

THIS WEEK

WEDNESDAY, SEPT. 13

PPPL Inventor Recognition Reception

FRIDAY, SEPT. 15

PPPL Big Bang Bash
11 a.m.

[See page 6 for details.](#)

SATURDAY, SEPT. 16

Princeton University's Community Staff Day

[See page 5 for details.](#)

UPCOMING

WEDNESDAY, SEPT. 20

Colloquium

4:15 p.m. ♦ MBG Auditorium
The Interstellar Boundary Explorer (IBEX)

David McComas, Princeton University
Vice President for PPPL

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PPPL delivers new key components to help power a fusion energy experiment

By John Greenwald

Fusion power, which lights the sun and stars, requires temperatures of millions of degrees to fuse the particles inside plasma, a soup of charged gas that fuels fusion reactions. Here on Earth, scientists developing fusion as a safe, clean and abundant source of energy must produce temperatures hotter than the core of the sun in doughnut-shaped facilities called tokamaks. Much of the power needed to reach these temperatures comes from high-energy beams that physicists pump into the plasma through devices known as neutral beam injectors.

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Device invented at PPPL to identify nuclear materials is licensed to a start-up

By Jeanne Jackson DeVoe

A portable device invented at PPPL by engineer Charles Gentile and others at the Laboratory that identifies gamma emitting radioactive materials has been licensed to a start-up company that plans to develop and market the device.

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PPPL hosts IAEA



Physicists Nikolai Gorelenkov, left, and Mia Schneller, both from PPPL, talk to visitors at the poster session. (Photo by Elle Starkman)

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PPPL hosts IAEA biennial meeting for fusion researchers

By John Greenwald

More than 80 researchers from 21 countries gathered at PPPL Sept. 5-8 for the 15th International Atomic Energy Agency (IAEA) Technical Meeting on Energetic Particles in Magnetic Confinement Systems. The biennial meetings are held around the world to discuss the status of experimental and theoretical work on suprathreshold, or highly energetic, electrons and ions in a wide variety of magnetic confinement geometries.

Presentations during the four-day meeting ranged over topics that included the transport of energetic particles, runaway electrons and disruptions, and diagnostics for energetic particles. Also discussed were alpha particles produced by fusion reactions, the effects of energetic particles in magnetic confinement devices, and the collective phenomena of Alfvén waves, energetic particle modes and other modes.



Fabio Camilo de Souza, of the Institute of Physics at the University of São Paulo in Brazil shows a visitor his poster. (Photo by Elle Starkman)



Tour guide Ray Camp speaks to visitors on a tour. (Photo by Raphael Rosen)




Visitors look at the NSTX-U center stack during a tour of the Laboratory. (Photo by Raphael Rosen)

More than 35 invited talks and oral presentations, plus 45 posters, were given and displayed during the event, which was co-chaired by PPPL physicists Mario Podesta, who headed the local organizing committee, and Eric Fredrickson, who chaired the International Program Advisory Committee. Papers reported on progress achieved since 2015, when the meeting was held in Vienna.

“Attendees discussed and compared results from different devices and theory groups working on similar issues,” said Podesta. “This leads to possible collaborations, improvements to existing theories and codes, and projections of current research to ITER.”

Also discussed was recent work in preparation for the next deuterium-tritium campaign on the JET tokamak at the Culham Centre for Fusion Energy in the United Kingdom. The next campaign, which will be the first use of the combined high-power fuel since JET and the Tokamak Fusion Test Reactor (TFTR) at PPPL employed it in the 1990s, is scheduled to begin in 2019.

PPPL last hosted an IAEA meeting in this series, which began in 1989, in 1995. Selected sites are chosen for their strong scientific communities and major laboratories, said Sehila González de Vicente, scientific secretary in the Division of Physical and Chemical Scientists at the IAEA.

Plans call for publishing papers from the meeting in a special issue of the journal *Nuclear Fusion*, the leading publication on thermonuclear fusion research. Rich Hawryluk, interim director of PPPL, became chair of the board of editors of the journal last year. 



Researchers attending the four-day meeting. Front row: cochairs Eric Fredrickson and Mario Podesta, with scientific secretary Sehila González de Vicente. (Photo by Elle Starkman)



Charles Gentile, center, with fellow inventors Andy Carpe, left, and Kenny Silber. (Photo by Elle Starkman)

The Miniature Integrated Nuclear Detection Systems (MINDS) was licensed to Gamma HQ in Frederick, Maryland, through Princeton University's Office of Technology Licensing. The company plans to develop the technology for a variety of uses that would likely include detecting radioactive materials for homeland security and ensuring that radioactive materials aren't inadvertently transported out of hospitals, Gentile said.

"I feel good," Gentile said. "We really want to be able to help different organizations in the country, to give them better tools to detect and identify certain nuclear signatures in the environment that shouldn't be there, from people looking to damage the country."

MINDS is a compact system that uses artificial intelligence detection software to quickly identify nuclear signatures to distinguish radionuclides used in medical procedures from certain radionuclides considered threat materials by the U.S. Department of Homeland Security and other regulatory agencies

Laurie Bagley, head of Technology Transfer at PPPL, who drove the effort to execute the license agreement, said she is delighted to see the technology licensed. "It's a great example of transferring a technology from the Lab to the market which can have an impact on improving lives, creating jobs, and supporting additional research," she said.

Raising venture capital funds

The next steps would be for Gamma HQ to raise venture capital funds to develop the project, after which it would enter into a Strategic Partnership Project (SPP) agreement (formerly known as a Work for Others agreement) with Gentile to further develop the MINDS platform. SPP funding would eventually amount to approximately half a million dollars over several years, Gentile said

MINDS has been installed at Newark Penn Station and toll-booths, and used to scan cargo containers at the Port of Oakland. It has also been used several times to screen visitors at the air show at the Joint Base McGuire-Dix-Lakehurst, which has attracted hundreds of thousands of people over the years. MINDS avoids false alarms by filtering out radiation from materials used to treat cancer, or used in medical stress tests. It has never detected weapons-grade materials while deployed in various areas.

Technology won awards

The device was featured in the television show, "NICS-Los Angeles," in which the heroes recover the stolen device from villains. It won the 2008 Thomas Alva Edison Patent Award from the Research Development Council of New Jersey and the 2009 Award for Excellence in Technology Transfer from the Federal Laboratory Consortium for Technology Transfer.

Gentile, who is head of the Tritium Systems Group, and head of the Exploration Group at PPPL, is a prolific inventor who has five patents. Gentile, former deputy director Adam Cohen, and Health Physics Manager George Ascione received the 2016 Edison Patent Award from the Research & Development Council of New Jersey for their invention of an on-demand method to create molybdenum-99, a badly-needed medical isotope used in medical imaging.

Gentile's collaborators on the MINDS device include Andrew Carpe, a research technician; engineer Steve Langish; software engineers Kenny Silber and Bill Davis, who recently retired, former software engineer Dana Mastrovito, and former employee Jason Perry.

First developed for TFTR

Gentile and his fellow inventors first developed MINDS to detect nuclear materials during the decommissioning of the Tokamak Fusion Test Reactor (TFTR) in 1999.

They reconfigured it in 2001 after the September 11 attacks when they received funding from the U.S. Department of Energy and the U.S. Army to develop the device. Gentile has three patents on MINDS.

Other inventions that have been licensed at PPPL are engineer Chris Brunkhorst's device to pasteurize eggs using radio frequency waves and physicist Sam Cohen's Princeton field-reversed configuration (PFRC) fusion engine.

Gentile said he is looking forward to further developing MINDS via the SPP process. One possibility is to explore how to further miniaturize the technology, Gentile said. He said he is happy to know the technology will be put to good use. "It gives the Laboratory an opportunity to help this country with homeland security," he said. "It is nice to be part of the solution for the greater good." 📍

DIII-D

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At PPPL, engineers recently designed and delivered a set of innovative new components for the neutral beam injectors that heat plasma in the DIII-D National Fusion Facility, the tokamak that General Atomics operates for DOE in San Diego.

The redesigned parts, called pole shields, protect magnets in the injectors from the energetic particles from the beam and will replace units that melted and cracked during previous fusion experiments, resulting in water leaks. The magnets redirect charged atomic nuclei, or ions, in the beams to an ion dump inside the injectors, permitting only neutral atoms to enter into the plasma.



Alex Nagy

“They had a problem that needed fixing. In the end, we came up with a solution that solved the problem,” said PPPL engineer Irving Zatz, who oversaw the design, analysis and delivery of the shields. He teamed with engineers Andrei Khodak, who ran computer analyses to verify the new design, and Alex Nagy, who heads PPPL engineering collaborations

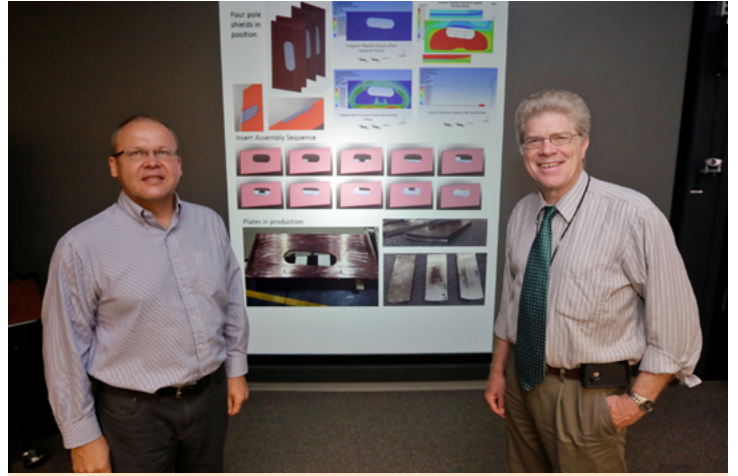
on DIII-D. Support for this work comes from the DOE Office of Fusion Energy Sciences.

The new units are similar to shields that PPPL delivered to DIII-D for installation on the first of the facility’s four injectors in 2014. Following months of use of those shields, “inspection results showed no signs of wear or damage,” Nagy said.

Withstand increased heat loads.

The new design will withstand the sharply increased heat loads that the injectors are scheduled to produce. Plans call for an upgrade in the injector’s maximum power from 2.6 megawatts in three-second pulses to 3.2 megawatts in pulses that will last twice as long.

The new shields consist of half-inch thick, roughly five-foot long copper plates equipped with inserts of the hard, silvery metal molybdenum in the center of the plates, the area that will absorb the most energy from the beam. The inserts, which



Engineers Andrei Khodak and Irving Zatz with poster showing design of shields with space for molybdenum inserts. (Photo by Elle Starkman).

resist melting at high temperatures, are a key design innovation originally proposed by General Atomics’ Tim Scoville, the head of neutral beam operations at DIII-D.

Each new shield contains 10 molybdenum plates that are grooved together like a puzzle, with a copper key piece holding them in place. This setup will accommodate different degrees of heat expansion and other conditions, and will enable the molybdenum tiles to be easily disassembled and replaced, without injector disassembly.

Khodak used a software code to examine how the shields stood up to factors ranging from the distribution of heat loads to the stresses in the copper and molybdenum that greater power will exert. Results showed that the design met or exceeded all performance requirements. “The original, all-copper plates typically fail after about five year of service,” Nagy said. “The life of the new pole shield design should significantly increase the time to failure for this critical component. The difference between the old and new shields is like comparing old bias-ply tires to new steel-belted radials.”

Pole shields are not the only parts that PPPL is upgrading on the DIII-D neutral beam injectors. The Laboratory has designed new collimators, which align the neutrals in parallel beams, and calorimeters, which measure heat, for the machines. Fabrication is under way and the components are scheduled for delivery in the fall. 📦



PPPL-designed pole shields packed for delivery to DIII-D.

Princeton University's Community & Staff Day

Saturday, Sept. 16

Princeton Vs. San Diego
12 p.m.

Skydivers deliver the
game ball at 11:30 a.m.

Family Fun Fest
10:30 a.m.

Princeton Stadium
Concourse and
Weaver Track

Free Youth Sports Clinic
10:30—11:30 a.m.

**Free tickets available at PPPL HR Tuesday, Sept. 12 from 8 a.m. to 4 p.m.
or online at www.GoPrincetonTigers.com/tickets**

Help solve the case of the disappearing flatware

Please return any forks, knives, and
spoons you have in your office or
work area to the cafeteria and put
the utensils in the proper container
in the cafeteria. Thank you!



COLLOQUIUM

The Interstellar Boundary Explorer (IBEX)

David McComas

Princeton University Vice President for PPPL

Wednesday, Sept. 20

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

The PPPL Big Bang Bash 2017

Friday, Sept. 15
11 a.m.

Rain date: Tuesday, Sept. 19

Enjoy great food, fun games and team-building activities, and the opportunity to network and socialize with friends and colleagues and meet new ones!

The Big Bang Bash includes:

- An antique & specialty vehicle show
- A cultural fair
- A United Way community service project
- A dunk tank and other activities

<https://sites.google.com/pppl.gov/bigbangbash2017/home>

BROCK

NICK PETTI
Chef Manager



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 Sept. 11	Tuesday Sept. 12	Wednesday Sept. 13	Thursday Sept. 14	Friday Sept. 15
COMMAND PERFORMANCE Chef's Feature	Chicken Cacciatore	Kung Pao Meatballs over Fried Rice with Egg Roll	SUSHI RETURNS	Fill Your Box — Breakfast for Lunch Omelets, Eggs, Sausage, French Toast, Tater Tots, Fruit Salad and Iced Tea	N/A
Early Riser	Belgian Waffle Sticks	Huevos Rancheros	Frittata Lorraine	Omelette Florentine with Spinach, Tomato & Mozzarella	Breakfast Tacos
Country Kettle	Chef's Choice	Chef's Choice	Chef's Choice	Chef's Choice	CLOSED FOR BIG BANG BASH UNLESS EVENT IS POSTPONED TO SEPT. 19 DUE TO RAIN
Deli Special	Smoked Turkey Baguette	Greek Tuna Salad with Pita Chips over Lettuce	Tomato & Fresh Mozz on Ciabatta with Roasted Garlic Hummus	N/A	
Grill Special	Italian Grilled Cheese	Buffalo Chicken Steak Sandwich with Fries	N/A	N/A	
Panini	Buffalo Shrimp Wrap	Italian Beef with Spinach and Provolone	Crab Cake on a Kaiser with Lettuce & Tomato	N/A	

MENU SUBJECT TO CHANGE WITHOUT NOTICE

HEART HEALTHY

VEGETARIAN OPTION

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DEADLINE for calendar item submissions is noon on WEDNESDAY. Other stories should be submitted no later than noon on TUESDAY.

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