Heidi Newberg is observing some of the farthest objects in the universe, page 2

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Spinning in control

The polarized electron beam at DOE's Thomas Jefferson National Accelerator Facility is delighting researchers with high levels of polarization and current, and with exceptionally high polarized source operational "up" time. Polarization refers to the state of electrons in the beam—getting millions of electrons rotating the same way as they move through the accelerator to the target material. Polarized beam allows physicists to add another parameter during an experiment—providing more control or more defined data. Beam has been running with high average current and ~40% polarization and more recently has been delivering polar-izations above 70% with lower beam currents.

[Linda Ware, 757/269-7689, ware@jlab.org]

Neutrons probe polymers' reptilian ways

How polymers bond to each other and to other materials determines the effectiveness of many materials used in industry, including paints, coatings, adhesives and lubricants. Improving bond strength leads to better materials. The first direct experimental evidence of how bond strength is accomplished was observed by scientists at the Intense Pulsed Neutron Source at DOE's Argonne National Laboratory. This research provides a better understanding of the way polymers bond and a means to improve their bonding properties. A bulk polymer melt is like a plate of wriggling worms that a polymer chain must move through. To do this, the polymer chain performs a snake-like movement—reptation—to diffuse lengthwise along the direction of the chain through the network of polymer chains.

[Catherine Foster, 630/252-5580, cfoster@anl.gov]

Hope for smokers, addicts from epilepsy drug

Smokers and other addicts who want to kick the habit may find powerful help from a European epilepsy drug that already has shown promise in treating cocaine's effects in animals. That's the conclusion of animal studies published in Synapse by scientists from DOE's Brookhaven National Laboratory, St. John's University, New York University and the Albert Einstein College of Medicine. The same team published results in August showing that the epilepsy drug gamma vinyl-GABA, or GVG, looks promising for treating cocaine addiction. In both studies, it prevented the dramatic changes in brain chemistry and behavior brought on by nicotine and cocaine.

[Kara Villamil, 516/344-5658, karav@bnl.gov

Glue solves sticky ceramics problem

Continuous fiber-reinforced ceramic composites (CFCCs) may someday replace steel and superalloys because they can withstand higher temperatures while resisting corrosion. But first, manufacturers need a robust, practical method of joining these materials in a normal air environment because traditional ceramic joining processes are ineffective with CFCCs. Scientists at DOE's Ames Laboratory have developed and tested a glue to meet those needs. It is made of silicon-bearing preceramic polymers and an aluminum-silicon alloy powder, and produces joints with strengths of up to 14,500 psi at 1200 degrees C. The easy-to-use glue can be heated with a propane torch and cured in air.

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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).

Treasures from a Siberian journey

If "Vector" sounds like a code name in a James Bond movie, in fact Vector was once a vast, secret Siberian biological warfare facility. These days, however, scientists from Vector and DOE's Lawrence Berkeley National Laboratory are working together under Initiatives for Proliferation Prevention, a DOE program established to help keep former Soviet defense researchers peacefully employed.

"Only five years ago Vector had 3,500 scientists," says Tamas Torok, of Berkeley Lab's Life Sciences Division. "Now they are down to 1,500. Luckily these are top staff, people you wouldn't want to see working for any third party."

Torok, a member of the Center for Environmental Biotechnology headed by Jennie Hunter-Cevera, recently collaborated with Vector microbiologist V.E. Repin to search the Lake Baikal region for microorganisms with medical and biotechnological potential. The last leg of Torok's travels took him by off-road van through snowy mountains to the "Saint's Nose" peninsula on Baikal's southeastern shore, dragging his laboratory with him in two ice chests.

Torok gathered samples from hot springs as well as the cold, deep waters of the biggest, oldest lake in the world. When he returned to Berkeley, he had the specimens he went to Siberia for, plus an unexpected bonus.

"For several years the International Baikal Drilling Project has been taking core samples from sediments in different parts of the lake," Torok explains—sediments which fill a rift in the Earth's crust more than five miles deep, preserving a record of climate change over millions of years. But none of the scientists involved in the drilling were microbiologists.

"When we met, both parties saw an incredible opportunity. . . . I've got 47 samples from the 1998 drilling to work on right here at the Lab."

Torok hopes to find sponsorship to sample the project's final season of drilling, which will begin this January. In the meantime, the Center for Environmental Biotechnology's lab is chock full of microorganic treasures awaiting analysis.

Submitted by DOE's Lawrence Berkeley National Laboratory

Tamas Torok working at his traveling Siberian laboratory, completely contained in two ice chests.

Observations of long ago and far, far away

When Heidi Newberg gazes at the night sky with her two toddler-age daughters, she can offer them a unique sense of identity with the stars.

Newberg, an astrophysicist at DOE's Fermilab, has been a collaborator for six years helping build the Sloan Digital Sky Survey, a project to produce a three-dimensional model of one-quarter of the night sky over the next five years. SDSS uses a 2.5-meter optical telescope, a $6 million camera and 52 charge-coupled devices at Apache Point Observatory in New Mexico, with data handled at Fermilab.

Still in its trial run after seeing first light on May 27, with its first collection of data representing about one percent of its ultimate effectiveness, SDSS is already achieving spectacular results.

On December 7, the collaboration announced it had observed three new quasars—not just any quasars, but three of the four most distant quasars ever seen. Quasars appear to be the rarest and most distant objects seen in the universe. The more distant an object, the longer its light takes to reach us; in effect, we are looking back in time.

"Quasars will allow us to study the large-scale structure of very early times in the universe," Newberg explained. "We want to study a large population of them, and these results show that we will be able to find them very easily."

Newberg, who received her physics degree from Rensselaer Polytechnic Institute in 1987 and her Ph.D. from the University of California-Berkeley in 1992, shifted to astrophysics in graduate school with a summer job on the Automated Supernova Search at DOE's Lawrence Berkeley Lab.

"After working on Sloan for six years, it's really neat to have data coming in," Newberg said. "We're still making improvements. The images will only be getting better."

Submitted by DOE's Fermi National Accelerator Laboratory.