

At PPPL THIS WEEK

MONDAY, AUGUST 27

NSTX Physics Meeting

1:30 p.m. - 3 p.m. ♦ B-318

FRIDAY, AUGUST 31

DIII-D Science Meeting

1 p.m. ♦ B-233

ATTENTION!

TAKE THE GOOGLE APPS SURVEY: It has been roughly 10 months since Google Apps was implemented here at PPPL. The Laboratory's Information Technology Department is asking you to participate in a short survey to help us learn about your experience with the new system. Your feedback will be used to determine the areas in which Google Apps excels as well as the areas for improvement.

The survey can be accessed at:
<https://docs.google.com/a/pppl.gov/spreadsheets/viewform?pli=1&formkey=dG45SEdialJazhZSFZqcTUtLTZUWGc6MQ#gid=0>
Please complete the survey no later than this Friday, August 31. Please contact Steve Baumgartner or Marc Cohen with any questions.

INSIDE...

- **Boon to Fusion**
pages 1-3
- **Saville Lauded**
pages 1-3
- **Lithium Incident**
page 4
- **Prager in Video**
page 5

Boon to Fusion:

Goldston Finds New Way to Predict Heat Layer Troublemaker

By John Greenwald

Researchers at a recent worldwide conference on fusion power have confirmed the surprising accuracy of a new model for predicting the size of a key barrier to fusion that a top scientist at the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) has developed. The model could serve as a starting point for overcoming the barrier. "This allows you to depict the size of the challenge so you can think through what needs to be done to overcome it," said physicist Robert Goldston, the Princeton University professor of astrophysical sciences and former PPPL director who developed the model.

Lab Lauded for Inventory Reporting of Nuclear Materials Saville Singled Out For Praise

By Emily Silber

PPPPL has been recognized by representatives of both the National Nuclear Security Administration and the U.S. Nuclear Regulatory Commission for outstanding inventory reporting and reconciliation of nuclear materials.

Catherine Saville, the PPPL employee who has been the lead in the Lab's program since its inception, was singled out for praise in bringing this first-ever distinction of a "certificate of appreciation" from the agencies to the Lab. "This certificate of appreciation is the first one received at Princeton and she alone is the individual responsible for such recognition," said George Ascione, Head, Health Physics Division, Radiological Control Manager and Safeguards Manager at PPPL, speaking of Saville's contributions.

continued on page 3



Catherine Seville

Photo by: Emily Silber

Goldston

continued from page 1

Goldston was among physicists who presented aspects of the model in late May to the 20th Annual International Conference on Plasma Surface Interactions in Aachen, Germany. Some 400 researchers from around the world attended the conference. Results of the model have been “eerily close” to the data, said Thomas Eich, a senior scientist at the Max Planck Institute for Plasma Physics in Garching, Germany, who gave an invited talk on his measurements. The agreement appears too close to have happened by chance, Eich added.

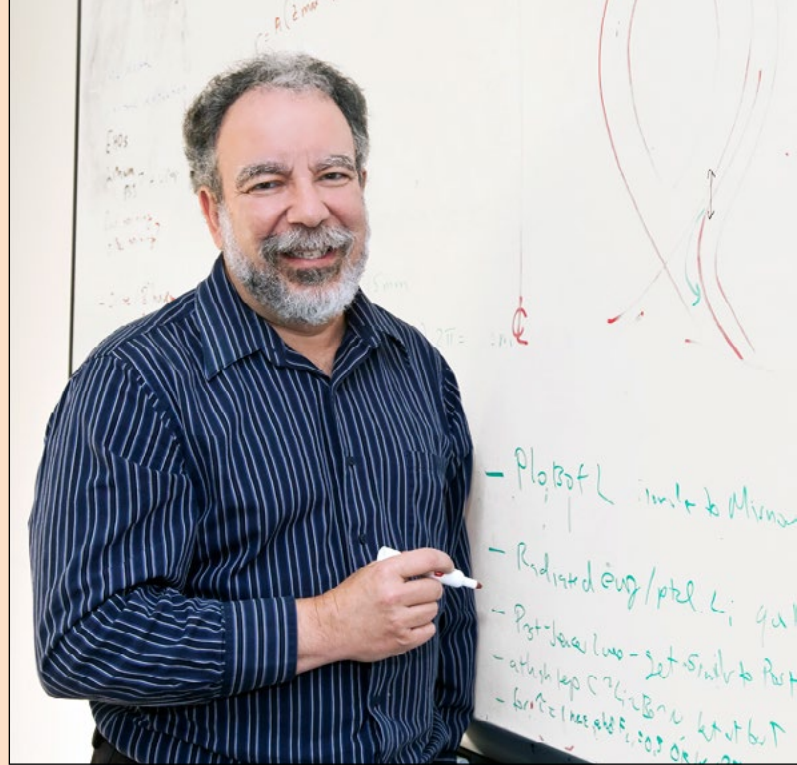
Goldston’s model predicts the width of what physicists call the “scrape-off layer” in tokamaks, the most widely used fusion facilities. Such devices confine hot, electrically charged gas, or plasma, in powerful magnetic fields. But heat inevitably flows through the system and becomes separated, or scraped off, from the edge of the plasma and flows into an area called the divertor chamber.

The challenge is to prevent a thin and highly concentrated layer of heat from reaching and damaging the plate that sits at the bottom of the divertor chamber and absorbs the scrape-off flow. Such damage would halt fusion reactions, which take place when the atomic nuclei, or ions, inside the plasma merge and release energy. “If nothing was done and you took this right on the chin, it could be a knockout blow,” said Goldston, who published his model in January in the journal *Nuclear Fusion*.

Solving this problem will be vital for future machines like ITER, the world’s most powerful tokamak, which the European Union, the United States and five other countries are building in France to demonstrate fusion as a source of clean and abundant energy. The project is designed to produce 500 megawatts of fusion power in 400 second-long pulses, which will require researchers to spread the scrape-off heat as much as possible to protect the divertor plate.

Goldston’s model could help guide such efforts. He began pondering the width of the heat flux during an international physics conference in South Korea in 2010. Looking at the latest scrape-off layer data based on improved measurements, he estimated—literally on an envelope—that the new widths could be produced without plasma turbulence, a factor that is typically considered but is notoriously difficult to calculate. This led him to search for a way to estimate the width of the surprisingly thin layer, and to gauge how the width would vary as conditions such as the amount of electrical current in the plasma varied.

The way plasma flows inside tokamaks provided the major clue. The ions within the charged gas gyrate swiftly along the magnetic field lines while drifting slowly across the lines. At the same time, the electrons also in the plasma travel very rapidly along the lines and carry away most of the heat. Goldston arrived at his prediction by determining how fast these subatomic particles flow into the divertor re-



Rob Goldston

gion, and how long it therefore takes them to reach it. The result “is what we call a ‘heuristic’ estimate, based on the key aspects of the physics, but not a detailed calculation,” said Goldston.

His estimate confirmed what Goldston had suspected: the width of the scrape-off layer nearly matched the results of a calculation, made without considering turbulence, for determining how far the ions drift away from their field lines. “What’s stunning is how closely the values correspond to the data, both in absolute value and in variation with the plasma current, magnetic field, machine size and input power,” Goldston said. “This does not mean that turbulence plays no role, but it suggests that for the highest performance conditions, where turbulence is weakest, the motion of the ions is dominated by non-turbulent drift effects.” This will be true in the case of ITER, he added, since it is designed to operate in high-performance conditions.

Researchers are developing techniques for widening the scrape-off layer. Such methods include pumping gas into the divertor region to keep some heat from reaching the plate. Physicists use deuterium, a form of hydrogen, to block the heat, and are injecting nitrogen to turn other parts of the heat into ultraviolet light. (While charged deuterium ions are already in the plasma, the deuterium gas that is injected into the divertor region to block the heat is not electrically charged.)

These strategies look promising. “We know that they will work,” said Goldston. “The outstanding question is whether they will work completely enough” to mitigate the heat flux at ITER’s highest power levels, without introducing so much gas that it cools the fuel. Physicists around the world are conducting experiments to understand the process better.

Saville

continued from page 1

As a participant in the Nuclear Materials Control and Accountability (MC&A) program at PPPL, Saville, as the Nuclear Materials Representative, must monitor and maintain records on the use of all nuclear material.

During her 27 years at the Lab, Saville has worked in many sectors tied to nuclear materials, including the Radiation Dosimetry Program, Safety Action Item Tracking and Reporting, Health Physics Support, as well as MC&A. “I was first hired by members of the Occupational Safety Office to set up databases on their new IBM PC,” Saville said. “It was the first computer in the Safety Office and no one knew how to use it. I set up safety-related databases for training, chemical tracking and labeling, and a PCB inventory.”

While going through the process of issuing radiation badges, Saville was able to learn more deeply about the increasingly strict regulations pertaining to radiation monitoring and the reporting and tracking requirements involved. “I was already issuing and collecting the radiation badges and setting up the files for each monitored individual, so I was the logical choice to do the reporting as well,” she said.

In the early 1940s, government accounting standards for nuclear materials were sparse and not well developed, according to the Nuclear Materials Management and Safeguards System (NMMSS) official website. Detailed manual records were kept to some degree but calibration throughout facilities was minimal until 1948 when the first standard procedures were established. After the Atomic Energy Act of 1954 was passed, the Atomic Energy Commission (AEC) created a comprehensive set of requirements and procedures that facilities could follow when accounting for nuclear materials. The AEC was not only responsible for the government’s nuclear programs, but also for the private nuclear industry, until the Nuclear Regulatory Commission (NRC) became an independent agency in 1975. The Nuclear Materials Information System (NMIS) was one of three information systems built in the AEC that proved the feasibility of having a full-scale system that could store data and produce management reports.

NMIS was first deployed on the IBM 7090 computer at Union Carbide in Oak Ridge, Tennessee. At that time there were only 12 nuclear materials in NMIS accounting including uranium, deuterium, tritium, and plutonium. In 1976 the name of the NMIS was changed to NMMSS to reflect the support for nuclear materials safeguards.

Inventory

“The nuclear material inventory reporting at PPPL became more involved in the early 1990s when tritium was selected as the fuel in the Tokamak Fusion Test Reactor. The MC&A program had to provide documented evidence that PPPL was accounting and controlling the DOE-owned tritium being supplied for this experiment,” Saville said. Today, even though tritium is no longer being processed at the Lab, there are still some remaining systems that must be tracked and reported, she said. All the reporting goes to NMMSS, which is managed by the National Nuclear Security Administration (NNSA).

The MC&A program is required to account for and control the use of all nuclear materials as defined in DOE Order 474.2 and must be able to detect and deter their theft or diversion.

“Since different facilities house different types of material and amounts, MC&A programs are tailored to each facility using a graded approach. PPPL mainly uses small quantities of select materials which, compared to a facility housing nuclear weapons, is low on strategic and monetary value and therefore requires a smaller program,” Saville said. “I basically ensure that nuclear materials are tracked from the time they come on site to the time they leave. I monitor the quantities to ensure PPPL’s inventory stays within the level approved by DOE, and monitor the on-site location of the material as well. I depend greatly on the Health Physics technicians to provide the physical tracking and monitoring. As material is received, shipped, used, or decayed, I document it and report it to NMMSS,” Saville concluded. 📍

Goldston

continued from page 2

For Goldston, calculating the width of the scrape-off layer marks the latest research effort in a 40-year career at PPPL, which began when he was a graduate student. Along the way he helped to pioneer techniques for heating the plasma, and developed a widely used method called “Goldston scaling” for predicting how long heat is retained in a tokamak plasma.

“First, heat is injected into the plasma,” Goldston said of how tokamaks operate. “Second, that heat is retained while

much more heat is generated by fusion reactions. Finally, the resulting heat has to come out of the plasma. Without thinking about it, I have been following heat along this trajectory throughout my whole research career,” he added.

“We have made great progress on the first two steps, and now the most exciting challenge, to me, is the one that comes because of our success so far. Now we need to learn to handle the the outflow of heat from a high-power fusion energy source.” 📍

Lithium Reaction Causes Lab Evacuation But No Injuries, Emergency Response Lauded

By John Greenwald

A routine cleanup of lithium powder Aug. 14 created an unexpected chemical reaction that produced billowing smoke and odor-filled hallways, and provoked the evacuation of more than 100 people from a portion of the Lab.

“The support was incredible by everyone involved,” said Jamie Alkhateeb, emergency planning and training coordinator for site protection, who served as incident commander during the 90-minute evacuation. “Everyone was on their game.”

The incident caused PPPL Deputy Director Adam Cohen to issue a Stop Work order on all lithium work in the Laboratory, and to charter a Lithium Safety Committee that was initially discussed in July. Chairing the panel will be Dick Majeski, principal investigator for the Lithium Tokamak Experiment (LTX), who said the committee will work to develop a Laboratory-wide approach to lithium safety.

The lithium incident was the second in two days to require a PPPL evacuation. The first occurred Aug. 13 when a halon fire-suppression system accidentally discharged in the control room of the National Spherical Torus Experiment (NSTX), causing the Lyman Spitzer Building to be cleared for about an hour. The cause of the discharge remains under investigation.

The lithium incident began at 1:30 p.m. while staffers were vacuuming what appeared to be passivated—or deactivated—lithium powder from a stainless steel NSTX “dropper” in C-108, a first-floor workshop in the CS Building in the southeast corner of the Laboratory. Researchers had stored the powder to dry out inside the dropper after using the bucket-like device to shake lithium into the NSTX vessel to coat its floor and walls during experiments.

But while the top layer of the powder was crusted and dried, some still-active lithium remained unseen in the dropper. This lithium melted the filter of the black canister vacuum cleaner, sending acrid-smelling smoke into the workshop where three workers—engineer Lane Roquemore, physicist Dennis Mansfield and safety division head Bill Slavin—were doing the cleaning. The three quickly backed from the room, shutting the door and placing a towel between it and the floor to keep the smoke from escaping.

The Emergency Services Unit (ESU) led by Capt. Howard Caruso arrived on the scene with alarms going off and the odor drifting up halls all the way past the Harold P. Furth Library. Also arriving to help were Construc-

tion Branch Manager Eric Perry and Facilities Manager Stephen Langish, who cordoned off the affected area as personnel in the CS Building, the L-Wing, the Theory Department and the library were evacuated. Perry wheeled in a cart of bottled water to refresh the ESU crew members, who wore full firefighting attire.

The ESU workers immediately checked for any risk to life. “We were able to ascertain that there was no life-safety hazard,” said Alkhateeb.

“There was no active fire and the smoke was in an isolated area.” The odor itself apparently came from the burning filter rather than the lithium, added Dolores Stevenson, deputy head of the Site Protection Division.

To clear out the smoke, workers started up the long-dormant ventilation system in the former Motor Generator Building that adjoins the CS Building. Contributing to this task were Alan Bara, Richard McDonough, Tom Ward and Bill Gervasi of the Facilities and Site Services Division, and Neil Gerrish of Industrial Hygiene.

Firefighters placed the damaged vacuum cleaner into a 55-gallon drum as the ventilation came on and the smoke dissipated. Members of the Environmental Services group transferred the drum to the Laboratory’s hazardous materials facility. Workers examined the vacuum cleaner and filter the following day, found them to be safe and assigned them to Environmental Services for disposal.

In summing up the lithium episode, Cohen noted that, “Clearly we had a situation that could have been prevented with better control. Further, there is some question about the adequacy of the fire detection and protection system in that room that needs to be evaluated.” Nonetheless, he added, “the response to the incident from the time the smoke was seen through the ending of the evacuation is laudable.”



From left, Jamie Alkhateeb, Fran White, and Rob Sheneman examine the container.

Photo by: Dolores Stevenson

Director Prager Featured in Video Interview with Plainsboro Mayor Cantu

PPPL Director Stewart Prager is featured in a video interview with Plainsboro Mayor Peter Cantu that is currently appearing on Comcast Channel 3 or Verizon Channel 26 in the Plainsboro area. In the 13-minute "Spotlight Special" video, filmed this summer in Prager's third-floor office at PPPL, Cantu asks Prager a series of questions ranging from what scientific challenges remain for fusion researchers to how the Lab receives funding. They discussed the Lab's history in Plainsboro and the longstanding cooperative relationship between the Lab and the community.

Vigilant viewers can spy some of the books occupying Prager's bookshelves, including: "Waves in Plasmas," and "Quantum Mechanics." The Plainsboro cable television schedule can be accessed at www.plainsboronj.com.

Plainsboro Cable Television Schedule	
Thursday, August 23rd - Wednesday, September 5th, 2012	
Daytime Programming	Evening Programming
9:00am COMCAST NEWSMAKERS <i>With Mayor Peter Cantu</i>	7:00pm COMCAST NEWSMAKERS <i>With Mayor Peter Cantu</i>
9:04am HELPING HANDS <i>The Mission of the West Windsor-Plainsboro Education Foundation</i>	7:04pm HELPING HANDS <i>The Mission of the West Windsor-Plainsboro Education Foundation</i>
9:24am SPOTLIGHT SPECIAL <i>The Mayor visits Princeton Plasma Physics Laboratory</i>	7:24pm SPOTLIGHT SPECIAL <i>The Mayor visits Princeton Plasma Physics Laboratory</i>
9:38am Plainsboro Founder's Day Celebration	7:38pm Plainsboro Founder's Day Celebration
9:41am Village/Millstone Coat Drive	7:41pm Village/Millstone Coat Drive
9:54am Princeton/Plainsboro Hospital Grand Opening Ceremony	7:54pm Princeton/Plainsboro Hospital Grand Opening Ceremony
10:33am Aging Insights <i>August Edition</i>	8:33pm Aging Insights <i>August Edition</i>
11:02am July 19th Middlesex Board of Chosen Frecholders Meeting	9:02pm July 19th Middlesex Board of Chosen Frecholders Meeting
11:59am Breakfast with Mayor Peter Cantu <i>Hosted by the Plainsboro Business Partnership and the Princeton Regional Chamber of Commerce</i>	9:59pm Breakfast with Mayor Peter Cantu <i>Hosted by the Plainsboro Business Partnership and the Princeton Regional Chamber of Commerce</i>
12:33pm SPOTLIGHT ON MIDDLESEX	10:33pm SPOTLIGHT ON MIDDLESEX
1:01pm Our Ranger's Guide to the Plainsboro Park System	11:01pm Our Ranger's Guide to the Plainsboro Park System
1:06pm Plainsboro Founder's Day Celebration	11:06pm Plainsboro Founder's Day Celebration
1:09pm HELPING HANDS <i>The Mission of the West Windsor-Plainsboro Education Foundation</i>	11:09pm HELPING HANDS <i>The Mission of the West Windsor-Plainsboro Education Foundation</i>

From the PPPL Site Protection Division

Parking Decals

The Site Protection Division would like to remind all PPPL staff that a Parking Decal is required for all personal vehicles on site. A Parking Decal registers the vehicle with the Site Protection Division and governs the legal parking of the vehicle, regardless of the operator. The vehicle information will be used by SPD and the Badge Office staff in the event of a safety condition or concern.

Valid parking decals must be displayed at all times. Decals are to be displayed in the rear side window (*driver's side*). If your vehicle design does not allow for placing the decal in this window it is to be displayed in the rear window. Motorcycles are not required to display a PPPL decal, but the motorcycle must be registered with Site Protection.

To acquire a PPPL Parking Decal, please contact Sandy Shaw at sshaw@pppl.gov or at extension 2898.

For additional information on decals and the PPPL Parking and Traffic Regulations, please visit: http://www-local.pppl.gov/pdf/PARKING_TRAFFIC.pdf

Thank you for your co-operation.



PPPL Café Menu

BREAKFAST 7 a.m. • 10 a.m.
CONTINENTAL BREAKFAST 10 a.m. • 11:30 a.m.
LUNCH 11:30 p.m. • 1:30 p.m.
SNACK SERVICE until 2:30 p.m.

MONDAY AUG. 27

TUESDAY AUG. 28

WEDNESDAY AUG. 29

THURSDAY AUG. 30

FRIDAY AUG. 31

COMMAND PERFORMANCE
CHEF'S FEATURE



BAKED ZITI WITH A GARLIC TWIST & VEG.



CREATE YOUR OWN TURKEY TACO SALAD



JAMAICAN CURRY CHICKEN STEW



MEATLOAF WITH MASHED POTATOES



CHICKEN FRANCAISE OVER PASTA

EARLY RISER

Hash Brown, Bacon, Egg and Cheese Wrap

Ham, Cheese, Onion and Potato Frittata

The XL Greek Egg White Omelet with Home Fries

Corn Beef Hash and Eggs

French Toast Sticks & Sausage

COUNTRY KETTLE

Vegetarian Black Bean

Cream of Broccoli

Turkey Chili

Egg Drop Soup

Chicken, Roasted Corn and Rice Chowder

GRILLE SPECIAL

Buffalo Chicken Tender Wrap w/ Onion Rings

Grilled Chicken Club Sandwich with Fries

XXL Turkey Burger Wrap w/ Fries

The BBQ "O" Burger w/ Fries

Mushroom, Onion and Pepper Quesadilla

DELI SPECIAL

The Pressed Turkey Club on Whole Wheat

Louisiana Shrimp Salad on a Multi Grain Roll

Open Faced Ham and Cheese Hoagie

Capicola, Fresh Mozzarella and Roasted Red Peppers

The Mini Salad Sampler (Choice of 2)

PANINI

Swiss Honey Ham and Cheese

BBQ Pulled Chicken with Provolone Cheese

Crispy Chicken, Pepper Jack, Onions and Peppers

3 Cheese, Tomato and Turkey Griller

Grilled Chicken Parmesan

MENU SUBJECT TO CHANGE WITHOUT NOTICE

[CLICK HERE FOR A PRINTABLE WEEKLY MENU](#)

WEEKLY

Graphic Designer: Greg Czewowicz ♦ Photographer: Elle Starkman ♦ Webmaster: Chris Cane

PPPL WEEKLY is published by the PPPL Office of Communications on Mondays throughout the year except for holidays. Deadline for calendar item submissions is noon on Thursday. Other stories should be submitted no later than noon on Wednesday. Comments: commteam@pppl.gov ♦ PPPL WEEKLY is archived on the web at: <http://www.pppl.gov/ppplweekly.cfm>

NOTE: Due to the Labor Day holiday on September 3, the next issue of the PPPL Weekly will be published on Monday, September 10, 2012.