCOMING EVENTS...

Feb. 22 - 23
DOE's NJ High School Science Bowl®

Volunteers needed.
Contact Deedee Ortiz, x2785 or email dortiz@pppl.gov

Arturo Dominguez

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Dominguez replaced Stephanie Wissel, who joined the research staff at UCLA, where she will have research assignments in Antarctica and Hawaii.

Dominguez said he enjoys the fact that there are so many facets to his job. He might start his day working on a project to build a DC discharge demonstration project and then travel to Trenton to work with high school students or visit other local schools.

Andrew Zwicker, head of Science Education, said Dominguez brings a lot to his multifaceted job. "He's taking on a bunch of different roles," Zwicker said. "He's taking his plasma physics knowledge and applying it to a plasma education project, he's taking his fusion knowledge and applying it to education with students."

Dominguez recently received his PhD from the Massachusetts Institute of Technology where he worked on the Alcator C-Mod tokamak and often collaborated with PPPL scientists.

His dual role as scientist and educator could be seen at the American Physical Society conference in Rhode Island. He presented a poster on his PhD research at the conference and manned a booth with several colleagues and PPPL volunteers at the Science Expo. Some 2,000 students flocked to the event.

A native of Colombia, Dominguez came to the U.S. in 2000 to study physics as an undergraduate at the University of Texas, Austin. While he was in college, he began working with physics professor Kenneth Gentle, who got Dominguez interested in studying plasma and fusion. He went on to MIT to pursue his new interest.

A passion for teaching

Dominguez has retained his zest for research but his enthusiasm and passion for outreach and teaching is obvious. "I like the outreach component a lot and the teaching part a lot," Dominguez said. "I think one of the most important things we need to do is communicate to the general public and students the importance of plasma physics and fusion."

Once every two weeks, Dominguez and his colleague Aliya Merali travel to Trenton Central High School to meet with students involved in the Clouds (Classroom Leadership Operative in u-gravity Discovering Science) program. The students are learning about the scientific process by designing and developing their own zero gravity experiment. "Working with kids is really great because there's a lot of enthusiasm there and it looks like they really enjoy the process," he said.

Dominguez clearly enjoys teaching and outreach. Here he speaks to young people during the Science Expo at the American Physical Society's Rhode Island conference in November. (Photo courtesy of Science Education).

Dominguez rode his Vespa scooter "Lady" to work sporting a ladybug helmet before the weather got too cold.

Project for Liberty Science Center

He has a hand in various research projects in Science Education but his big project is a DC discharge demonstration exhibit for the Liberty Science Center in Jersey City. The exhibit would allow visitors to manipulate a plasma by using a touchscreen. They can learn what happens when levels of voltage, pressure or magnetic field are altered. He is hoping to test the device sometime next spring. "It's a good way of showing plasmas to people," he said. Dominguez and his colleagues would like to use the device in other museums and perhaps even in PPPL's lobby.

Dominguez is married to Carolina Pabon-Escobar, a graduate student at Pratt University who is studying industrial design. The high school sweethearts maintained a long-distance relationship when Dominguez left for the University of Texas. They got married when Pabon-Escobar came to the U.S. in 2006.

They live in Bushwick, Brooklyn, near Pabon Escobar's university. The couple has little free time. When there's room in the schedule, however, they enjoy salsa dancing.

When Dominguez first began at PPPL in mid-September, he rented a room near the Princeton Junction train station and stayed there a few days a week. He commuted to PPPL on a Vespa motorcycle, which he dubbed "Lady," wearing his trademark ladybug helmet. Dominguez gave up his room and hung up his helmet in November and jokes that "Lady" is going to hibernate. He and his wife purchased a car, which he dubbed "Tramp" after the Disney movie "Lady and the Tramp," that he uses to commute from Brooklyn.

Meanwhile, he seems to have his hand in everything and the list of projects is growing. "It's great because there's a lot of brainstorming of ideas, of things we can be doing," he says, "so it's keeping me very sharp."

Supercomputing

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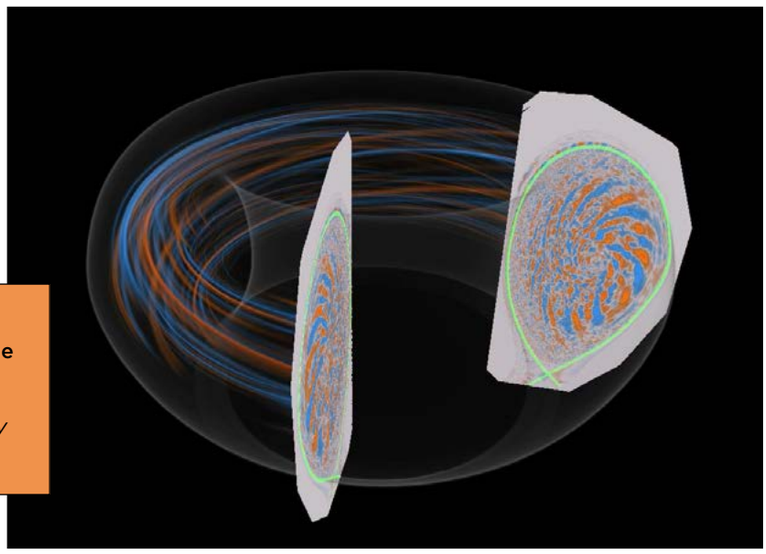


At right is a donut-shaped plasma simulation that C.S. Chang's EPSI project produced on a supercomputer. The orange and blue colors show regions of turbulence.

Credit: Visualization by Prof. Kwan-Liu's group, University of California-Davis

The allotted time could go surprisingly quickly. "If we utilized one million cores an hour we would have the machine for 100 hours or less than five days," said Chang.

Learning to control the turbulent plasma edge will be vital for future fusion facilities such as ITER, an international tokamak of unprecedented size and power that is under construction in France. Uncontrolled turbulence can disturb the rest of the plasma and prevent fusion from taking place, while controlling the edge conditions can make the fusion reaction more efficient. "This is definitely among the most critical issues facing fusion plasma physics," said Prager, "and one that is perfect for an INCITE award."

The INCITE award will enhance a five-year, $12.5 million project to simulate the plasma edge that Chang's EPSI team has already begun. Funds for that project come from the DOE's Scientific Discovery through Advanced Computing (SciDAC) program supported by the Department's Office of Science. Participants in EPSI include physicists, mathematicians and computer scientists from 11 U.S. research institutions, together with PPPL staffers Stephane Ethier, Seung-Hoe Ku, Jianying Lang, and Darren Stotler, and postdoctoral fellow Robert Hager.

A PPPL-led international team that is studying the rapid loss of plasma confinement caused by growing turbulence as fusion facilities become larger and more powerful. Such losses can significantly decrease the power output of fusion systems but have been shown to level off when facilities reach a certain size—a development that bodes well for future tokamaks. "This is very good news for ITER," said project leader William Tang, a PPPL physicist and Princeton University lecturer with the rank of professor in the Department of Astrophysical Sciences.

Tang's project, called "Kinetic Simulations of Fusion Energy Dynamics at the Extreme Scale," won 40 million core hours on Mira, an IBM Blue Gene/Q supercomputer at the DOE's Argonne National Laboratory. Mira can calculate 10 million billion times a second, a speed that will be needed to simulate the complex processes that cause the turbulence to grow to a certain level as the plasma size increases, only to stop growing when the dimensions of the system increase further. "The question is a very basic one," said Tang. "What's the physics behind this favorable trend that is expected to occur in large plasmas such as ITER? No one can presently answer this question, which will require the efficient engagement of computing at the extreme scale to properly address."

Joining Tang in the quest for answers will be PPPL researchers Stephane Ethier and Weixing Wang, together with Bei Wang from the Princeton Institute for Computational Science and Engineering (PICSciE) at Princeton University, and co-investigators from Columbia University, the Max Planck Institute for Plasma Physics in Garching, Germany, and the DOE's Oak Ridge and Lawrence Berkeley national laboratories.

Researchers investigating magnetic reconnection, an astrophysical phenomenon that gives rise to the northern lights, solar flares and geomagnetic storms. A team led by Amitava Bhattacharjee, head of the Theory Department at PPPL and a professor of astrophysical sciences at Princeton University, won 35 million core hours on the Titan supercomputer at Oak Ridge.

Reconnection takes place when the magnetic field lines in merging plasmas snap apart and explosively reconnect, a process seen throughout the universe and in disruptions of plasma during fusion experiments. New insight into reconnection could lead to better predictions of geomagnetic storms and other space weather, and to greater control of experimental fusion reactions.

Plans call for Bhattacharjee's team to develop codes to simulate the reconnection that occurs when researchers focus high-powered laser beams on tiny spots of foil. This creates fast-expanding plasma bubbles with magnetic fields that trigger reconnection when the bubbles come together. The recently observed phenomena open up "a new regime of reconnection study of great interest to laboratory and plasma astrophysics," said Bhattacharjee, who launched the code-development project while a professor of physics at the University of New Hampshire (UNH) before joining PPPL and Princeton in August, 2012.

Work on the reconnection project will continue under Bhattacharjee with collaboration by UNH physicists Naoki Bessho, William Fox, Kai Germaschewski and Yi-Min Huang.

The supercomputing awards to PPPL were among five 2013 INCITE awards to researchers at Princeton University. Also winning supercomputing time were Emily Carter, the Gerhard R. Andlinger Professor in Energy, and a professor of mechanical and aerospace engineering & applied and computational mathematics; and Jeroen Tromp, a professor of geosciences, applied and computational mathematics, and Blair Professor of Geology. Carter and collaborator Lin-Wang Wang, of Lawrence Berkeley National Laboratory, won 25 million core hours on Titan to simulate processes inside nanosystems—systems measured in billionths of a meter. Tromp, who also is director of PICSciE, and co-investigator Olaf Schenk, of the University of Lugano, Switzerland, received 100 million core hours on Titan to develop computer models of the interior of the Earth.

University Health Services offers a wide array of services

Employee Health Services at Princeton University's McCosh Health Center in Room G07 offers numerous programs for University employees ranging from immunizations to physical therapy. You can take an audio tour of all Employees Health Services offers at https://www.princeton.edu/experienceuhs/tour/radiological-services/

Here are some of the services:

- Evaluations for work-related injuries and illnesses, consultations for short-term disability, and evaluations for returning to work or returning to work with restricted duties.
- Pre-travel planning, immunizations and prescriptions for travel abroad for personal and work-related travel for a fee. Please allow 6 to 8 weeks before travel. Call 609-258-5357.
- Screenings for certain illnesses including cardiac risk assessment, smoking cessation, cholesterol checks and screening for diabetes.
- Hamilton Physical Therapy Service: Offers physical therapy at McCosh on Mondays, Wednesdays and Fridays from 8 a.m. to 4 p.m. Call 609-258-4450 for more information or to schedule an appointment. Bring a prescription/order from your doctor and your insurance card.
- Laboratory Services: UHS through Quest Diagnostics offers laboratory services from Monday to Friday at 8:45 a.m. to 5 p.m. for all Aetna and UHC members. No appointment is necessary. Bring a prescription/order from your doctor and your insurance card.
- Radiological Services: Radiology services including x-rays, hearing tests and EKGs are available only to employees for work-related injuries who are referred by Employee Health or PPPL Occupational Medicine.
- Health Promotion and Wellness Services: Located on the 1st floor of McCosh, this program offers smoking cessation, weight management and cancer screenings and provides information and lectures. You can also visit the Janet C. Morgan Health and Wellness Library there.

McCosh Health Center

EXPRESS SCRIPTS®

Notice to PPPL Staff with prescription coverage prior to 2007

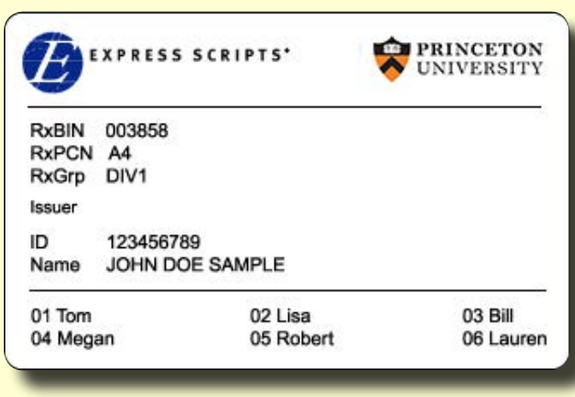
Express Scripts (previously Medco) has found that some Princeton University employees hired prior to January 2007 have been having trouble filling prescriptions at local pharmacies since Jan. 1 and are being told their accounts were terminated.

The problem is occurring because employees hired prior to January, 2007 were able to use their old ID numbers for Express Scripts up until Jan. 1 when Express Scripts' system could no longer recognize the old number.

Express Scripts is issuing new cards to all employees on Jan. 18. If you encounter this problem, you should ask the pharmacy to call the Express Scripts Pharmacy Help Desk at 800-922-1557 so that Express Scripts can give the pharmacy your correct ID number.

Employees can also print a temporary ID card online at www.expresscripts.com. You will need an ID number (you can call Express Scripts at 800-711-0917 to get your number), or you can use your Social Security number.

If you have further questions, please contact Kim Mastromarino in HR at ext. 2101, kmatrom@pppl.gov.



Volunteers Needed

PPPL will host 48 teams of middle and high school students (about 250 students total!) on Friday & Saturday, Feb. 22-23 at the New Jersey Regional Middle and High School Science Bowls.

We need YOUR help!

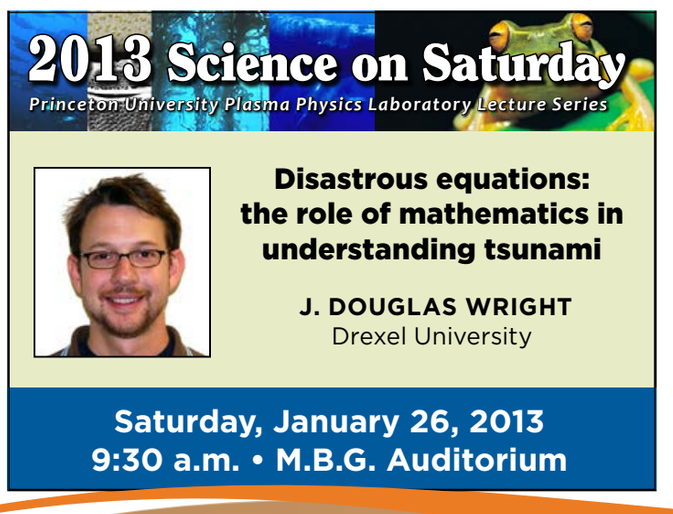
We are hoping to find: moderators, science/rules judges, time/score keepers, lunch attendants, etc.! Won't you please consider volunteering your time? Lunch provided for competition day volunteers!! Contact Deedee Ortiz @ 2785 or **dortiz@pppl.gov**, to sign up or for more information.

Hong Kong visitors tour PPPL

PPPL Deputy Director Adam Cohen led a tour for the president and vice-president of the Chinese University of Hong Kong on Jan. 14 that stopped at the NCSX site. From left to right: retired PPPL physicist King-Lap Wong; Cohen; Joseph J. Y. Sung, vice chancellor and president of the university; Tai-fai Fok, pro vice-chancellor and vice-president of the university; Eric S. P. Ng, registrar and secretary, and Amy Tsui, director of the Communications and Public Relations Office.

NUF Program offers summer of science for senior physics students

Outstanding physics undergraduates entering their senior year of college next fall who are U.S. citizens are encouraged to apply for the National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences (NUF). Students in the program win a generous fellowship to work on a fusion research project with leading scientists at laboratories all over the country during the summer. They begin the 10-week program with a one-week introductory course at PPPL and then work with a physicist mentor on research projects. Many students complete their research at PPPL, while others do research at sites that in the past have included General Atomics, the University of California – Davis and Los Alamos National Laboratory and other prestigious institutions. The deadline for the program is Feb. 1. More information and an application is available under NUF at the Science Education website or contact Deedee Ortiz at dortiz@pppl.gov.



Quarterly Safety Survey out this week

One-fourth of the PPPL staff will receive the new quarterly survey in their email boxes this week as part of an effort to get a continuous picture of the safety culture at the Laboratory.

PPPL Director Stewart Prager is asking all selected employees to fill out the 24-question anonymous web-based survey so that PPPL can use employees' responses to make improvements and gauge whether those improvements are effective.

The quarterly survey will be issued again in April, July and October, giving each staff member the opportunity to participate once a year.

2013 Science on Saturday

Princeton University Plasma Physics Laboratory Lecture Series

JAN. 26	**DISASTROUS EQUATIONS: THE ROLE OF MATHEMATICS IN UNDERSTANDING TSUNAMI** by J. Douglas Wright, Associate Professor, Department of Mathematics, Drexel University
FEB.2	**FROM 0 TO C IN 60 MINUTES: A CRASH COURSE IN EINSTEIN** by Prof. R. Shankar, John Randolph Huffman Professor of Physics, Department of Physics, Yale University
FEB. 9	**FINDING A NEEDLE IN A (GENOMIC) HAYSTACK OR HOW CAN COMPUTERS HELP CURE CANCER** by Prof. Olga G. Troyanskaya, Lewis-Sigler Institute for Integrative Genomics and Department of Computer Science, Princeton University
FEB. 16	**FROM ROBOT SOCCER TO AUTOMOTIVE SAFETY: AN OPTICAL TOUR** by Prof. R. Andrew Hicks, Department of Mathematics, Drexel University
FEB. 23	**NO LECTURE — DOE'S NJ HIGH SCHOOL SCIENCE BOWL®**
MAR. 2	**LIGHT AND NANOTECHNOLOGY — ENGINEERING AND SO MUCH MORE** by Prof. Claire Gmachl, Department of Electrical Engineering, Princeton University
MAR. 9	**A SHORT HISTORY OF LENGTH** by Prof. Joel Langer, Department of Mathematics, Case Western Reserve University
MAR. 16	**A ROBOT'S VIEW OF OUR OCEAN PLANET** by Josh Kohut, Assistant Professor of Oceanography, Center for Coastal Physical Oceanography, Rutgers University

Talks will beheld in the Auditorium of the Princeton Plasma Physics Laboratory, James Forrestal Campus, U.S.Route 1 North in Plainsboro, NJ FOR ADDITIONAL INFORMATION PLEASE VISIT OUR WEBSITE AT: www.pppl.gov

SCIENCE ON SATURDAY is a series of talks geared toward high school students but open to all. Students, teachers, parents, and community members are welcome. There is no fee for the program.

TIME: Doors open at 8:15 a.m. Lectures begin promptly at 9:30 a.m. and usually last one hour followed by a moderated question-and-answer session which typically ends by 11:15 a.m.

REGISTRATION: Register on site prior to each session. No preregistrations accepted. Seating is on a first-come first-served basis.

CANCELLATIONS: If it becomes necessary to cancel a session due to inclement weather, laboratory or national emergency, a message will be left on the Science-on-Saturday Hotline at (609) 243-2121.

PPPL U.S. DEPARTMENT OF ENERGY

Presently, PPPL, a federal facility, is taking heightened security measures. Upon arrival, all adult visitors must show a government-issued photo ID. This could include a passport or a driver's license. Non-U.S. citizens must show a photo ID, plus provide the following information: citizenship, date of birth, and place of birth. For the welfare of both our staff and visitors, PPPL security staff retain the right to inspect vehicles and personal packages such as briefcases, satchels, bookbags, and purses.

COLLOQUIUM

Ensemble Modeling of Climate-Carbon Cycle Interactions

JOHN KRASTING
Geophysical Fluid Dynamics Laboratory

Wednesday, January 23

4:15 p.m. (Coffee/Tea at 4 p.m.)
M.B.G Auditorium, Lyman Spitzer Building

The Plasma Hutch now has an order form that allows you to order items anytime! You can pick up an order form at the Plasma Hutch and give or send it to Kim Mastromarino in HR or download it from the HR website at hr.pppl.gov and send it via email to Kim at kmastrom@pppl.gov.

Come check out the new items in the Plasma Hutch: ceramic mugs, long sleeve T-shirts, crew neck sweatshirts and T-shirts in new colors, including PINK!

Fleece Vest	**$30** (S-XL)	**$32** (2-3XL)
Polo Shirt	**$20** (S-XL)	**$24** (2-3XL)
Zippered Sweatshirt (Hooded)	**$32**	
Pullover Sweatshirt (Hooded)	**$28**	
Crew Sweatshirts	**$20**	
Long Sleeve T-Shirts	**$15**	
T-Shirt	**$12**	
Hat	**$12**	
Travel Mug	**$10**	
Ceramic Coffee Mug	**$6**	
Tumbler	**$5**	
Lanyard	**$3**	
Pen / Ornament	**$1**	

THE PLASMA HUTCH
OPEN FRIDAYS
11:30 A.M. to
12:30 P.M

Brock PPPL 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.

COMMAND PERFORMANCE CHEF'S FEATURE

	MONDAY JAN. 21	**TUESDAY** JAN. 22	**WEDNESDAY** JAN. 23	**THURSDAY** JAN. 24	**FRIDAY** JAN. 25
					
	TORTELLINI ALFREDO WITH PEAS	**PECAN CHICKEN WITH SCALLOPED POTATOES**	**FRENCH DIP ROAST BEEF TORPEDO**	**CHICKEN FAJITA WITH REFRIED BEANS & RICE**	**ENGLISH STYLE FISH & CHIPS**
EARLY RISER	Chorizo, Peppers, Onion and Cheese Omelet	Sausage & Cheese Mini Quiche with Mushrooms & Peppers	Hash Browns, Egg & Cheese on a Kaiser Roll	Grilled Kielbasa with Two Eggs any style & Potatoes	Strawberry Pancakes with Whipped Cream & Maple Syrup
COUNTRY KETTLE	Cream of Spinach	French Onion Soup	Chicken Noodle	Three Bean Vegetarian Chili	New England Clam Chowder
GRILLE SPECIAL	Kielbasa & Sauerkraut Torpedo Served with French Fries	Double Turkey Cheeseburger with Turkey Bacon & Fries	Beef Gyro with Tzaziki Sauce and Fries	Chicken Tender Torpedo with Ranch Dressing & Fries	Trenton Cheeseburger with Pork Roll, Cheese and Fries
DELI SPECIAL	Roast Beef & Swiss Cheese on Asiago Cheese Roll	Classic Turkey Club	Fresh Mozzarella, Tomato & Basil Pesto on Ciabatta Bread	Italian Hoagie Wrap	Bruschetta Chicken Cutlet & Provolone Wrap
PANINI	Chicken Cutlet, Tomato, Fresh Mozzarella and Pesto Ciabatta	Cuban Panini with Pulled Pork, Ham, Swiss Cheese & Pickle	Turkey, Turkey Bacon, Tomato and Cranberry Mayo Ciabatta	Vegetarian Mediterranean Panini	Eggplant Parmesan Ciabatta

MENU SUBJECT TO CHANGE WITHOUT NOTICE

CLICK HERE FOR A PRINTABLE WEEKLY MENU

WEEKLY

Editor: **Jeanne Jackson DeVoe** ◆ Layout and graphic design: **Gregory J. Czechowicz**
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