

*At PPPL*  
**THIS WEEK**

**TUESDAY, MARCH 27**

**PPPL Theory Seminar**

10:45 a.m. - noon ♦ T-169

Bootstrap Current Destabilization of the Kinetic Ballooning Mode in the Tokamak Edge Pedestal

Scott Parker

**WEDNESDAY, MARCH 28**

**GFDL Events and Seminars**

Noon - 1 p.m. ♦ GFDL

Smagorinsky Seminar Room

Radical Loss in the Atmosphere by Cu-Fe Redox Coupling in Aerosols

Jingqiu Mao (AOS/GFDL)

[www.gfdl.noaa.gov/events](http://www.gfdl.noaa.gov/events)

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

**PPPL Colloquium**

4:15 p.m. ♦ M.B. Gottlieb Auditorium

Overview of the PPPL International Experimental Stellarator Collaboration Activity

David Gates (Princeton University)

[CLICK HERE FOR ABSTRACT](#)

**THURSDAY, MARCH 29**

**Physics Colloquium**

4:30 p.m. ♦ Main Campus, Jadwin A10

Building the Most Precise Atomic Clocks in the World by Studying Many-Body Physics

Ana Maria Rey (Jila Institute)

**FRIDAY, MARCH 30**

**DIII-D Science Meeting**

1 p.m. ♦ B-233

**SATURDAY, MARCH 31**

**Sherwood Fusion Theory Conference**

Atlanta, GA (through April 3)

**Plasma Source Created by PPPL Will Benefit Major Particle Accelerator Experiment**

By John Greenwald

Scientists at PPPL have designed and delivered a crucial component for a device that can heat a spot of foil to 30,000 degrees Centigrade in less than a billionth of a second. The part will complete a linear accelerator that researchers at the DOE Lawrence Berkeley National Laboratory are using to create a superheated state called "warm dense matter."

Researchers are eager to study this substance, which is rarely seen on Earth but common throughout the universe. Warm dense matter can be found in the molten core of giant planets like Jupiter, and in the preliminary stages of fusion, a process that powers the sun and stars. Such matter intrigues physicists studying the cosmos and scientists including those at PPPL who are seeking to harness fusion to produce electric power.



Erik Gilson

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**Princeton University Welcomes Japan's Elite Science Students**  
*Students Exchange Culture, Ideas*

By Catherine Zandonella

Ten of the best and brightest students from the University of Tokyo visited Princeton University — and PPPL — on March 13 as part of a tour of top level universities in the U.S.

The Japanese students are participants in a program to promote the exchange of ideas and cultures among undergraduate students and faculty researchers in American and Japan.

Princeton's Dean for Research A. J. Stewart Smith, the Class of 1909 Professor of Physics, welcomed the students to the campus where they visited with physics



PPPL physicist Hantao Ji takes the University of Tokyo students on a tour of the Magnetic Reconnection Experiment (MRX) during their March 13 visit to PPPL and Princeton University.

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# Plasma Source

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For PPPL physicist Erik Gilson, the plasma source he designed for the accelerator marks the third generation of components that he has created for Berkeley Lab projects that are part of the Heavy Ion Fusion Science Virtual National Laboratory, a joint venture of PPPL, Berkeley Lab, and Lawrence Livermore National Laboratory. Gilson's latest device upgrades previous versions while retaining the core — modules made from 1.6-inch-long rings of barium titanate ceramic. The material produces a swarm of ions and electrons at its surface when a high voltage is applied to it.

A bit of mystery surrounds where these ions come from. "The mechanism isn't completely understood," Gilson said. "It could be absorbed gas on the surface of the modules. But whatever fuel you have is what you brought with you when the parts were installed."

The 10-meter-long accelerator, known as the Neutralized Drift Compression Experiment-II (NDCX-II), is expected to begin full-scale operation this fall. The device will send a beam of charged lithium particles — or ions — through a series of electromagnetic induction cells that will accelerate and compress the beam, turning it from a javelin-like projectile into one that resembles a tiny comet. The highly compressed beam will heat a target made of a custom-designed foil, producing the warm dense matter that instruments can analyze in the instant before the target vaporizes.



Photo by Roy Kaltschmidt, LBNL

**The plasma source, created by PPPL's Erik Gilson, will serve as a critical component of a linear accelerator at the Lawrence Berkeley National Laboratory.**

The target material is not like kitchen foil. It measures four one-hundredths of an inch in diameter and is less than a micron thick, making it more than 10 times as thin as the foil that might be used to wrap warm leftovers. It can be made from many materials including gold, tungsten, carbon, or even a metallic foam.

Without the PPPL-designed device, the intense NDCX-II beam would rapidly expand into the beam tube walls before reaching the target. The copper-clad, 43-inch cylinder the size of a hand telescope will create an electrically charged plasma to fill the penultimate stage of the accelerator called the drift line. Negatively charged electrons in the plasma will neutralize the positively charged ion beam after it leaves the accelerator and zips through the drift line on its way to the target chamber. This neutralization is needed to keep the beam from dispersing, since particles with the same charge would repel one another.

Gilson's device improves upon the plasma source he designed for the previous Berkeley Lab accelerator, the NDCX-I. The biggest change involved connecting a separate 10,000-volt electric power

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**A technician at the Berkeley Lab aligns the PPPL-designed plasma source. The device is a key component of the Neutralized Drift Compression Experiment-II, which is shown in the background and is expected to begin full-scale operation this fall.**


Photo by Roy Kaltschmidt (LBNL)

## Plasma Source

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supply to each barium titanate module. This enables researchers to regulate power all along the device and deliver added power to modules that might need it. By contrast, the NDCX-I plasma source connected four or five modules to a single power supply and was unable to regulate the power to individual modules.

The new device rounds out a particle accelerator that has hundreds of times more heating power than the NDCX-I, which was operated by scientists in the mid-2000s. The NDCX-II will compress bunches of about 200 billion lithium ions so rapidly that the tail of the beam will overtake the head in the drift line, condensing the beam to deliver the maximum heating punch. "What makes NDCX-II unique is the beam's charged-particle density," said Joe Kwan, Berkeley Lab project manager for the new accelerator.

Construction of the NDCX-II began in 2009 with \$11 million from the American Recovery and Reinvestment Act, the stimulus program that Congress passed that year. Experiments on the accelerator will complement research under way at the National Ignition Facility (NIF), part of the Lawrence Livermore National Laboratory. Scientists at NIF are seeking to produce fusion by imploding hydrogen fuel capsules with the world's most powerful laser beams in a process called inertial confinement. At the same time, Berkeley Lab researchers have been studying ion beams for the possible production of fusion through the same process. 



Erik Gilson with a copper-clad plasma source module and chamber for testing the units.

Photo: Elle Starkman, PPPL Office of Communications

## Elite Students Tour PPPL


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undergraduates and toured PPPL, several laboratories in the Department of Physics, and the Lewis-Sigler Institute for Integrative Genomics.

During the PPPL visit, the students learned about plasmas and fusion energy research during an introduction by engineer Al von Halle and toured the L-wing experiments with scientist Hantao Ji — who also welcomed them — and the NSTX Control Room with scientist Masa Ono.

The students' U.S. visit also included the campuses of Columbia University and the Rockefeller University in New York. The ten young men and women were accompanied by Dr. Emiko Goshio, International Student Advisor at the University of Tokyo and organizer of the trip.

The School of Science at the University of Tokyo sends 10 students to top international universities each year as part of its Elite Science Student Visit Abroad Program.

The leading university in Japan, the University of Tokyo educates roughly 12,000 undergraduate and 16,000 graduate students in a range of disciplines. 



PPPL physicist Sam Cohen discusses his research with the Japanese students during a tour of PPPL's L-wing, which houses smaller experiments.

# COLLOQUIUM

## Overview of the PPPL International Experimental Stellarator Collaboration Activity

**DAVID GATES**

Princeton University

**Wednesday, March 28**

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

M.B.G. Auditorium, Lyman Spitzer Building



### Volunteers Needed for PPPL Exhibit

Volunteers are needed to staff the PPPL exhibit at Community on Saturday, April 28, from noon to 5 p.m. Community is an annual town-gown community arts festival sponsored by Princeton University students and the Arts Council of Princeton. If you can volunteer for an hour or two at our table, please contact Patti Wieser at [pwieser@pppl.gov](mailto:pwieser@pppl.gov).

## Prospect House Events

### Breakfast with the Easter Bunny

Saturday, April 7

9 a.m. to 11 a.m.

\$23.95 Adult

\$15.95 Children 5-12

Children under 5 are free



Spend the morning with the Easter Bunny at a special breakfast and arts and crafts. After your meal, hunt for Easter eggs on the front lawn, weather permitting. To ask about our special "Buy one get one free" promotion for this event, please call 258-3686.



### Easter Sunday Brunch

Sunday, April 8

10 a.m. — First seating

12:30 p.m. — Second seating

\$33.95 Adult

\$16.95 Children 5-12

Children under 5 are free



Reservations required for all events. Call 258-3455.  
[www.princeton.edu/prospecthouse/events](http://www.princeton.edu/prospecthouse/events)



## PPPL Café Menu

BREAKFAST ..... 7 a.m. - 10 a.m.  
CONTINENTAL BREAKFAST..... 10 a.m. - 11:30 a.m.  
LUNCH ..... 11:30 p.m. - 1:30 p.m.  
SNACK SERVICE ..... until 2:30 p.m.

**MONDAY, MAR. 26**

**TUESDAY, MAR. 27**

**WEDNESDAY, MAR. 28**

**THURSDAY, MAR. 29**

**FRIDAY, MAR. 30**

COMMAND PERFORMANCE  
CHEF'S FEATURE



**Lasagna Served with a Garlic Twist**



**BBQ Grilled Chicken Breast, Mac & Cheese**



**Create Your Own... Chicken Burrito**



**Teriyaki Glazed Pork Loin w/Potato**



**Jamaican Brown Stew w/Potatoes**

EARLY RISER

Chocolate Chip Pancakes with Bacon

Breakfast Pizza

Steak, Egg and Cheese Quesadilla

The Belly Buster Hoagie

The XL Pork Roll and Cheddar Omelet w/Toast

COUNTRY KETTLE

Cream of Broccoli

Beef Rice

Turkey Chili

Onion Soup

New England Clam Chowder

GRILLE SPECIAL

BBQ Chicken Wrap with Cheddar and Bacon

Crispy Buffalo Chicken Quesadilla

Turkey Burger with Chili and Cheese served with Fries

Bacon, Cheddar, Ranch Grilled Chicken Sandwich

Black and Blue Burger with Fries

DELI SPECIAL

The XXL BLT

Santa Fe Crispy Chicken Sandwich

Mini Deli Sampler (Choice of Two)

Corned Beef Reuben

Honey Mustard Chicken Salad on a Multigrain Roll

PANINI

Ham, Bacon, Cheese and Tomato Flatbread Griller

Salami, Provolone, Roasted Peppers

Turkey Reuben

Three Cheese and Turkey w/ Tomato, Chipotle Mayo

The Philly Cheese Steak Panini

MENU SUBJECT TO CHANGE WITHOUT NOTICE

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

## WEEKLY

Editor: **Patti Wieser** ♦ Copy Editor /Graphic Design: **Gregory Czechowicz**  
Photography: **Elle Starkman** ♦ Web: **Chris Cane**

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Deadline for calendar item submissions is noon on Thursday. Other stories should be submitted no later than noon on Wednesday.

Send to: [pwieser@pppl.gov](mailto:pwieser@pppl.gov) ♦ Comments: [commteam@pppl.gov](mailto:commteam@pppl.gov) ♦ PPPL WEEKLY is archived on the web at: <http://www.pppl.gov/ppplweekly.cfm>