PPPL's Andrew Post-Zwicker (left) and Elle Starkman

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New supercomputer to crunch numbers at Brookhaven

The RIKEN BNL Research Center at Brookhaven is home to a new super-fast (10 trillion calculations per second), "low"-power (100 kilowatt) supercomputer. Known as QCDOC, for quantum chromodynamics on a chip, the computer will be used to help predict and understand the properties of a new state of matter under study at the Relativistic Heavy Ion Collider, and also for calculations in quantum chromodynamics — the physics theory that describes the interactions of subatomic quarks and gluons. Ten percent of its operating time will also be devoted to projects in biology, materials science, and other fields.

[Karen McNulty Walsh, 631/344-8350, kmcnulty@bnl.gov]

Methods honed in search for salamanders

Rare salamanders at a Georgia military base are the guinea pigs for researchers at DOE's Oak Ridge National Laboratory whose goal is to develop methods to better determine whether a species has vanished. Following a drought, no flatwoods salamanders had been found at Fort Stewart, Ga., for four years, until this spring. The ORNL researchers are developing a method to make field sampling techniques more accurate and efficient at predicting the type and location of suitable habitats. This research is important to the military because better information about the presence or absence of salamanders can help installation natural resource managers apply effective conservation strategies for this species.

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New hydrogen sensor fast, more effective

The same kind of chemical coating used to shed rainwater from aircraft and automobile windows also dramatically enhances the sensitivity and reaction time of hydrogen sensors, researchers at DOE's Argonne National Laboratory have discovered. Hydrogen sensor technology is a critical component for safety and other practical concerns in the proposed hydrogen economy. The scientists demonstrated that the enhanced sensor design shows a rapid and reversible response to hydrogen gas that is repeatable over hundreds of cycles. The scientists reported that the enhanced sensors are sensitive enough to detect hydrogen levels as low as 25 parts per million (ppm), far below hydrogen's lower explosive limit around 40,000 ppm. A patent is pending.

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Fermilab building a better MICE project for neutrino research

Scientists at DOE's Fermilab will soon be testing specially designed radiofrequency cavities and liquid hydrogen absorbers that are critical for the Muon Ionization Cooling Experiment (MICE), a step toward a full-scale neutrino factory where the decay of muons in a storage ring produces an intense neutrino beam. As an advanced tool for precision studies of neutrino oscillations and CP violation, a neutrino factory could prove decisive in understanding the matter-antimatter asymmetry of the universe. MICE has received funding from the UK's Rutherford Appleton Laboratory, with ongoing R&D by the Neutrino Factory and Muon Collider Collaboration involving the Illinois Institute of Technology, University of Illinois, Northern Illinois University, and Argonne National Laboratory.

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DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

Transmission line sensor guards the grid

High-voltage towers carry millions of watts of power across thousands of miles in the United States, Many of these miles, particularly in the West, track across remote and unpopulated areas – seldom visited and hard to maintain.

Extremes of nature can play havoc on this infrastructure. High winds and ice can bring down lines and disrupt power. But in the last few years, another threat began looming on the horizon for the power industry – terrorism.

INL researchers John Svoboda (left) and Bob Polk

DOE Idaho National Laboratory researchers John Svoboda and Bob Polk are developing a platform capable of detecting tower tampering, and relaying this information to the Power Transmission Control Center.

The transmission line sensor is self-powered and virtually maintenance free. The technology consists of a series of small, inexpensive, low-power electronic sensor platforms mounted on conductors adjacent to each tower/pole of an electric power transmission or distribution line.

When an event is recorded by the sensor indicating tower tampering, the platform wakes up and sends a message containing event information and tower identification to adjoining towers. The platforms on the adjoining towers wake up in response and transmit to the next towers. The process continues until the message reaches the end of the line, where it can be communicated to a central monitoring location.

The whole system is powered from the magnetic fields that are produced from the wire's alternating current. The power generated is stored for use by the sensors, processor and RF transmitter/receiver.

While security is the primary driver, the sensors could be capable of detecting other abnormal conditions of concern to utilities such as galloping conductors and fires below the towers.

"There is evidence that the sensors could detect movement of vehicles or even low-flying planes," said Polk. "Our design using energized systems as the power source, provides space and power for a number of sensors, including miniature acoustic, chemical, biological or nuclear sensors."

Submitted by DOE's Idaho National Laboratory

Art created from plasma experiments at PPPL

Andrew Post-Zwicker (left) and Elle Starkman with their collaborative art, "Plasma Table."

Science is boring. Art is stupid. Prove us wrong. Elle Starkman and Andrew Post-Zwicker, of the U.S. Department of Energy's Princeton Plasma Physics Laboratory, did just that and came up with art that shows the beauty of science.

Starkman, PPPL's staff photographer, and Post-Zwicker, Head of PPPL's Science Education Program, collaborated to create "Plasma Table," a photograph of a dust cloud of silica microspheres illuminated by laser light and suspended in a plasma. The dust cloud is approximately 0.5 inches high and floats in a conical shape between the dust tray and an electrode as long as the plasma is maintained. Fundamental dust cloud properties and dynamics have applications ranging from plasma processing to space plasmas. Plasmas are hot, ionized gases.

Undergraduate and high school students at PPPL's Science Education Laboratory were studying dusty plasmas in a DC glow discharge when Post-Zwicker asked Starkman to take pictures of the experiment. "We weren't shooting for the beauty of it. We were documenting the science," Starkman said.

Along with the science, however, they saw a breathtaking image. "We spend our time studying the cloud in the dusty plasma experiment for its physical properties and take for granted its intrinsic beauty," Post-Zwicker said.

Post-Zwicker and Starkman submitted Plasma Table for the Art of Science Competition at Princeton University this spring and took home the first-place prize. More than 200 entries were received. Princeton students and faculty from many departments launched the competition, seeking entries of images that came directly from research in science and engineering or works by artists incorporating tools and concepts from science. "I have always been personally fascinated by the blurring of the boundaries of art and science," said Post-Zwicker.

Submitted by DOE's Princeton Plasma Physics Laboratory