LANL's Brenda Dingus

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DOE Pulse

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Controlling the size of nanoclusters

Researchers from DOE's Brookhaven Lab and Stony Brook University have developed a new instrument that allows them to control the size of nanoclusters — groups of 10 to 100 atoms — with atomic precision. With this new instrument, the scientists can control how many and what type of atoms are in a nanocluster, enabling them to make nanoclusters with predetermined size, structure, and chemical composition. As a demonstration, the scientists created a model nanocatalyst of molybdenum sulfide, the first step in developing the next generation of materials to be used in hydrodesulfurization, a process that removes sulfur from natural gas and petroleum products to reduce pollution.

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

Engine has eclectic taste

Argonne's "omnivorous engine" is not a picky eater. It can swallow ethanol or butanol just as easily as gasoline. Created by engineers in the DOE national laboratory's Vehicle Technologies program, the omnivorous engine will hopefully soon run on any kind of spark-ignited fuel.

Flexible-fuel vehicles (FFVs), which can run on ethanol or gas, have been around for years. However, their engines are typically calibrated to run optimally on only one particular fuel mixture. The "omnivorous engine" contains a suite of sensors that allow the engine to adjust itself to run efficiently on any combination of the three aforementioned fuels. "The ultimate goal is not to know what's in the tank, but to have it run as efficiently as possible on whatever comes down the fuel line," said Argonne engineer Thomas Wallner, who developed the engine.

[Jared Sagoff, 630/252-5549, jsagoff@anl.gov]

Probing new superconductors with a new tool

Researchers at DOE's Ames Laboratory took part in experiments using the new angular-range chopper spectrometer (ARCS) at DOE's Spallation Neutron Source to probe iron-arsenic compounds, the "hottest" new find in the race to explain and develop superconducting materials. Ames Lab physicist Rob McQueeney joined colleagues from Ames Lab, Oak Ridge National Laboratory, and the California Institute of Technology in an effort to determine if the lanthanum-iron-arsenic compound's superconductivity is related to lattice vibrations or magnetic spin. The group's findings, which will be published soon in *Physical Review Letters*, did not support the conventional electron-phonon mediated super-conductivity. The findings are also the first published research based on measurements made with ARCS.

[Kerry Gibson, 515/294-1405, kgibson@ameslab.gov]

Five years of Tevatron Run II results

Scientists working on the particle collider experiments at the DOE's Fermi National Accelerator Laboratory celebrated five years of publishing the Result of the Week in Fermilab Today. On Sept. 18, 2003, both the CDF and the DZero collaborations featured first results based on data produced by Fermilab's Tevatron Collider Run II. Since then the two have taken turns informing their colleagues of the latest science results every week. Discoveries of exotic particles, observations of new subatomic processes and searches for extra dimensions are among the 250 results. One particle, however, has eluded scientists so far: the Higgs boson. Maybe it will be among the next Results of the Week.

[Kurt Riesselmann, 630-840-5681, kurtr@fnal.gov]

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).

PNNL streamlines energy-guzzling computers

In a room the size of a garage, two rows of six-foot-tall racks holding supercomputer equipment sit back-to-back. Thin tubes and wires snake off the servers, slithering into the corners. Stepping between the rows, a rush of heat whips around you—the air from fans blowing off processing heat.

But walk farther in, between the next racks of servers, and the temperature drops noticeably. These servers are being cooled by a liquid that runs right over the hardworking processors. The liquid carries the heat away in tubes, reducing the strain on air-cooling.

This is the Energy Smart Data Center at Pacific Northwest National Laboratory. The bigger, faster and meatier supercomputers get, the more energy they consume. PNNL's Andres Marquez and his team have developed this test bed to learn how to train the behemoths in energy efficiency.

The work will help supercomputers perform better as well. Processors have to keep cool or suffer from "thermal throttling," says Marquez. "That's the threshold where the processor is too hot to operate safely, reduces processing capabilities and might result in worse performance."

The center at EMSL, DOE's national scientific user facility at PNNL, harbors several ways of experimenting with energy usage. For example, the center has its own air- and liquid-cooling systems that can be controlled independently from the rest of EMSL. Pipes running beneath the floor carry temperature-controlled water through the center's own heat exchangers to the supercomputer. The center developed its own software called FRED—Fundamental Research for Efficient Datacenters—to address the difficulty of monitoring over the various scales of the whole cooling infrastructure—from the chip, to the heat-exchangers, pumps, chillers and water towers.

"With this center we can test under real-world conditions whether it's more energy efficient to cool directly on the processing chips, possibly bypassing the chillers, or if a traditionally optimized air-cooled infrastructure still comes out ahead. Other aspects such as reliability, maintainability and total cost of ownership are evaluated as well," says Marquez.

Marquez's group is also developing "power aware computing," where the computer programs themselves perform calculations more energy efficiently. Maybe once computers get smart about energy, they'll have tips for their users.

Submitted by DOE's Pacific Northwest National Laboratory

Pushing the limits

Brenda Dingus

Brenda Dingus of DOE's Los Alamos National Laboratory likes to live on the edge—in scientific theory, that is. "Gamma-ray astronomy allows us to look at the sky in a way that pushes our theories of physics to the limits," she said.

Recognized for her involvement in large-scale projects such as the Laboratory's Milagro Observatory at Fenton Hill and the High Altitude Water Cherenkov (HAWC) telescope at Volcàn Sierra Negra, Mexico; her collaboration with international physicists; and teaching astronomy at the Universities of Wisconsin and Utah, Dingus was named a 2008 LANL Star by the Women's Diversity Working Group.

"It's important to recognize the efforts and valuable contributions women make to the Lab," Dingus said of her LANL Star recognition.

A 2007 American Physical Society Fellow, Dingus sees gamma-ray astronomy as an innovative and interdisciplinary field at the intersection of astronomy and particle physics. "Gamma rays can tell us many interesting things about our universe," she said. "We use novel detection technology to study extreme phenomena in space, such as neutron stars, supernova explosions, and black holes."

Dingus said she enjoyed collaborating with students and faculty on the now-retired Milagro project. "It involved having many conversations to find creative solutions," she said. Now, she's looking forward to getting HAWC, a joint U.S.-Mexican project that incorporates recycled Milagro components, up and running.

A native of Los Alamos, Dingus obtained her doctorate in physics from the University of Maryland and later worked for NASA. Although her work allowed her to travel extensively, something always pulled her back to Los Alamos, she said. "I did research at the Los Alamos Neutron Science Center as a graduate student at Maryland and worked on Milagro when I was a faculty member at Utah and Wisconsin," Dingus explained. "I've always loved it here."

Submitted by DOE's Los Alamos National Laboratory