PPPL PRINCETON PLASMA PHYSICS LABORATORY
A Collaborative National Center for Fusion & Plasma Research
U.S. DEPARTMENT OF ENERGY
WEEKLY
June 8, 2015

At PPPL THIS WEEK

MONDAY, JUNE 8

Colloquium
4:15 p.m. ◆ MBG Auditorium
Handling Plasma Wall Interactions on ITER
Dr. Richard Pitts, ITER

JUNE 8–JUNE 12

SULI Introductory Course in Plasma Physics
B318
http://w3.pppl.gov/scied/oneweek2015/

JUNE 9–JUNE 12

21st Tokamak Physics Activity Scrape-Off Layer & Divertor Task Group Meeting
PPPL

WEDNESDAY, JUNE 10

Colloquium
4:15 p.m. ◆ MBG Auditorium
ITER and its Diagnostics – Rising to the Challenge
Dr. Mike Walsh, ITER

UPCOMING

WEDNESDAY, JUNE 17

Colloquium
4:15 p.m. ◆ MBG Auditoriumj
Comets and the Origin and Evolution of the Solar System
Professor David Jewitt, University of California, Los Angeles

FRIDAY, JUNE 19

Open Public Tour
10 a.m.
tours@pppl.gov

INSIDE

Anyone can learn about plasma physics through live-streamed course at PPPL

By Jeanne Jackson DeVoe

If you've always wanted to learn about the science behind plasma physics and fusion energy, you can listen to the very same lectures being offered to college students at PPPL in a weeklong introductory course this week without having to leave your home or office.

The introductory course June 8 to June 12 features top experts from around the country, including many from PPPL, will be streamed live all week from PPPL. So while the students enrolled in PPPL's Science Undergraduate Laboratory Internship (SULI) and other internship programs are attending the lectures, you can watch by tuning into http://w3.pppl.gov/scied/oneweek2015/ where you can also find a schedule of the talks. Joining the 32 SULI students will be two students from the Community College Internship program for community college students and another 14 undergraduates working with other researchers at the laboratory.

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An improvement to the global standard for modeling fusion plasmas

By Raphael Rosen

The gold standard for modeling the behavior of fusion plasmas may have just gotten better. Mario Podestà, a staff physicist at PPPL, has updated the worldwide computer program known as TRANSP to better simulate the interaction between energetic particles and instabilities – disturbances in plasma that can halt fusion reactions. The program's updates, reported recently in Nuclear Fusion, could lead to improved capability for predicting the effects of some types of instabilities in future facilities such as ITER, the international experiment under construction in France to demonstrate the feasibility of fusion power.

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Princeton Reunion tours at PPPL

There were bursts of orange throughout PPPL on May 29 when the Laboratory hosted three tours for people attending Princeton University reunions. (Photo by Jeanne Jackson DeVoe)

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Live-streaming plasma course

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The course will begin with an introduction to plasma physics by Nat Fisch, director of the Princeton Program in Plasma Physics and a professor in the University's Department of Astrophysical Sciences, on Monday at 9: 30 a.m. Dennis Whyte, director of the Plasma Science and Fusion Center at MIT, will deliver an introduction to magnetic fusion at 11 a.m.

The program was traditionally run by Fisch, who stepped down this year in light of numerous other research and teaching responsibilities. Arturo Dominguez, senior program leader in Science Education, took over the responsibility with the help of Deedee Ortiz, program administrator in Science Education. "We're picking up the baton and really trying to live up to the standards of the great course it has always been," Dominguez said.

The streaming is aimed at broadening the audience for the lectures. "We tried to make the course as inclusive as possible," Dominguez said. "We've always had great professors from all over the country and this year I wanted to add even more and to stream the lectures, and in most cases, archive the talks for later."

For the past 22 years, the program was offered to students through PPPL's National Undergraduate Fellowship (NUF) in Plasma Physics and Fusion Energy Science, which offered fellowships for students working on research at PPPL and institutions around the country. The NUF fellowship ended this year due to funding issues.

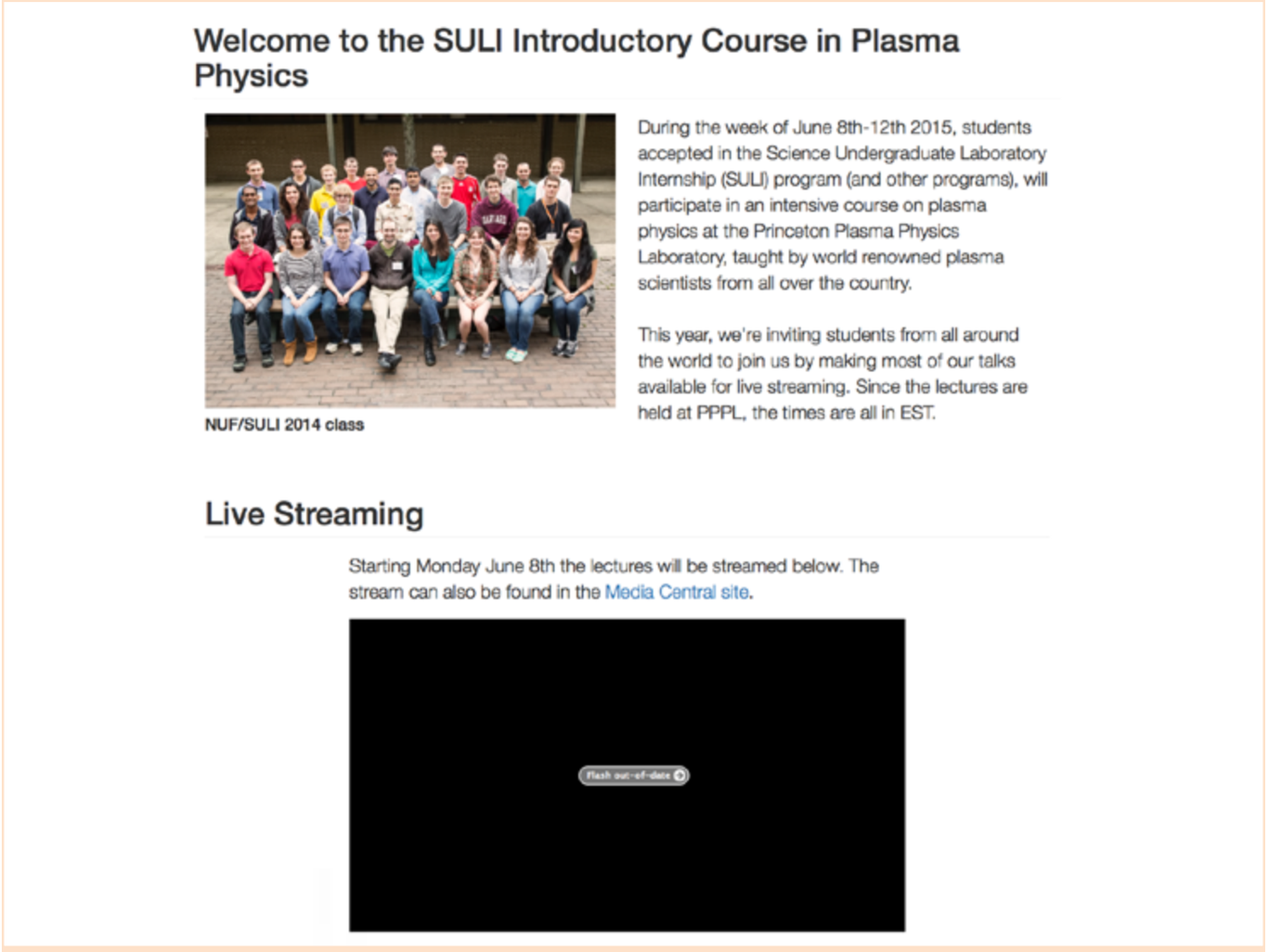
The SULI Internship brings students in science, technology, engineering and mathematics (STEM) to the Laboratory from all over the country. The paid internship pairs students with scientists at PPPL who serve as mentors. Students work on research projects over the summer and present their research results at a poster session at the end of the 10-week program.

This year, 23 of the 32 SULI students will stay at PPPL after the introductory week and the other nine will move to General Atomics in San Diego. Also staying at PPPL will be the two students from the Community College Internship program and the 14 undergraduates working with other researchers.

PPPL speakers include Amitava Bhattacharjee, head of the Theory Department and a professor of Astrophysical Sciences, who will discuss astrophysical plasmas on Friday at 9:30 a.m. Sam Cohen, director of the Program in Plasma Science and Technology and a lecturer with the rank of professor, will discuss "Experimental Methods," on Tuesday at 11 a.m. Greg Hammet, a principal research physicist and lecturer with the rank of professor, will discuss "Turbulence and Transport" on Wednesday at 9:30 a.m. Angie Capece, an adjunct faculty member at the College of New Jersey and former associate research physicist at PPPL, will speak on "Materials Science in Fusion Devices" on Friday at 1:30 p.m.

Dominguez and other members of PPPL's Science Education Department have experience live-streaming events. Dominguez designed the Remote Glow Discharge Experiment, which allows anyone to view a real physics experiment in real time. Science Education also live-streams the Ronald E. Hatcher Science on Saturday lectures.

Dominguez said he is eager to see the new website and live-streaming in operation. "I'm really looking forward to it," he said. "I'm nervous but I think we at Science Education have put a lot of effort into getting this to work just right and for the course to live up to the standards set by Professor Nat Fisch in the past."



A screenshot of the new SULI website where a course in plasma physics will be live-streamed.

Princeton Reunion tours at PPPL

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Princeton reunion tour-goers attending the 10 a.m. and 1:30 p.m. tours watched the PhD Comics video in the auditorium and were treated to plasma demonstrations given by John DeLooper. Atiba Brereton, Arturo Dominguez and Shannon Greco were the tour guides for a total of 36 people for the 10 a.m. tours and Henry Carnevale and Russ Feder guided the afternoon tours for 42 people. Dominguez also gave plasma demos and a tour to 20 children from the Class of 1985 reunion at 12:30 p.m. The tours visited the NSTX-U Control Room, QUASAR, the Hall thruster experiment, and the Science Education laboratory. Rich Torraca, Chris Cane, Raphael Rosen, and Deedee Ortiz volunteered at the welcome desk. (Photos by Jeanne Jackson DeVoe)

Youngsters try out the computer program for the Remote Glow Discharge Experiment in the Science Education laboratory during a tour for children of the Class of 1985.

Ian Brown, 13, of Darien, Connecticut, holds a magnet during a plasma demonstration with Arturo Dominguez.

Tour-goers share a laugh with tour guide Shannon Greco, center, in blue, at QUASAR.

A couple takes a selfie in front of QUASAR during one of the tours.

Tour guide Russell Feder shows visitors an illustration of NSTX-U in the lobby.

Youngsters are fascinated by the plasma balls in the Science Education lab.

TRANSP

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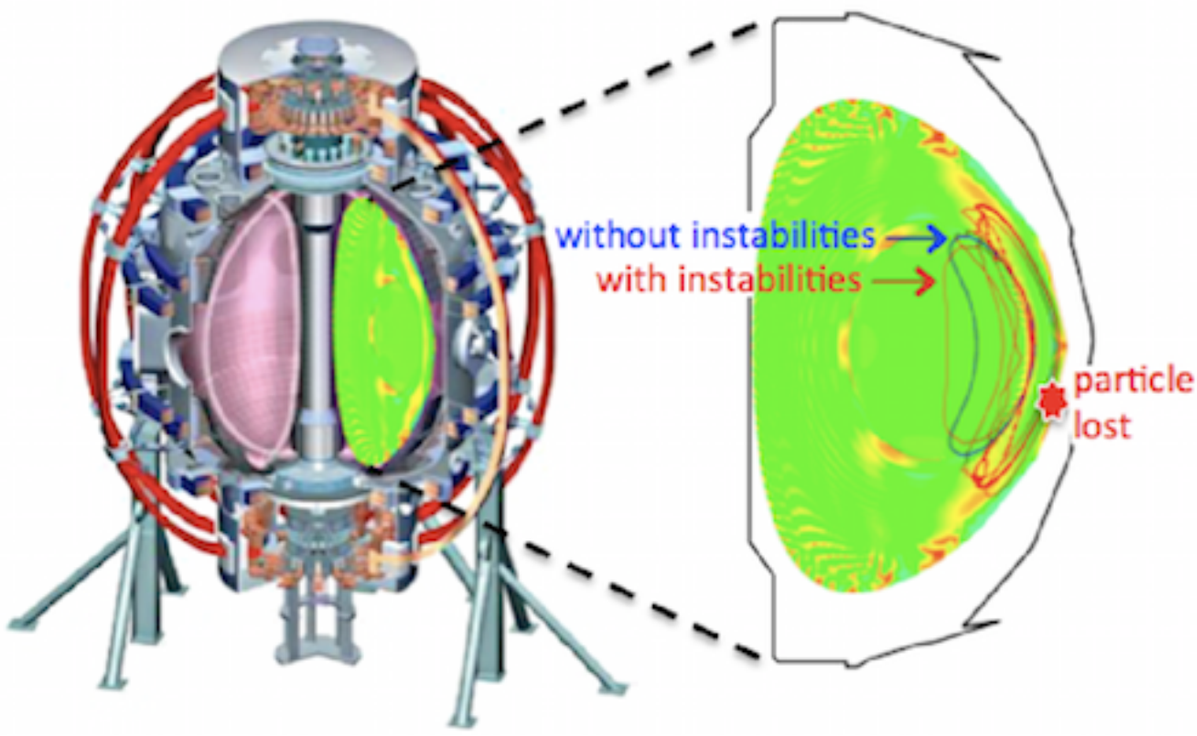
Podestà and co-authors saw a need for better modeling techniques when they noticed that while TRANSP could accurately simulate an entire plasma discharge, the code wasn't able to represent properly the interaction between energetic particles and instabilities. The reason was that TRANSP, which PPPL developed and has regularly updated, treated all fast-moving particles within the plasma the same way. Those instabilities, however, can affect different parts of the plasma in different ways through so-called "resonant processes."

The authors first figured out how to condense information from other codes that do model the interaction accurately – albeit over short time periods – so that TRANSP could incorporate that information into its simulations. Podestà then teamed up with TRANSP developer Marina Gorelenkova at PPPL to update a TRANSP module called NUBEAM to enable it to make sense of this condensed data. "Once validated, the updated module will provide a better and more accurate way to compute the transport of energetic particles," said Podestà. "Having a more accurate description of the particle interactions with instabilities can improve the fidelity of the program's simulations."

Fast-moving particles, which result from neutral beam injection into tokamak plasmas, cause the instabilities that the updated code models. These particles begin their lives with a neutral charge but turn into negatively charged electrons and positively charged ions – or atomic nuclei – inside the plasma. This scheme is used to heat the plasma and to drive part of the electric current that completes the magnetic field confining the plasma.

The improved simulation tool may have applications for ITER, which will use fusion end-products called alpha particles to sustain high plasma temperatures. But just like the neutral beam particles in current-day-tokamaks, alpha particles could cause instabilities that degrade the yield of fusion reactions. "In present research devices, only very few, if any, alpha particles are generated," said Podestà. "So we have to study and understand the effects of energetic ions from neutral beam injectors as a proxy for what will happen in future fusion reactors."



Schematic of NSTX tokamak at PPPL with a cross-section showing perturbations of the plasma profiles caused by instabilities. Without instabilities, energetic particles would follow closed trajectories and stay confined inside the plasma (blue orbit). With instabilities, trajectories can be modified and some particles may eventually be pushed out of the plasma boundary and lost (red orbit). (Image by Mario Podesta)

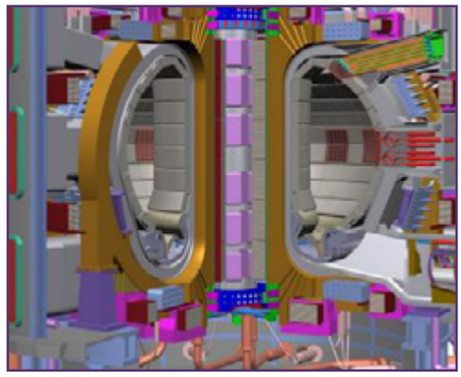
Volunteer for all-girls FIRST Lego League Robotics Team

The PPPL Science Education team, in collaboration with the YWCA-Princeton, is looking for volunteer coaches for a new all-girls FIRST Lego League Robotics team for students in grades 4 through 8. You can be a part of it from the very start of this new team! No experience necessary! The teams will meet throughout the fall semester.

Please contact Shannon Greco, sgreco@pppl.gov, ext. 2208, by **Friday, June 12** if you are interested.

COLLOQUIUM

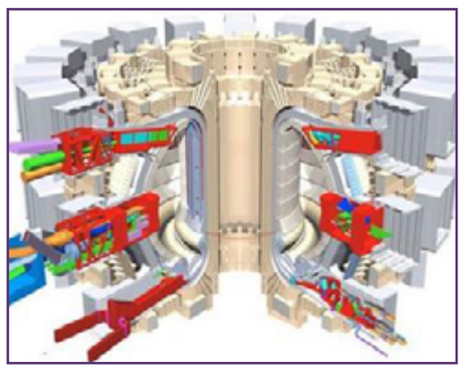
Handling Plasma Wall Interactions on ITER



Dr. Richard Pitts
ITER

Monday, June 8
4:15 p.m. (coffee/tea at 4 p.m.)
M.B.G Auditorium, Lyman Spitzer Building

ITER and its Diagnostics – Rising to the Challenge



Dr. Mike Walsh
ITER

Wednesday, June 10
4:15 p.m. (coffee/tea at 4 p.m.)
M.B.G Auditorium, Lyman Spitzer Building

Zwicker's TEDx talk on science education now available on YouTube

A TEDx talk by Andrew Zwicker on the topic on the importance of science education can now be viewed on the Web. The talk entitled "Scientific literacy is necessary," can be viewed on YouTube. It was given on April 25 at Princeton Public Library as part of a TEDxCarnegieLake event on the theme of "Revive." The talk focuses on PPPL's long history of innovation and the importance of science education in ensuring that tradition continues.

Zwicker's "Science literacy is necessary," talk is available on YouTube.

BROCK

MARK GAZO
Chef Manager

Café at PPPL

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 8	Tuesday June 9	Wednesday June 10	Thursday June 11	Friday June 12
COMMAND PERFORMANCE Chef's Feature	**Cajun Chicken Fettucine**	**Italian Vegetable Stew** with Brown Rice & Herbed Green Beans	**Flank Steak Pepperonata** served with Cilantro Smashed Potatoes	**Glazed Ham** with au Gratin Potatoes & Green Beans	**Teriyaki Salmon Rice Bowl**
Early Riser	**Ham & Cheese Breakfast Quiche**	**Asparagus & Cheese Omelet** with Home Fries	**Corned Beef Hash & 2 Eggs**	**Sausage Cheddar Bake**	**Strawberry French Toast**
Country Kettle	**Italian Wedding**	**Pasta e Fagioli**	**Chicken & Wild Rice**	**Italian Sausage Bean**	**Manhattan Seafood Chowder**
Grille Special	**Beef Burger Stack** with Pretzels & Fresh Vegetable Crudité	**Breaded Pork** with Sweet Slaw, Lettuce & Tomato on a Kaiser	**Fillet of Fish Sandwich with Fresh Carrots & Cucumbers**	**Bacon BBQ Chicken Cheesesteak**	**Chicken Tostada** with Corn Chips
Deli Special	**Falafel** served with Chick Pea Salad	**Carved Beef au Jus** with Choice of Cheese & Horseradish on an Onion Roll	**Liverwurst & Onion** on Rye	**Seafood Salad Wrap**	**Chicken & Ranch Slaw Wrap** with Cheddar Cheese
Panini	**Flank Steak, Caramelized Onion, Blue Cheese & Broccoli Rabe Ciabatta**	**Open-Faced Crab Bread** on French Bread	**Cajun Chicken** with Peppers, Onions, Mushrooms, Mozzarella & Cajun BBQ Sauce	**Vegetarian Chili over Rice**	**Greek Salad Wrap** with Gyro Meat

MENU SUBJECT TO CHANGE WITHOUT NOTICE

Menu Item is in keeping with American Heart Association (AHA) and U.S. Department of Agriculture (USDA) guidelines.

VEGETARIAN OPTION

WEEKLY
Editor: **Jeanne Jackson DeVoe** ◇ Layout and graphic design: **Kyle Palmer**
Photography: **Elle Starkman** ◇ Science Editor: **John Greenwald** ◇ Webmaster: **Chris Cane**

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Comments: commteam@pppl.gov ◇ **PPPL WEEKLY** is archived on the web at: http://w3.pppl.gov/communications/weekly/.