PPPL PRINCETON PLASMA PHYSICS LABORATORY
A Collaborative National Center for Fusion & Plasma Research
U.S. DEPARTMENT OF ENERGY
WEEKLY
May 8, 2017

THIS WEEK

TUESDAY, MAY 9

Facts & Snacks
11:30 a.m.–12:30 p.m. ◆ LSB, B318
See page 4 for details.

WEDNESDAY, MAY 10

Colloquium
4:15 p.m. ◆ MBG Auditorium
Compact Approach to Plasma Confinement
Uri Shumlak, University of Washington

MAY 11–13

Bangs, Bounces, Black Holes, and Bubbles: Where General Relativity meets Cosmology
PCTS
See page 6 for details.

UPCOMING

MAY 15–18

Extent of Condition Review meeting

FRIDAY, MAY 19

Public Tour

JUNE 4–8

IEEE Symposium on Fusion Engineering (SOFE)
Shanghai

MONDAY, JUNE 12

SULI & CCI students arrive

INSIDE

Experiments verify key source of fast reconnection of magnetic fields

By John Greenwald

Magnetic reconnection, a universal process that triggers solar flares and northern lights and can disrupt cell phone service and fusion experiments, occurs much faster than theory says that it should. Now researchers at PPPL and Germany's Max Planck Institute of Plasma Physics have discovered a source of the speed-up in a common form of reconnection. Their findings could lead to more accurate predictions of damaging space weather and improved fusion experiments.

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Take Our Daughters and Sons to Work Day is a hit with parents & kids

By Raphael Rosen

Arturo Dominguez flash freezes a flower with liquid nitrogen during a presentation in the MBG Auditorium for Take our Daughters and Sons to Work Day. *(Photo by Elle Starkman)*

More than 50 PPPL staffers brought over 70 kids to the Lab for PPPL's first official Take Our Daughters and Sons to Work Day on April 27, where they watched plasma demonstrations in the auditorium and ate ice cream made with liquid nitrogen.

"Walking into the lobby and seeing staff and their children with smiles on their faces as they learned about plasmas and more was the highlight of my day and it sure seemed like it was for everyone that attended too," said Andrew Zwicker, head of the Office of Communications and Public Outreach, which hosted the event. "Letting our families see what we do here at PPPL and perhaps inspiring the next generation of PPPL employees was a delight!"

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Take Our Daughters and Sons to Work Day

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And while the kids had fun, the event also helped parents rediscover the importance of PPPL's research. "This event reminded me of why I love working at PPPL," said Dina Christie, program manager in the Site Protection Division. "A typical work day often revolves around emails, project deadlines and policy. And although these tasks are crucial to the success of Laboratory operations, they often mislead you away from mission of PPPL — discovering!"

"Bringing families together here at PPPL, even if just once a year, creates a bond that helps strengthen confidence in our discoveries and instill the need for continuous learning for our children," she added.

Photos by Elle Starkman.

Shannon Greco with son Lukas Greco at the spectroscope activity.

Stanley Reece with his daughter Victoria and sons Joshua and Jacob Reece.

Luis Delgado-Aparicio, right, with wife Camila Miranda Llosa and children Mateo Delgado-Aparicio and Anahi Aymar Miranda, and Arturo Dominguez, left, in auditorium for physics demonstrations.

Dina Christie and daughter Kelly in lobby.

Farra Rosko with her two kids, Mattea and Trey Rosko, as well as Chris Riccardo, son of Valeria Riccardo, left, in Rosko's office.

Kathryn Morrison with son Ryan Morrison and daughter Madelyn Morrison looking through spectroscopes in the lobby.

Dorothy Strauss with daughter Julianne Strauss.

Bringing plasma to the people at PPPL's Communiversity booth

PPPL's booth offered hundreds of visitors the chance to do cool plasma demos and talk to scientists and engineers about fusion energy at the 2017 Communiversity ArtsFest celebration on Sunday, April 30. About 10 PPPL volunteers showed visitors plasma demonstrations and talked to members of the public about PPPL, fusion energy, and ITER, the international fusion experiment. The event was organized by Deedee Ortiz, the program manager in PPPL's Science Education office. Other volunteers were: Stuart Hudson, Yuhu Zhai, Nicole Allen, Jacob Schwartz, Paul Hughes, Brian Kraus, Russ Feder, Dick Majeski, Raphael Rosen, and Mike Zarnstorff. T.J. Levis and Tim Conwell moved everything from PPPL to Princeton University and back again and helped with set-up.

Photos by Elle Starkman.

Deedee Ortiz shows a youngster the Van de Graaff generator.

Brian Kraus shows children how marshmallows expand in the vacuum demonstration.

Jacob Schwartz talks to a visitor in front of the ITER model.

Static electricity from the Van de Graaff does its work on a visitor's hair.

Two children seem fascinated by the marshmallow in the vacuum demonstration.

Russ Feder and his son Brandon show youngsters the vacuum demonstration.

A father and daughter try out the Van de Graaff together.

Fast reconnection

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Reconnection occurs when the magnetic field lines in plasma — the collection of atoms and charged electrons and atomic nuclei, or ions, that make up 99 percent of the visible universe — converge and forcefully snap apart. Electrons that exert a varying degree of pressure form an important part of this process as reconnection takes place.

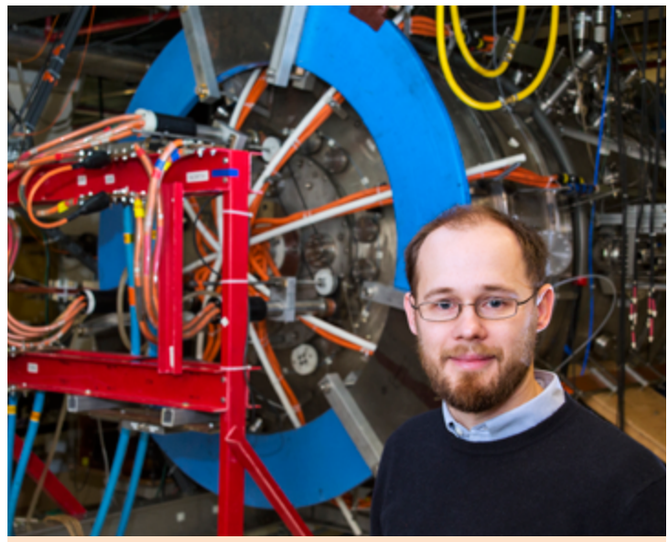
The research team found that variation in the electron pressure develops along the magnetic field lines in the region undergoing reconnection. This variation balances and keeps a strong electric current inside the plasma from growing out of control and halting the reconnection process. It is this balancing act that makes possible fast reconnection.

"The main issue we addressed is how reconnection can take place so quickly," said Will Fox, lead author of a paper that detailed the findings in March in the journal *Physical Review Letters*. "Here we've shown experimentally how electron pressure accelerates the process."

The physics team built a picture of the gradient and other parameters of reconnection from research conducted on the Magnetic Reconnection Experiment (MRX) at PPPL, the leading laboratory device for studying reconnection. The findings marked the first experimental confirmation of predictions made by earlier simulations performed by other researchers of the behavior of ions and electrons during reconnection. "The experiments demonstrate how the plasma can sustain a large electric field while preventing a large electric current from building up and halting the reconnection process," said Fox.

Among potential applications of the results:

- **Predictions of space storms.** Magnetic reconnection in the magnetosphere, the magnetic field that surrounds the Earth, can set off geomagnetic "substorms" that disable communications and global positioning satellites (GPS) and disrupt electrical grids. Improved understanding of fast reconnection can help locate regions where the process triggering storms is ready to take place.



Will Fox with the Magnetic Reconnection Experiment *(Photo by Elle Starkman)*

- **Mitigation of the impact.** Advanced warning of reconnection and the disruptions that may follow can lead to steps to protect sensitive satellite systems and electric grids.
- **Improvement of fusion facility performance.** The process observed in MRX likely plays a key role in producing what are called "sawtooth" instabilities that can halt fusion reactions. Understanding the process could open the door to controlling it and limiting such instabilities. "How sawtooth happens so fast has been a mystery that this research helps to explain," said Fox. "In fact, it was computer simulations of sawtooth crashes that first linked electron pressure to the source of fast reconnection."

Support for this work comes for the DOE Office of Fusion Science and the Max Planck-Princeton Center for Plasma Physics.

Facts & Snacks!

A fun guide to PPPL Publications

May 9, 11:30 a.m.–12:30 p.m.

LSB, B318

Refreshments will be provided!

Not on-site, but would like to attend remotely? Email Aileen Pritch at apritch@pppl.gov for more information.

Earth Day poster contest winners show off their posters

The children who won PPPL's Earth Day poster contest show off their posters in front of the Lyman Spitzer Building. From left: Grant Sikkema, 13, son of Tori Sikkema; Caitlin Jones, 8, daughter of Jennifer Jones; Chloe Lamb, 5, daughter of Kevin Lamb; Julianne Strauss, 6, daughter of Dorothy Strauss; and Catalina Serai, 9, daughter of Pamela Serai. *(Photo by Elle Starkman)*

TRANSP users from around the world meet at PPPL

Members of the TRANSP users group, which includes fusion researchers from around the world, gathered at PPPL on May 4-5 for their biennial meeting. TRANSP is a worldwide software code developed at PPPL for analyzing fusion experiments and predicting the results of future research. The two-day session, attended by physicists from PPPL, DIII-D, C-Mod, JET, EAST and Lehigh University, with physicists from Europe, Asia and the U.S. participating remotely, updated users on TRANSP development progress and plans. Researchers discussed their usage and needs, long-range plans and issues, and any modification of development plans. *(Photo by John Greenwald)*

Bike Challenge Team Gears Up

The PPPL Bike Challenge Team kicked off National Bike Month with a May 3 breakfast in the MBG Auditorium. To register for the bike team go to the Love to Ride Federal Bike Challenge website or contact organizer Rob Sheneman, rshenema@pppl.gov, ext. 3392.

Some members of last year's Bike Challenge Team set off for a lunchtime ride. *(Photo by Jeanne Jackson DeVoe)*

A successful clothing drive

PPPL'ers donated 1,050 pounds of clothing in the Earth Month Drive for the Trenton Rescue Mission. Thank you to everyone who contributed!

Spring 2017 Princeton Center for Theoretical Science Events

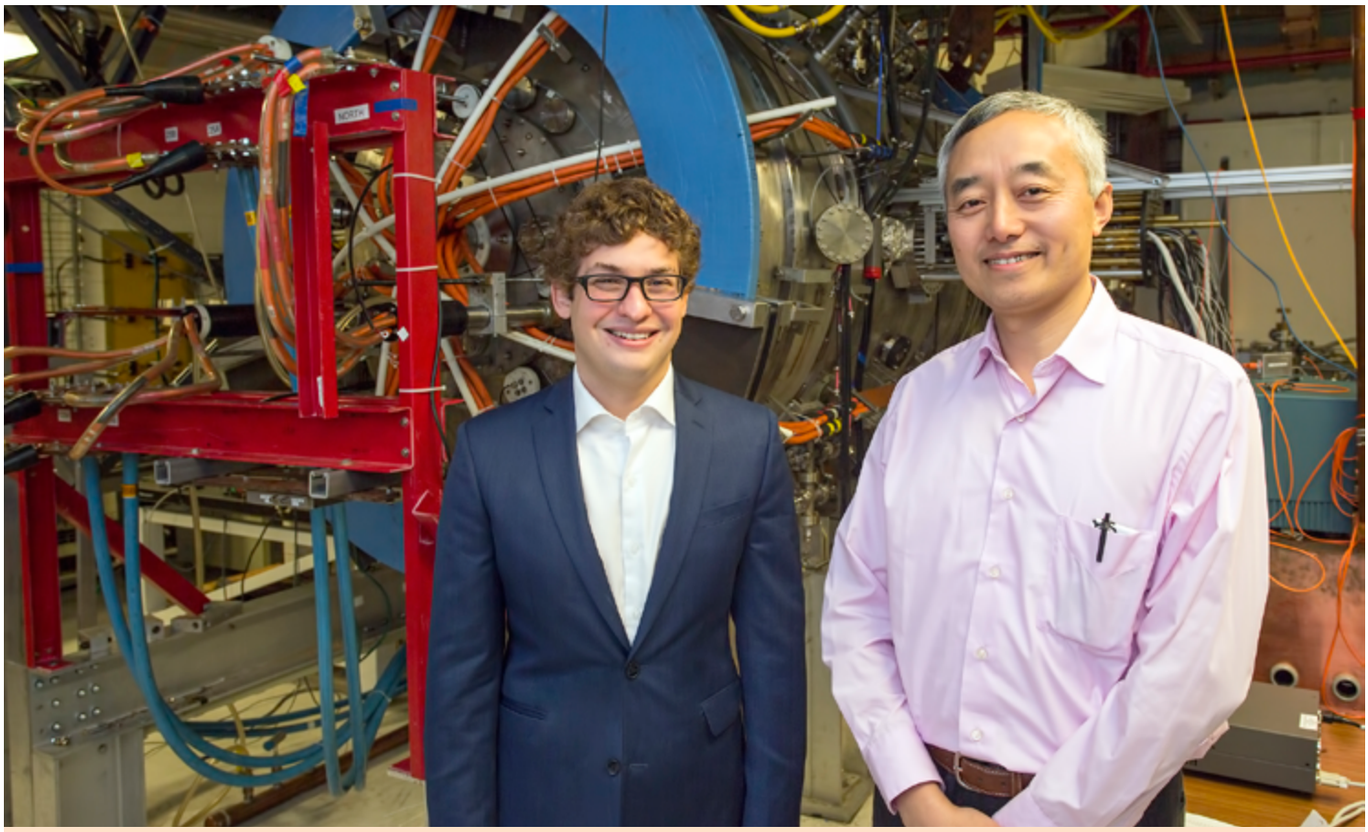
Registration is now open for:

Bangs, Bounces, Black Holes, and Bubbles: Where General Relativity Meets Cosmology
May 11-13, 2017
Room 407 Jadwin Hall

Free online registration is required.

Details about the events and ***required registration*** can be found here.

A successful dissertation defense



Physics graduate student Jonathan Jara-Alamonte has successfully defended his doctoral dissertation. Here he stands with his advisor, PPPL scientist Hantao Ji, in front of the Magnetic Reconnection Experiment (MRX). *(Photo by Elle Starkman)*

Society of American Military Engineers tours PPPL

Nineteen members of the Society of American Military Engineers in the National Spherical Torus Experiment-Upgrade Control Room during an April 27 tour of PPPL The group also visited the D Site Tunnel, the Mock-up Building, the NSTX-U test cell, and QUASAR. *(Photo by Elle Starkman)*

American Red Cross Blood Drive

Thursday, May 25
8 a.m.–1 p.m.

The blood mobile will be parked next to the warehouse near Mod 6 in the Lower Parking Lot. The check-in point will be the Mod 6 Conference Room.

Appointments are still available! Please call the OMO at ext. 3200 or go to redcrossblood.org and enter sponsor code PPPLPrinceton. You can make a difference! Your blood donation matters!

Thank you!
—American Red Cross, Occupational Medicine Office and Human Resources

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BROCK

NICK PETTI
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 May 8	Tuesday May 9	Wednesday May 10	Thursday May 11	Friday May 12
COMMAND PERFORMANCE **Chef's Feature**	**Beef and Bean Burrito** with Yellow Rice	**Buffalo Chicken Mac and Shells**	**Teriyaki Pork Loin** with Lo Mein Noodles and Egg Roll	**Sloppy Joe** with Tater Tots	**Shrimp Basket**
Early Riser	**Blueberry Pancakes**	**Cheesy Polenta Cakes** with 2 Eggs	**Tater Tot Breakfast Bake**	**Ham, Egg & Cheese French Toast**	**Bacon, Spinach & Mozzarella Quesadilla** with Cilantro Cream
Country Kettle	**Cream of Broccoli**	**Spinach and White Bean**	**Chicken Pot Pie**	**Cream Of Mushroom**	**Beef and Rice**
Deli Special	**Pepper Ham and Provolone** on Semolina Hero	**Made to Order Pita Pizza Bar** with Tossed Salad	**Lemon Rosemary Turkey Sandwich**	**American Hoagie** with Ham, Bologna, and American Cheese	**Salami and Fresh Mozzarella** with Spicy Pepper Pesto Mayo
Grill Special	**Chicago-Style Hot Dog**	**Chorizo Quesadilla**	**Grilled Fish Cake Sandwich**	**Grilled Margherita Sandwich**	**Pepperoni Roll**
Panini	**Corned Beef Reuben**	**Chicken Breast, Fontina Cheese,** Pesto Mayonnaise & Tomato on Ciabatta Bread	**Lattice Chip Nachos**	**Meatball Parmigiana Sandwich**	**NY Street Dog—** 2 Sabrett Hot Dogs with Sauerkraut, Red Onions & Mustard served with Fries

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY | VEGETARIAN OPTION

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