

At PPPL THIS WEEK

MON.-FRI., NOV. 17-21
**Environmental Management
Systems Audit**
TUESDAY, NOV. 18
**20th Anniversary Celebration
10MW of Fusion Power in TFTR**
1 p.m. ♦ Labwide celebration
(Ice cream and cake served)

2 p.m. ♦ Colloquium

 "Achieving 10MW of Fusion Power in
TFTR: a Retrospective"

Michael Bell, PPPL
WEDNESDAY, NOV. 19
United Way Campaign Kickoff
10:30 p.m. ♦ MBG Auditorium

Light refreshments will be served

PPPL Colloquium
4:15 p.m. ♦ MBG Auditorium

 Antibiotic Resistance: A Global Challenge
R. Laxminarayan, Princeton Univ.

UPCOMING EVENTS

November 27-28
Lab closed

Thanksgiving Holiday

January 14, 2015
PPPL's Records/
Paper Shredding Event
9 a.m. - 4 p.m. ♦ Receiving 3

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for Hunger**
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PPPL, Princeton launch hunt for Big Bang particles

By John Greenwald

Billions upon billions of neutrinos speed harmlessly through everyone's body every moment of the day, according to cosmologists. The bulk of these subatomic particles are believed to come straight from the Big Bang, rather than from the sun or other sources. Experimental confirmation of this belief could yield seminal insights into the early universe and the physics of neutrinos. But how do you interrogate something so elusive that it could zip through a barrier of iron a light-year thick as if it were empty space?

At PPPL, researchers led by Princeton University physicist Chris Tully are set to hunt for these nearly massless Big Bang relics by exploiting a curious fact: Neutrinos can be captured by tritium, a radioactive isotope of hydrogen, and provide a tiny boost of energy to the electrons — or beta particles — that are emitted in tritium decay.

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Chris Tully, front left, and Charles Gentile, front right, with project participants in the PTOLEMY laboratory under construction. Back row from left: Irving Zatz, Robert Woolley, Lloyd Ciebiera, Junast Suerfu, Doug Westover, Philip G. Efthimion, William Sands, Jim Taylor.

Audit examines PPPL's wide-ranging Environmental Management System

By Jeanne Jackson DeVoe

Robert Sheneman, the head of the Environmental Services Division, points out that PPPL's award-winning environmental program is really a reflection of the Lab's mission to develop magnetic fusion as a clean, safe and abundant source of energy for producing electricity.

"We are pursuing an environmentally friendly, globally available source of energy so we should strive to operate the Laboratory in an environmentally friendly manner," Sheneman said. "It's just a natural fit for the Lab."

In fact, the practices at the Lab that promote the Lab's goals of operating in a green and sustainable manner as possible are woven into everyday life — so much so that people may not be aware of the numerous components of PPPL's Environmental Management System (EMS), Sheneman said.

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Big Bang

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Tully has created a prototype lab at PPPL to detect Big Bang neutrinos by measuring the extra energy they impart to the electrons — and to achieve this with greater precision than has ever been done before. Spotting these neutrinos is akin to “detecting a faint heartbeat in a sports arena filled to the brim” said Charles Gentile, who heads engineering for the project, which Tully has dubbed PTOLEMY for “Princeton Tritium Observatory for Light, Early Universe Massive Neutrino Yield.” Ptolemy was an ancient Greek astronomer who lived in Egypt during the first century.

Darkest, coldest conditions achievable

The task calls for measuring the energy of an electron with a precision comparable to detecting the mass of a neutrino, which until recently was thought to have no mass at all. Such measurements require the darkest, coldest conditions achievable in a laboratory and the use of quantum electronics — a discipline that deals with the effect of quantum mechanics on the behavior of electrons in matter — to detect the minute extra energy that a Big Bang neutrino would impart. Quantum mechanics describes the motion and direction of subatomic particles.

Why is the energy that a Big Bang neutrino provides so extraordinarily small? What’s unique about these relics is that their wavelength has been stretched and cooled as the space-time we live in has expanded over approximately 13.7 billion years. This expansion has cooled a tremendous number of neutrinos to temperatures that are billions of times colder, and therefore less energetic, than those of neutrinos originating from the sun. When tritium captures these cold neutrinos, they create a narrow peak in energy that is just above the maximum energy of an electron from tritium decay.

The difficulty in identifying a Big Bang relic doesn’t end there. Since neutrinos can take different forms, the height of the peak could be higher or lower by a factor of two, depending on whether the neutrino is like normal matter with a corresponding particle of antimatter — an antineutrino — or whether the neutrino is different and is in fact its own antiparticle. The extra height might not appear at all if neutrinos decay over billions of years into yet unknown, lighter particles.

Cutting-edge technology

Tully aims to show that the prototype for PTOLEMY, which is housed in a basement site at PPPL, can indeed achieve the precision needed to detect Big Bang neutrinos. The cutting-edge technology could then become the basis for a major experiment at PPPL to test long-held assumptions about the density of Big Bang neutrinos throughout the universe.

Confirming the assumptions could validate the standard model of the origin of the universe, Tully says, while refuting them could overturn the model and prompt new ideas about the Big Bang and its aftermath. Finding the neutrinos could also show if they could be a source of the invisible dark matter that scientists say makes up 20 percent of the total mass of the universe.

Such discoveries could be epochal. Could the project “make long-term contributions to the understanding of the universe?” Tully asks in presentations about PTOLEMY. “Absolutely!” he says. “We believe that we live in a sea of 14-billion-year-old neutrinos all around us. But is it true?”

The prototype at PPPL may hold the key to finding out. The device consists of a pair of superconducting magnets connected to opposite ends of a 5-foot cylindrical vacuum chamber. A source containing a tiny bit of tritium sits inside one end of the chamber, with a calorimeter that Argonne

National Laboratory is providing to measure electron energy set at the other end. The experiment will bind electrons from the tritium decay to magnetic field lines and pass them through filters in the vacuum chamber that will remove all but the highest-energy electrons, which the calorimeter will then measure.

Preventing “noise”

Great care will be taken to keep random thermal “noise” from disrupting the finely tuned equipment at each end of the experiment. Researchers will deposit the tritium on the nanomaterial graphene — a layer of carbon just one atom thick — to ensure that the electrons come off cleanly into the vacuum.

The calorimeter at the other end of the chamber will be connected to a dilution refrigerator set at between 70 and 100 millikelvins, a temperature 20 times colder than deep space and less than one-tenth of a degree above absolute zero. This deep-freeze will keep the calorimeter poised between a superconducting state — one in which electrons can flow with virtually no resistance — and a non-superconducting state with resistance to the flow of electrons. The delicate balance between these two states, combined with extremely low noise conditions achievable only with quantum electronics, will provide the sensitivity needed to precisely measure the energy of an electron that impinges upon the calorimeter. The setup will produce “the most precise electron-energy measurements ever made using calorimeter techniques,” Tully said.

This experiment is “a perfect match for the competencies and capabilities that exist at PPPL,” said Adam Cohen, deputy director for operations at PPPL and supervisor of the PTOLEMY project. Such qualities include know-how in handling tritium, a laboratory for synthesizing nanomaterial, decades of experience operating magnets and vacuum vessels, and space for an expanded experiment. “Chris and I talked about collaboration between PPPL and the University about three years ago,” Cohen recalled. “Every time we pursue an activity with the campus it strengthens the bridge that exists between us.”

Looking ahead, Cohen sees PTOLEMY attracting new students, researchers and visitors, along with experts in high-energy physics, to PPPL. This could produce cross-fertilization with the Laboratory’s core mission of advancing fusion and plasma science, he said.

For Tully, PTOLEMY could become the gateway to many avenues of research. “When one opens a new frontier of exploration,” he noted, “there is no telling what will be found and learned.”



Chris Tully makes an adjustment to the PTOLEMY prototype.

Environmental Management

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Audit based on international standards

As PPPL prepares for an audit to re-register to be certified to meet the environmental standards of the International Organization of Standards, Sheneman and his group are trying to get the word out about exactly how the Environmental Management System works. The system spells out how PPPL will comply with federal and international environmental standards and specifies how the Lab will measure its progress so that it can keep making improvements. "Our EMS is the management tool that we use to spell out those goals and to translate them into action in the Laboratory," Sheneman said.

The EMS states how PPPL will meet its environmental/sustainability goals on everything from saving energy to water quality. It also states how the Lab will measure how well it's meeting those goals so it can keep improving. The audit this week is a comprehensive independent evaluation that will look at how well the whole system works.

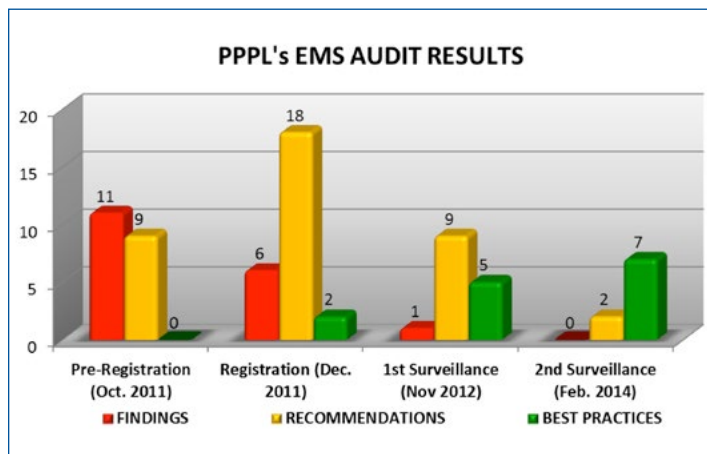
PPPL first agreed to be certified as meeting the environmental standards of the International Organization of Standards in 2011 and was certified in February of 2012. The Laboratory has had two annual surveillance audits since that time. The weeklong audit taking place this week will examine every aspect of the Environmental Management System and could include interviews with employees about their roles in the system.

EMS woven into PPPL

The Environmental Management System is supported by and complements PPPL's Site Sustainability Plan, which is required by DOE, and includes water use, energy use, greenhouse gas emissions, PPPL's use of environmentally friendly fuels and office products. In fact, Sheneman says, the Environmental Management System is so much a part of PPPL's fabric that PPPLers may not be aware of their role in PPPL's environmental management even though each person at the Lab is playing a part.

PPPL's energy and water use are two major performance measures of the EMS. The audit will look specifically at things such as whether computers, PPPL vehicles and other equipment are energy efficient. This is particularly important as NSTX-U begins operations next year. PPPL's lead experiment uses a great deal of energy and PPPL strives to offset some of that energy use with energy savings elsewhere in the Lab, Sheneman said.

Another area the audit will examine is PPPL's use of recycled and environmentally friendly products. The federal government requires that PPPL and other federal facilities buy recycled paper and other environmentally



friendly products. But it can sometimes be hard to determine what products are genuinely environmentally friendly, Sheneman said. The Environmental Services Division's new website <https://sites.google.com/a/pppl.gov/environmental-services/green-purchasing> offers some guidelines in choosing these products. Sheneman said PPPL is also working with DOE headquarters on a database of environmentally preferable products.

PPPL has for years used bio-based cleaning products, and bio-based products have made their way into other areas of the Lab as well, Sheneman said. For example, much of the machining at PPPL is done with biodegradable, water-based cutting fluids, which replaced petroleum-based products.

Raising awareness of sustainable practices

Part of the challenge is raising the awareness of sustainable practices, Sheneman said. Most employees are aware of PPPL's recycling and composting program but not everyone thinks of small things he or she can do to reduce waste, such as using rechargeable batteries or choosing environmentally friendly printers, Sheneman said. Sheneman and his group plan to focus more on encouraging people to use bio-based and other environmentally friendly products over the next year.

Sheneman said all PPPLers should give some thought to building sustainable practices into projects and their daily work lives. "It comes down to how you interact with the environment, and what you do if there's a problem," he said. "If you follow the work procedures of the Lab you're 90 percent there and if you're not there, pick up the phone and call. We're not the green police. We want to help people understand what they can do."

More information about PPPL's Environmental Management System is available at <https://sites.google.com/a/pppl.gov/environmental-services/ems>.

PPPL kicks off United Way campaign


PPPL is once again taking part in the Princeton University United Way campaign to raise money for the United Way of Mercer County. The campaign kicks off when PPPL hosts a speaker from the United Way on Nov. 19 at 10:30 a.m. in the MBG Auditorium. Light refreshments will be served. A bake sale fundraiser is also planned for later this year.

GIVE. ADVOCATE. VOLUNTEER.
LIVE UNITED 

HOW TO LIVE UNITED:

JOIN HANDS.
OPEN YOUR HEART.
LEND YOUR MUSCLE.
FIND YOUR VOICE.
GIVE 10%. GIVE 100%.
GIVE 110%.
GIVE AN HOUR.
GIVE A SATURDAY.
THINK OF US BEFORE ME.
REACH OUT A HAND TO ONE AND



INFLUENCE
THE CONDITION OF ALL.
GIVE. ADVOCATE. VOLUNTEER.
LIVE UNITED 

Want to make a difference? Help create opportunities for everyone in your community. United Way is creating real, lasting change where you live, by focusing on the building blocks of a better life: education, income and health. That's what it means to Live United. For more, visit LIVEUNITED.ORG.

PPPL makes recycling fun for Recycling Day celebration

PPPL's Recycling Day celebration on Nov. 11 was full of fun activities, from the recycled fashion show to designs made of recycled materials. There was a toss-the-recycling game and a matching game to test PPPL's recycling skills. The electronics collection in the lower parking lot was also a resounding success with employees contributing 2,100 pounds of electronic devices from home. Some 144 employees signed a pledge to recycle at home and at work and were rewarded with new PPPL thermal lunch bags made of recycled materials.

The winners of the Recycle Design contest were: Dana Eckstein, first place, for her "Disco Ball" diorama; Virginia Finley, second place, for her quilted pillow made of her husband's old ties and a Rutgers tee-shirt; and Nevell Greenough, third place for his 3-D printer and example display. The fashion show featured dresses made of recycled bags, newspapers, paper, and even newspaper shoes. The winners of the Recycled Fashion Competition were: Margaret Kevin-King, first place; Nicole Allen, second place; and Dana Eckstein, third place.



At left: PPPL'ers in paper hats model Recycling Day dresses. From left to right: Leanna Meyer, Lena Scimeca, Carl Scimeca, Margaret Kevin-King, Virginia Finley, Robert Hitchner, and Dana Eckstein in front. Kevin-King won first place in the fashion contest for the dress on the far right.

Above: Dana Eckstein won the design contest with her "Disco Ball" single stream recycling design.



Atiba Breerton tries for a basket in the toss the recycling game as Wesley Reese looks on.



Ewa Kontor tosses a plate in the recycling game as her colleagues look on. From left to right: Jane Feng, Roshni Ravi and Leanna Meyer.



Kyron Jones wraps up electronics contributed by PPPL employees after PPPL's electronics collection, which netted 2,100 pounds of electronics.



Wendy Worringer, left, models a dress made of recycled materials with Irene Newman, center, and Marissa Zara.

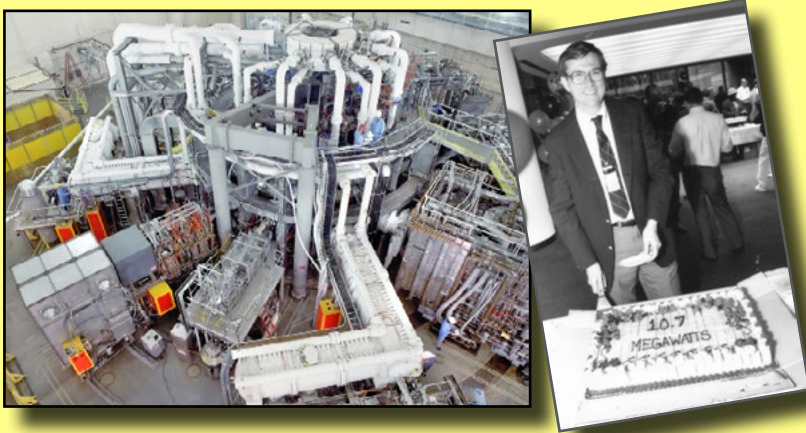
PPPL'ers take part in Tiger Trot for Hunger



PPPL'ers pose with the Princeton Tiger during Princeton University's 7th Annual Tiger Trot for Hunger for the Crisis Ministry of Princeton and Trenton. The Nov. 7 event raised funds and collected food donations for the food pantry. From left to right: Chandra Sanders, Andrea Moten, and Carol Ann Austin.

20th Anniversary

Celebrate 10MW of Fusion Power on TFTR on Nov. 18



All PPPL staff members are invited to enjoy cake and ice cream on Tuesday, Nov. 18 at 1 p.m. in the LSB Lobby to celebrate the 20th anniversary of TFTR producing 10.7 MW of fusion power on Nov. 2, 1994. PPPL physicist Michael Bell will give a colloquium on the anniversary at 2 p.m. in the MBG Auditorium.

PPPL Welcomes New Employees!



ALESSANDRO BORTOLON
Staff Research Physicist
ITER and Tokamaks Dept.



WENPING WANG
Mechanical Engineer
Engineering

Retirements at PPPL

PPPL bids a fond farewell to retiring employees!

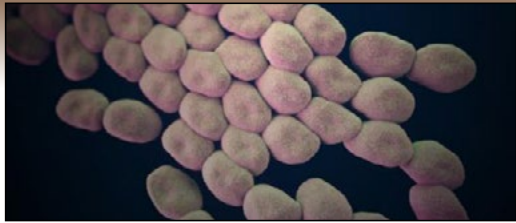


James Chrzanowski
Engineer and Mechanical
Design Branch Head,
39 years



Charles Kircher
Senior Project Engineer,
30 years

COLLOQUIUM



Antibiotic Resistance: A Global Challenge

RAMANAN LAXMINARAYAN

Princeton University - Princeton Environmental Institute

Wednesday, November 19

4:15 p.m. (Coffee/Tea at 4 p.m.)
M.B.G Auditorium, Lyman Spitzer Building

Don't forget to switch to CrashPlan PROe by Dec. 1

Dec. 1 is the deadline to switch to CrashPlan PROe by contacting the Help Desk (Call ext. 2275 or submit a ticket).

The new cloud-based system has several advantages:

- Users can back up their computer from anywhere with an active Internet connection.
- Users can access their data from any system with a modern web browser.
- After the system is installed, users can view their data on their smart devices by downloading the mobile app.



SPD • TIP • OF • THE • WEEK

COOKING SAFETY: Part I of III

As the holiday season approaches, the Site Protection Division (SPD) and the Emergency Services Unit (ESU) would like to emphasize the importance of health and safety to you and your families. This week's tip will be the first of a three-part series on cooking safety.

The number-one cause of residential fires and home injuries is cooking fires. These fires most often occur in the kitchen during unattended cooking so it is important that we are alert to prevent such cooking fires.

WHAT TO DO IF YOU ARE COOKING:

- Do not use the oven or stovetop if you are cooking late at night, feel sleepy or have consumed alcohol.
- Stay in the kitchen while you are cooking on your stovetop and if you have to leave your kitchen, even if it's only for a short period, **turn off the stove.**
- When baking food, check it regularly. Use a timer to remind yourself you are cooking and always **remain in your home.**
- Keep anything that can catch fire like oven mitts, wooden utensils, food packaging, towels, etc., far away from your stovetop.



Nothing is more important than the health and safety of you and your families. Everything else can wait.

BROCK Café Menu

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.

— MARK GAZO, *Chef Manager*

COMMAND PERFORMANCE
CHEF'S FEATURE

	MON. 17 NOV.	TUE. 18 NOV.	WED. 19 NOV.	THU. 20 NOV.	FRI. 21 NOV.
	NATIONAL FAST FOOD DAY Taco Bella Enchilada	Create Your Own Sautéed Chicken Bar served over Rice	Fresh Carved Roast Beef	Thanksgiving Dinner <i>Turkey, Gravy, Mashed Potatoes, Stuffing, Vegetable, Dinner Roll, Cranberry Sauce, Pumpkin Pie</i>	Vegetarian Vegetable Cacciatore served over Polenta
EARLY RISER	French Toast Snicker Doodle served with Sausage	2 Eggs Any Style with Hash Brown Casserole	Assorted Quiche	Apple Pancakes served with Homemade Turkey Sausage	Pumpkin Cranberry Pancakes
COUNTRY KETTLE	Wendies Beef Chili	Pasta Fagioli	Sausage Lentil	Three Bean Vegetarian Chili	New England Seafood Chowder
GRILLE SPECIAL	Big Mack Sandwich with Fries	Bratwurst Torpedo with Braised Cabbage & German Potato Salad	Homemade Tuna Burger on a Kaiser Roll with Lettuce & Tomato	Grilled Cheese with Turkey & Tomato	Veggie Burger Stacker on a Kaiser Roll
DELI SPECIAL	Chick Filet Sandwich with Fries	Egg Salad, Cheddar Cheese, Lettuce & Tomato on a Croissant	Southwest Slow-Cooked Pork Torta	Fresh Seafood Salad served on a Multigrain Roll	Smoked Turkey with American Cheese on a Kaiser Roll
PANINI	R-Bees Roast Beef Sandwich with Fries	Peppers & Scrambled Egg Torpedo served with Hash Browns	Chicken Parmesan Sandwich	Baked Spinach Pie served with Greek Salad	Taco Quesadilla

MENU SUBJECT TO CHANGE WITHOUT NOTICE

VEGETARIAN OPTION

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

WEEKLY

Editor: **Jeanne Jackson DeVoe** ♦ Layout and graphic design: **Gregory J. Czechowicz**
Photography: **Elle Starkman** ♦ Science Editor: **John Greenwald** ♦ Webmaster: **Chris Cane**

The 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 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/>.

NOTE: Due to the Thanksgiving holiday the PPPL WEEKLY will not be published on **Dec. 1.**