PPPL PRINCETON PLASMA PHYSICS LABORATORY
A Collaborative National Center for Fusion & Plasma Research
U.S. DEPARTMENT OF ENERGY
WEEKLY
April 2, 2018

THIS WEEK

WEDNESDAY, APRIL 4

Council Café Lunch
12 p.m. ◆ Cafeteria
Valeria Riccardo
Head of Engineering

Colloquium
4:15 p.m. ◆ MBG Auditorium
Paths to low-carbon energy
Robert Socolow, Princeton University

FRIDAY, APRIL 6

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

UPCOMING

WEDNESDAY, APRIL 11

Council Café Lunch
12 p.m. ◆ Cafeteria
David Carle
Head of Facilities and Site Services

FRIDAY, APRIL 13

Employee Tour
10 a.m.
Register here.

WEDNESDAY, APRIL 18

Council Café Lunch
12 p.m. ◆ Cafeteria
Jon Menard
Director of the NSTX-U Recovery Project

INSIDE

William Tang wins 2018 Global Impact Award to advance development of AI software to help create "a star on earth"

By John Greenwald

Physicist William Tang has won a highly competitive $100,000 Global Impact Award from NVIDIA Corp., the leading producer of graphics processing units (GPUs) for carrying out artificial intelligence (AI) computing. This award was one of two presented at the NVIDIA national GPU technology conference held March 26-29 in San Jose, California.

William Tang *(Photo by Elle Starkman)*

Tang, a principal research physicist at PPPL, is a lecturer with the rank and title of professor in Princeton University's Department of Astrophysical Sciences. He leads a team of scientists that is using modern NVIDIA GPU's to develop a form of AI machine learning called "deep learning" to predict and mitigate the onset of dangerous disruptive events capable of terminating fusion reactions in doughnut-shaped devices known as "tokamaks."

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UK officials explore possible collaborations

By Jeanne Jackson DeVoe

From left: Rich Hawryluk, PPPL's interim director; Sharon Ellis, director of Business Innovation at the Department for Business, Energy, Industry, Strategy and International Science; Andrew Price, head of the UK Science and Innovation Network, Americas, Foreign and Commonwealth Office; and physicist Michael Jaworski, in the National Spherical Torus Experiment-Upgrade *(NSTX-U) test cell. (Photo by Elle Starkman)*

PPPL showed off its research and discussed ways to increase collaborations with researchers across the pond during a visit by two United Kingdom officials last week.

The two officials came to PPPL on March 28 to meet with some of PPPL's leadership team and scientists and discuss ideas for new partnerships between PPPL and the United Kingdom Atomic Energy Authority (UKEA). Ideas could include a joint fellowship program to attract scientists to PPPL and the UKEA and additional collaborations on fusion research.

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PPPL, Princeton University and DOE leaders sign declaration of cooperation

Rich Hawryluk, PPPL's interim director, along with David McComas, the Princeton University vice president for PPPL, and Pete Johnson, head of the DOE's Princeton Site Office, signed a declaration on March 26 pledging their intention to cooperate on achieving the mission of the Laboratory.

The three pledged to "serve the public interest in delivery of world-class science, supported by excellence in engineering, management, operations and community service."

The declaration declares each institution's commitment to carrying out PPPL's mission "in alignment with the Department's management principles," and specifies the role of each in carrying out the mission.

The declaration is an additional commitment that supplements the contract, which was signed in 2013 and extends through 2018. The last such document was signed in 2016.

Signing the declaration of cooperation are from left, Dave McComas, Princeton University vice president for PPPL; Richard Hawryluk, PPPL's interim director; and Pete Johnson, head of the Department of Energy's Princeton Site Office. *(Photo by Elle Starkman)*

William Tang award

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The team, working through the Princeton Institute for Computational Science and Engineering (PICSciE) at Princeton University, has sharply increased the speed and accuracy of disruption predictions. The researchers now seek to develop the software for enabling control systems to avoid plasma disruptions in ITER, the $25 billion international fusion facility under construction in France to demonstrate the achievability of fusion power.

Fusion, the power that drives the sun and the stars, is the fusing of light elements in the form of a plasma – a hot, charged state of matter composed of electrons and atomic nuclei, that produces massive amounts of energy. Scientists are seeking to replicate fusion on Earth by producing a safe and virtually inexhaustible supply of power for generating electricity.

"This most welcome and timely recognition brings excellent attention to Princeton's deep learning research and development to help establish the feasibility of producing fusion energy," said Tang. "It also highlights the powerful connection between deployment of advanced GPU technology and accelerated understanding of major scientific endeavors such as the quest for fusion energy."

Tang's team has developed software called the "Fusion Recurrent Neural Network (FRNN)" code that has markedly improved the speed and accuracy of predictions of disruptions using vast amounts of data provided by the Joint European Torus (JET) that is located in the United Kingdom. The software was developed on the Tiger cluster of GPUs at Princeton University to demonstrate for the first time the ability of deep learning methods to predict disruptive events at an accelerated and more accurate pace.

Chief architect of the FRNN is Julian Kates-Harbeck, a graduate student at Harvard University and a U.S. Department of Energy Office of Science Computational Science Graduate Fellow. Also included on the team are Eliot Feibush, a computational scientist and experienced data analyst at PPPL, and Alexey Svyatkovskiy, a leading deep learning/AI expert at Princeton University's PICSciE.

Going forward, the group plans to further develop the FRNN software to meet the ITER requirements of 95 percent correct predictions of disruptions, with fewer than 5 percent false alarms at least 30 milliseconds before the onset of disruptions. Achieving this goal will mark a major step forward in controlling fusion energy.

Support for this work has primarily come from Laboratory Directed Research and Development (LDRD) funds provided by PPPL. Support also comes from the DOE Computational Science Graduate Fellowship Program, and from Princeton University's Office of Information Technology and PICSciE departments.

UK officials visit

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Sharon Ellis, director of Business Innovation at the agency that sponsors the U.K.'s seven research councils and the U.K. Atomic Energy Authority, said she and Andrew Price, head of the UK Science and Innovation Network, Americas, in the Foreign and Commonwealth Office in Washington, D.C., are looking for additional partnerships with researchers in the United States that could come out of the Science and Technology Cooperation Agreement signed by the U.K. and the U.S. in September. The agreement is already providing $88 million in funding for the international Long-Baseline Neutrino Facility and Deep Underground Neutrino Experiment (LBF/DUNE) at the U.S. Department of Energy's Fermi National Accelerator Laboratory.

"The reason I'm back in the U.S. is to follow up on the science and technology agreement and while we have a great collaboration on the DUNE experiment, our visit is all about looking for the next collaboration," said Ellis, whose agency is the Department for Business, Energy and Industrial Strategy.

The two officials met with Rich Hawryluk, PPPL's interim director; Dave McComas, Princeton University vice president for PPPL; and Stanley Kaye, deputy head of NSTX-U research; Terry Brog, deputy director for operations; Stacia Zelick, chief planning officer; and Andrew Zwicker, head of Communications and Public Outreach and head of Science Education.

Ellis and Price in the NSTX-U control room with Hawryluk and physicist Michael Jaworski. *(Photo by Elle Starkman)*

Jaworski, left, and Hawryluk, right, give a tour of the NSTX-U test cell to Price and Ellis. *(Photo by Elle Starkman)*

"We were delighted to host representatives from the U.K. to discuss our research here at PPPL and possible opportunities to collaborate in the future," Hawryluk said. "We have had long-term fruitful collaborations with MAST-U (the Mega Amp Spherical Tokamak-Upgrade) and JET (the Joint European Torus) and hope to strengthen them." Both are in the U.K.

The visitors toured PPPL's research laboratories, led by Hawryluk and physicist Michael Jaworski. They visited PPPL's flagship experiment, the National Spherical Torus Experiment-Upgrade (NSTX-U) and the NSTX-U control room. Dennis Boyle, a post-doctoral fellow, and Philip Efthimion, head of Plasma Science & Technology, showed the Lithium Tokamak Experiment (LTX), and Hantao Ji, a professor in Princeton University's Department of Astrophysical Sciences and a distinguished fellow at PPPL, showed them the Magnetic Reconnection Experiment (MRX).

Hawryluk told the visitors he hoped the tour gave them a sense of how MAST-U at the Culham Centre for Fusion Energy, which is also a spherical tokamak, complements the NSTX-U. "The objective was to give you a feel for what we do here and also to compare and contrast," he said.

He pointed out that many graduate students have received valuable experience on smaller experiments like the MRX and the LTX. "They have much more opportunity to do their experiments," he said. "Smaller experiments are much more hands-on."

Ellis and Price later visited Princeton University where they met with Pablo Debendetti, Dean for Research.

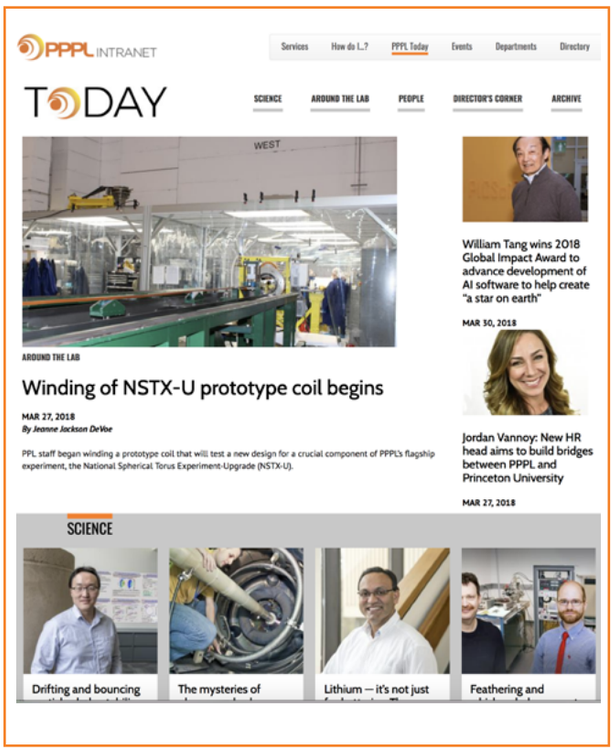
Post-doctoral researcher Dennis Boyle, second from right, and Hawryluk, far right, along with Phil Efthimion, head of Plasma Science & Technology, left, show Ellis and Price the Lithium Tokamak Experiment. *(Photo by Elle Starkman)*

PPPL Today e-news and PPPL Today pilot version arriving April 9

PPPL'ers: You can preview a new way of getting your news about the Lab, people, research, projects, and events on April 9 when you receive the *PPPL Today* e-newsletter. The Monday morning email will provide links to the *PPPL Today* web page instead of a PDF attachment.

The *PPPL Today* email will link to all the stories featured on the *PPPL Today* web page, which you can access from any device. You can get a sneak peek here. We will be asking you for your feedback so please let us know what you think and watch your email Monday, April 9, for a pilot of *PPPL Today*!

—PPPL Office of Communications



COLLOQUIUM

Paths to low-carbon energy

Robert Socolow
Princeton University

Wednesday, April 4
4:15 p.m., M.B.G. Auditorium, Lyman Spitzer Building

Council Café Lunch

This Week:
Valeria Riccardo, head of Engineering

Wednesday, April 4
12 p.m., PPPL Café

April 11: David Carle

Young Women's Conference will now be held on May 21

The Young Women's Conference, which was postponed due to the March 21 snowstorm, has been rescheduled for Monday, May 21.

Anyone who volunteered for the March 21 event should email Deedee Ortiz, dortiz@pppl.gov, to confirm you can volunteer on the new date.

Can Safety staff join me for a STOP observation?

Yes! Safety staff can accompany you on your STOP observations if you would like. Just ask!

Contact Dorothy Strauss, ext. 3072, dstrauss@pppl.gov, for more information.

Safety first:
Use the STOP program!

Lots of ways to go green in April and during Earth Week

Nominations for Green Machine Awards

Nominate your favorite green colleague or group or yourself for a Green Machine Award and show them you've noticed their sustainable practices! Go here for a nomination form.

Do some spring cleaning at home and help the needy

Donate your used clothing to the Trenton Rescue Mission clothing drive all through April at the bin in the Lower Parking Lot.

Get some fresh air and help make PPPL beautiful

Sign up here for the Earth Day Cleanup at PPPL,
Tuesday, April 24, 10:30 a.m. to noon. Rain date: Friday, April 27.

Lunch provided for volunteers

Earth Day Wednesday, April 25

Get crafty and celebrate Earth Day

Stop in the LSB Lobby from 11 a.m. to 1 p.m. and make and decorate your own water jar to cut back on plastic!

Watch your PPPL colleagues receive Green Machine Awards at 11 a.m.

Munch on some snacks and check out the Earth Day displays.

Tour the Laboratory on an employee tour!

Friday, April 13
10–11:30 a.m.
Meet in the lobby!

We are offering tours of the Laboratory the second Friday of each month at 10 a.m.

Go to the tour registration page here or contact tours@pppl.gov to register

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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 April 2	Tuesday April 3	Wednesday April 4	Thursday April 5	Friday April 6
Early Riser	**Bacon, Egg & Cheese** on English Muffin	**Sausage, Egg and Cheese Biscuit**	**Chocolate Chip Pancakes** Served with Choice of Breakfast Meat	**Ham, Egg and Cheese Sandwich**	**2 Eggs, 1 Pancakes,** Choice of Breakfast Meat & Potatoes
Country Kettle	**Soup of the Day**	**Soup of the Day**	**Soup of the Day**	**Soup of the Day**	**Soup of the Day**
Deli Specialty	**Capicola** with Provolone and Hot Pepper Relish	**Wasabi Turkey Wrap**	**Maple-Roasted Vegetable Wrap**	**Deviled Egg Salad Croissant**	**Chicken, Mozzarella,** Red Onion, Basil, Spinach and Balsamic Tomatoes on French Bread
Grill Specialty	**Patty Melt**	**Shrimp Tacos**	**Chicken and Sausage Jambalaya**	**Portobello Mushroom Cheese "Steak"**	**Apple Cheddar Melt**
COMMAND PERFORMANCE **Chef's Feature**	**Chicken Piccata** over Garlic Rice	**Baked Potato Bar**	**Roast Beef Au Jus** with Mashed Potatoes and Corn	**"Super Salad"**	**Fish and Chips**
Grilled Panini	**Tomato, Fresh Mozzarella, Spinach and Pesto Hoagie**	**Roast Beef** with Boursin Cheese and Caramelized Onion	**Bologna Pretzel Melt**	**Sausage and Peppers**	**Cuban Sandwich**

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/.