

## THIS WEEK

### JULY 17-19

#### 5th Annual Theory and Simulation of Disruptions Workshop

July 17-18: 8 a.m.-6 p.m.  
July 19: 8 a.m.-12:30 p.m.  
Room B318

#### Alpha Immersion Workshop

Science Education Laboratory

### JULY 19-21

#### **Fusion Energy Sciences Advisory Committee Transformative Enabling Capabilities Subcommittee Meeting**

MBG Auditorium

### FRIDAY, JULY 21

#### **Public Tour**

10 a.m.  
Contact [tours@pppl.gov](mailto:tours@pppl.gov)

### JULY 21-22

#### **Workshop in Plasma Physics for Minority-Serving Institutions Faculty**

Science Education Laboratory

## UPCOMING

### JULY 28-29

#### **Workshop in Plasma Physics for Under-represented Undergraduates**

Science Education Laboratory

The next issue of the PPPL Weekly will be on July 31.

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## U.S.-China researchers optimizing lithium to control fusion plasmas

By John Greenwald

For fusion to generate substantial energy, the ultra-hot plasma that fuels fusion reactions must remain stable and kept from cooling. Researchers have recently shown lithium, a soft, silver-white metal, to be effective in both respects during path-setting U.S.-Chinese experiments on the Experimental Advanced Superconducting Tokamak (EAST) in Hefei, China. Leading the U.S. collaboration is PPPL, together with co-principal investigators Los Alamos and Oak Ridge National Laboratories, with Johns Hopkins University, the universities of Illinois and Tennessee, and the Massachusetts Institute of Technology. Scientists from General Atomics also participate via a separate grant.

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## DOE approves next phase of IOI construction plan

By Jeanne Jackson DeVoe

PPPL can move forward with the next phase of the Infrastructure and Operational Improvements (IOI) plan to transform the Research Storage and Assembly (RESA) Building into a modern storage building and demolish the Mod VI trailer after the U.S. Department of Energy (DOE) approved the construction last month.

“Whenever you achieve a milestone such as this, it’s an important step in the project execution process,” said Les Hill, the head of the IOI project, “so we’re always happy to be out in front of this.”



The second phase of the IOI construction plan calls for the demolition of Mod 6. (Photo by Elle Starkman)

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## New issue of Quest magazine surveys exciting new advances and discoveries in PPPL research



Quest magazine, [now available online here](#), profiles the world-class research conducted by PPPL scientists and engineers over the past year. The annual publication describes the latest projects, findings and explorations of this national laboratory, the only one dedicated to fusion and plasma science, and highlights the progress made in a broad range of areas.


“Quest can serve as a calling card for the Laboratory,” said Science Editor John Greenwald, who edited the publication. “It packages Laboratory achievements in an attractive and accessible format that makes for a really good read.”

Greenwald assembled the publication from articles written by Communications staff Jeanne Jackson Devoe, Raphael Rosen and himself, with an array of attractive photos taken by Elle Starkman. Chris Cane, manager of digital strategy and visual communications, designed and developed the online format, with Communications Director Larry Bernard overseeing all the work.

“I am very pleased with this issue of Quest magazine,” said Terry Brog, interim director of PPPL. “The quality is excellent and the online format is more accessible to our readers. Please enjoy reading this issue of Quest magazine and all the outstanding research here at PPPL.”

This fifth annual issue is published only online. It follows the format used in previous issues that were mailed with the Princeton Alumni Weekly. The format showcases individual areas of Laboratory research and development in separate sections, each with its own title. These sections are:

- **New paths to fusion energy.** A look at recent advances toward the goal of understanding the science behind a new safe, clean and abundant source of energy for the world.
- **Advancing fusion theory.** Current findings and projects of the Theory Department, including leadership of part of the Exascale Computing Project, a national initiative to develop the next generation of supercomputers.
- **Advancing plasma science.** The latest discoveries and developments in fields of study ranging from astrophysics to nanotechnology.
- **Collaborations.** Substantial PPPL contributions to ITER and major fusion facilities around the world.
- **People.** Additions to management and the oversight team from Princeton University in 2016.
- **Education & Outreach.** Recent programs for student and public participation and a visit by then-Secretary of Energy Ernest Moniz.
- **Awards.** Recognition for a wide range of achievements, from patents to DOE Early Career Research Program grants.

Taken together, the articles and photographs portray a Laboratory engaged in compelling research that has the potential to change the world. The work the magazine describes can be a source of pride for all who work here. 

## Run for your health! PPPL Run Club

Daily meets at 12:15 p.m.  
in the LSB Lobby



See Angela Powell (x3347) or Laurie Bagley (x2425) for details.

# Undergraduates in PU research internship tour the Laboratory

About 70 college students from Princeton University's MIRTHE Research Experience for Undergraduates program, based at the Photonics Sensing Center, toured PPPL on Friday, July 7. MIRTHE is the National Science Foundation-sponsored Engineering Research Center for Mid-InfraRed Technologies for Health and the Environment.

The students visited the NSTX-U Control Room, the NSTX-U test cell, and the Science Education Laboratory, where tour guide Atiba Brereton showed them plasma demonstrations. The tour guides were: Erik Gilson, Ray Camp, Clayton Myers, Walter Guttenfelder, Jessica Guttenfelder and Soha Aslam.



REU MIRTHE students in the auditorium. (Photo by Raphael Rosen)



An interpreter for the deaf translates a discussion in the Laboratory with tour guides Erik Gilson, left, Ray Camp, and Clayton Myers. (Photo by Raphael Rosen)



Soha Aslam discusses the National Spherical Torus Experiment-Upgrade in the lobby as a second interpreter translates. (Photo by Raphael Rosen).



Students in the NSTX-U test cell. (Photo by Raphael Rosen)

# New Site is Live for Submitting Scientific Manuscripts

*Helps fulfill DOE requirement on reporting*

Publishing a scientific paper? PPPL's Publications Office has a new online form to submit draft and accepted manuscripts to the U.S. Department of Energy's (DOE) Office of Scientific and Technical Information to make the process more efficient and less time-consuming.

*"This reduces the turnaround time for patent clearance on draft manuscripts, and gives researchers a one-stop shop for submitting draft and accepted papers to our office," said Laurie Bagley, head of Technology Transfer, Patents and Publications.*

The site for submission is [here](https://docs.google.com/a/pppl.gov/forms/d/e/1FAIpQLSce5450XQ6lyKE3zWA298gR4L2CTzXCdMIRXoGF-NdRxtEobg/viewform?usp=sf_link#responses), or copy and paste this in your browser: [https://docs.google.com/a/pppl.gov/forms/d/e/1FAIpQLSce5450XQ6lyKE3zWA298gR4L2CTzXCdMIRXoGF-NdRxtEobg/viewform?usp=sf\\_link#responses](https://docs.google.com/a/pppl.gov/forms/d/e/1FAIpQLSce5450XQ6lyKE3zWA298gR4L2CTzXCdMIRXoGF-NdRxtEobg/viewform?usp=sf_link#responses)

## **Submittal is easy. For publication and patent clearance of DRAFT manuscripts:**

1. Complete the form as prompted by the conditional questions.
2. Enter your cost center and select your department head/cost center approver.
3. Attach your draft publication for approval.

**For ACCEPTED manuscripts (The accepted manuscript is the final peer-reviewed manuscript or PRAM. It is the final version of the article that includes changes made during the peer-review process. This is not the final published version or a reproduction)**

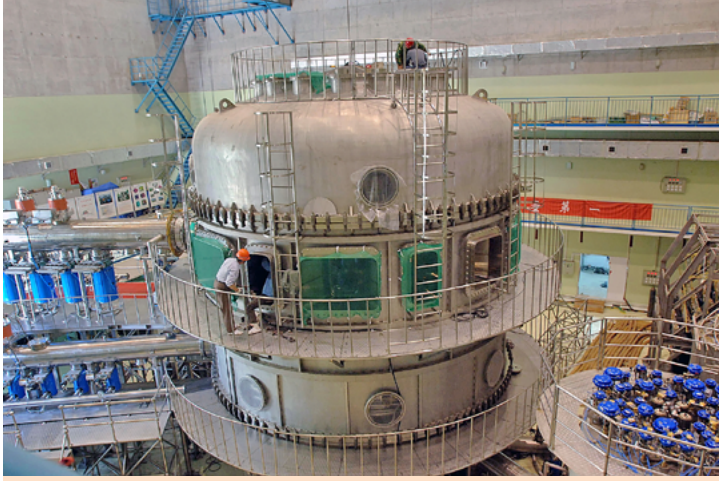
1. Complete the form as prompted by the conditional questions.
2. Attach the peer-reviewed accepted manuscript.

The completed form will automatically generate an email to the appropriate department head/cost center approver. The email will contain a link to the completed form, including the submitted paper.

*"Remember that the DOE requires researchers to report all scientific and technical information resulting from DOE funds," Bagley said. "This is not optional. We hope this new form will make it easier for researchers to comply."*

## U.S.-China collaboration

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Experimental Advanced Superconducting Tokamak.  
(Photo courtesy of Institute of Plasma Physics Chinese Academy of Science.)


Seven U.S. researchers traveled to EAST in December, 2016, to participate in the experiments. They deployed lithium in the Chinese tokamak in three different ways: through a lithium powder injector, a lithium granule injector, and a flowing liquid lithium limiter (FLiLi) that delivered the element in liquid form to the edge of EAST plasmas.

The research showed excellent progress in all three areas. The form of the experiments and their results included:

- **The first use of the lithium powder injector** in EAST discharges that exhausted hot plasma through the tokamak's tungsten divertor. The injected powder successfully eliminated periodic instabilities known as edge localized modes (ELMs) that could damage the divertor. The results compared well with the use of powdered lithium in the carbon divertor in previous EAST experiments, in previous National Spherical Torus Experiments (NSTX) research at PPPL, and in the DIII-D National Fusion Facility that General

Atomics operates for the DOE in San Diego, indicating a basic compatibility between tungsten and lithium. Such compatibility will be needed for future power plant designs that consider tungsten to be the substrate for liquid lithium plasma-facing components.

- **Use of the lithium granule injector** showed that a threshold exists for the minimum size of the granules that are large enough to trigger ELMs — an alternative procedure that causes the instabilities to be smaller, more frequent and less detrimental to plasma-facing components. The observed threshold showed similarities to the minimum size of ELM-triggering granules in recent DIII-D experiments.
- **Use of a second-generation FLiLi device** sharply reduced the amount of deuterium at the edge of the plasma that recycled back into the core of the plasma and cooled it off during high-confinement experiments. Loss of heat caused by recycling can halt fusion reactions. The FLiLi device was inserted at the outer midplane of the EAST device. Fast-camera images of EAST experiments, performed with and without limiter insertion, showed potentially damaging deuterium recycling without the limiter, compared with neutral and ionized lithium with the limiter in place. In addition, researchers observed for the first time several improved phases of energy confinement with the use of FLiLi.

The DOE Office of Science supported U.S. collaboration on these experiments on EAST, which is hosted at the Institute for Plasma Physics, Chinese Academy of Sciences. The experiments were enabled by strong collaboration between the U.S. participants and Chinese colleagues, in particular Professors J.S. Hu, S. Zhen, and G. Zuo. The Chinese participants were supported by the National Magnetic Fusion Science Program, the National Nature Science Foundation, and the A3 Foresight Program in the field of Plasma Physics. 

## 2017 Fishing Trip Aboard the 80' Suzie Girl

**Date:** Sunday August 6th, 2017

**Departure:** 7:30 a.m. SHARP!!!

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

**Cost:** \$80 Per person ALL INCLUSIVE

Cost includes everything. Rods, bait, fish cleaning, food, beverages.

All you need to do is show up! If the trip is rescheduled due to bad weather there are NO REFUNDS.

Contact Andy Carpe, ext. 2118, [acarpe@pppl.gov](mailto:acarpe@pppl.gov), Bob Tucker Jr., ext. 3190, [rltucker@pppl.gov](mailto:rltucker@pppl.gov), or Andy Konca, ext. 2537, [akonca@pppl.gov](mailto:akonca@pppl.gov)

# IOI update

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The DOE's Science Laboratories Infrastructure Program's Office of Science's approval of the final phase of the project on June 22 means that PPPL can proceed with construction on the projects, which cost \$1.3 million of the \$26 million IOI project.

The start-date for the next phase depends on the progress of the first phase of the project, which includes building new office space in the Lyman Spitzer Building Annex and transforming the C Site-motor generator building into a space for technical shops.

Renovation of the 33-year-old LSB Annex could be substantially completed by the end of September, Hill said. The heating, ventilation, and air conditioning system that will be installed on the roof should be finished by mid-August. With that complete, workers can begin installing ceiling tiles and carpet. The final step will be installing furniture and finishing details.

The LSB Annex will accommodate 50 to 60 more people than it did previously. Once complete, Business Operations staff now housed in a temporary trailer outside the Theory Wing, as well as more than 30 staff members in Mod 6, can move to the LSB Annex as early as October or November, Hill said. This would allow PPPL to demolish Mod 6 in the lower parking lot. The building is a construction trailer that was




Sheet rock has been installed for future offices in the LSB Building. (Photo by Elle Starkman)

acquired in 1993 as temporary space. It is in such poor repair that there were 200 work orders from 2013 to 2016 ranging from insect infestations to HVAC repairs. It also is an energy drain. Eliminating the building will also reduce PPPL's electricity consumption by 5 to 6 percent.

Meanwhile, PPPL has been clearing trailers as part of a cleanup required by the DOE in PPPL's last "report card." So far, at least 30 of the 75 trailers have been cleared, Hill said.

While PPPL has recycled or disposed of much of the equipment, useful equipment will be stored in the existing warehouse or the refurbished RESA building, which will be refitted with pallets and a crane to store large equipment. That work will likely start in late December and will be completed by late May, Hill said.

The renovation of the C Site-MG Building is more complex. Work has been completed on concrete floors and supports. Work on a new roof began this month and should be complete by the end of the month or early August, Hill said. Work is also proceeding on piping for the HVAC system and wall partitions. That work is expected to be complete by the end of November.

With the C Site-MG Building completed by October, much of the equipment at the RESA Building can move into the building by the end of this year. That will clear the way for construction in the RESA building, which should be complete by October of 2018. The IOI project is on schedule to be completed by that time. 



Pillars in the basement of the C Site-MG Building. (Photo by Elle Starkman)



The interior of the RESA building, which will be converted into modern storage space. (Photo by Elle Starkman)



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<br>July 17                                | Tuesday<br>July 18  | Wednesday<br>July 19  | Thursday<br>July 20   | Friday<br>July 21  |
|---|--|---|---|---|--|
| <b>COMMAND PERFORMANCE<br/>Chef's Feature</b> | <b>Beef and Bean Burrito</b> with Yellow Rice    | <b>Buffalo Chicken Mac</b> and Cheese   | <b>Jerk Seasoned Pork Chops</b> with Pineapple Rice and Fried Plantains | <b>CELEBRITY GUEST CHEF "Vikas Khanna"</b> Spicy Potatoes with Cumin and Tamarind, Green Beans in Pomegranate Coconut Sauce Spiced Cauliflower with Orange Sauce, Snap Peas and Pearl Onions, Wheatberry Pilaf with Edamame, Creamy Black-eyed Peas with Garlic, Gingery Lemonade | <b>Shrimp Basket</b>   |
| Early Riser                                   | <b>Blueberry Pancakes</b>                        | <b>Cheesy Polenta Cakes</b> with 2 Eggs                                       | <b>Tater Tot Breakfast Bake</b>   | <b>Ham, Egg &amp; Cheese French Toast</b>   | <b>Bacon, Spinach &amp; Mozzarella Quesadilla</b> with Cilantro Cream                            |
| Country Kettle                                | <b>Cream of Broccoli</b>                         | <b>Spinach and White Bean</b>   | <b>Chicken Pot Pie</b>  | <b>Cream of Mushroom</b>  | <b>Beef and Rice</b>   |
| Deli Special                                  | <b>Pepper Ham and Provolone</b> on Semolina Hero | <b>Cobb Salad Wrap</b>  | <b>Lemon Rosemary Turkey Sandwich</b>                                   | <b>American Hoagie</b> with Ham, Bologna, and American Cheese   | <b>Italian Tuna Salad Wrap</b>   |
| Grill Special                                 | <b>Cheddar Bacon-Wrapped Hot Dog</b>             | <b>Chorizo Quesadilla</b>   | <b>Grilled Fish Cake Sandwich</b>                                       | <b>Grilled Margherita Sandwich</b>  | <b>Pepperoni Roll</b>  |
| Panini  | <b>Corned Beef Reuben</b>                        | <b>Chicken Breast, Mozzarella,</b> Spinach and Tomato Pesto on Ciabatta Bread | <b>Pirogies</b> with Fried Onions                                       | <b>Meatball Parmigiana Sandwich</b>   | <b>NY Street Dog—</b> 2 Sabrett Hot Dogs with Sauerkraut, Red Onions & Mustard served with Fries |

|   | Monday<br>July 24   | Tuesday<br>July 25  | Wednesday<br>July 26  | Thursday<br>July 27   | Friday<br>July 28   |
|---|---|---|---|---|---|
| <b>COMMAND PERFORMANCE<br/>Chef's Feature</b> | <b>Honey Barbecue Ribs</b> with Potato Salad and Baked Beans  | <b>Power Bowl</b>   | <b>Caprese Chicken</b> with Orzo Pilaf  | <b>Taco Meatloaf</b> with Rice and Beans                    | <b>Fish and Chips</b>   |
| Early Riser                                   | <b>Bacon, Egg and Cheese English Muffin</b>                   | <b>Mexican Breakfast Burrito</b>  | <b>Potato, Roasted Pepper &amp; Sundried Tomato Casserole</b> with 2 Eggs any Style | <b>Cinnamon-Raisin Pancakes</b> with Homemade Apple Compote | <b>French Toast Sticks</b>  |
| Country Kettle                                | <b>Manhattan Clam Chowder</b>                                 | <b>Vegetable</b>  | <b>Chicken Noodle</b>   | <b>Tomato Soup</b>  | <b>Chili Bean</b>   |
| Deli Special                                  | <b>Spring Chicken Salad Wrap</b>                              | <b>Asiago Roast Beef</b> with Grilled Onion, Tomato & Horseradish on Pumpernickel | <b>California BLT</b> with Avocado  | <b>Turkey Sloppy Joe</b>                                    | <b>Spicy Crab Sushi Wrap</b>  |
| Grill Special                                 | <b>Grilled Vegetable Quesadilla</b>                           | <b>Chipotle BBQ Pulled Pork Sandwich</b> with Fries and Slaw                      | <b>Burgerlicious Buffalo Turkey Burger</b>  | <b>Jalapeño Popper Bacon-Wrapped Hot Dog</b>                | <b>Teriyaki Chicken Cheesesteak</b>   |
| Panini  | <b>Smoked Ham and Gouda Melt</b> with Apple-Caramelized Onion | <b>Baja Fried Flounder Hero</b> with Crunchy Slaw and Pico de Gallo               | <b>Pastrami and Swiss</b> on Marble Rye   | <b>Chipotle Roast Beef Melt</b> on Focaccia                 | <b>Breaded Chicken Cutlet</b> with Ham, Swiss Cheese, Lettuce & Honey Mustard on Ciabatta |

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY

VEGETARIAN OPTION

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

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Comments: [commteam@pppl.gov](mailto:commteam@pppl.gov) ♦ PPPL WEEKLY is archived on the web at: <http://w3.pppl.gov/communications/weekly/>.