SLAC's Joachim Stöhr

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Chemical warfare agents detectable on soils, plants

Military commanders and national leaders need to know if chemical warfare agents are present before sending troops into hostile territory. Researchers at DOE's Idaho National Engineering and Environmental Laboratory can now detect part-per-million levels of chemical warfare agents directly on soil or plant surfaces within 5 to 10 minutes using a new ion-trap secondary ion mass spectrometer. Samples as small as 3 to 4 milligrams—about 40 grains of salt—are identified by the ions that the instrument sputters off the sample surfaces. Each chemical present is identified by a detectable spectrum as unique as a fingerprint.

[Deborah Hill, 208/526-4723, dahill@inel.gov]

Real-time beryllium detection

Beryllium's high strength and light weight make it an ideal metal for many industrial applications. Breathing fine particulate beryllium, however, can be a health hazard to workers who grind, mill or otherwise machine the metal. In some individuals beryllium triggers an autoimmune response that can result in Chronic Beryllium Disease, a debilitating, incurable and sometimes fatal disease. A beryllium detection technique, a quick colorimetric analysis from DOE's Los Alamos National Laboratory, involves wiping the surfaces of the lab with a chemically prepared pad and then adding a solution. If the pad turns blue, beryllium is present; if it remains orange, the surface is free of contamination.

[Shelley Thompson, 505/665-7778, shelley@lanl.gov]

Oboe: Music to Livermore ears

In 1992, testing of nuclear weapons by exploding them beneath the Nevada Test Site stopped. Today instead, science-based Stockpile Stewardship assures weapon safety and reliability. An array of high-tech experiments yields data for supercomputer programs that simulate weapon aging and operation. Now, far beneath the Nevada desert, subcritical experiments replace the "big-bang" explosions of decades past. In "subcrits," a coin-sized plutonium disc is shocked by high explosive, while sensitive instruments measure particles ejected from the surface. Subcrits began July 2, 1997. DOE's Lawrence Livermore National Laboratory is readying Oboe 8, which will be the 14th NNSA subcritical experiment overall and the 10th for Livermore.

[David Schwoegler, 925/422-6900, newsguy@llnl.gov]

Where in the water is that float from San Diego?

Jim Bishop of DOE's Lawrence Berkeley National Laboratory, co-director of the DOE Center for Research on Ocean Carbon Sequestration, was chief scientist on a recent voyage of the Scripps Institution of Oceanography's research vessel *New Horizon* out of San Diego, developing what Bishop calls "a forensic science to detect biological activity in the deep sea." A device for optically measuring particulate inorganic carbon was among the instruments tested and calibrated, along with a SOLO float that tested a new way to measure carbon sedimentation. An intermittent GPS caused the SOLO to spend most of ten days hiding, but it faithfully transmitted satellite data that aided a midnight recovery off wind-whipped Point Conception.

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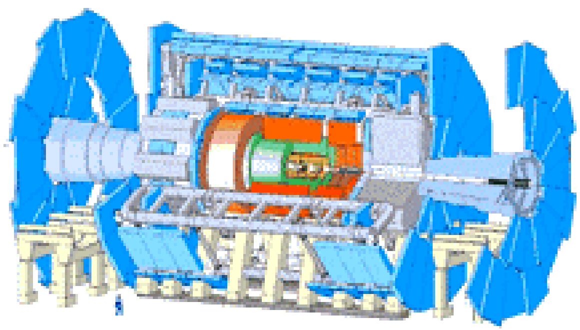
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***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).

Mammoth detector for tiny particles

Scientists from DOE's Brookhaven, Argonne and Lawrence Berkeley national laboratories and 27 U.S. universities are part of a worldwide collaboration of 150 institutions participating in the design, construction, and operation of a large detector known as ATLAS for the Large Hadron Collider (LHC) at CERN, the European laboratory for particle physics near Geneva, Switzerland.

The LHC, due to begin operation in 2006, consists of two circular vacuum pipes in which protons will travel in opposite directions and collide at nearly the speed of light. ATLAS is one of four detectors that will analyze particles generated by these collisions. One of its main goals is to look for a particle dubbed Higgs, which may be the source of mass for all matter. Findings may also offer insight into new physics theories, such as "supersymmetry," as well as a better understanding of the origin of the universe.



The ATLAS detector is a five-story-high cylindrical structure with "caps" on its lateral sides (think of a soda can lying on its side). The cylinder is divided into many components, each testing different types of particles. These components form layers stacked onto each other (like the layers of a "cylindrical onion") so that particles radiating from the collision move through the layers sequentially.

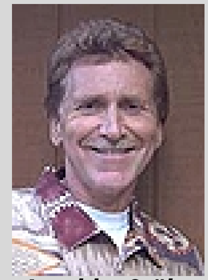
ATLAS will record millions of points of data during collision events. Computers will look at these data and figure out the particle paths and decays.

Brookhaven is building and testing electronic systems used to detect particles such as electrons and muons; Argonne is designing and testing a component used to detect protons and neutrons; and Lawrence Berkeley is developing the parts of ATLAS closest to the collision point.

Though the task of building a mammoth such as ATLAS may be daunting, the physicists are confident that the detector will be up and running on schedule, and will greatly enhance our knowledge of physics and astronomy.

Submitted by DOE's Brookhaven National Laboratory

SYNCHROTRON LIGHT HELPS DEVELOP NEW LCD TECHNIQUE



Joachim Stöhr

A team of researchers from IBM and DOE's Stanford Linear Accelerator Center recently announced that they have developed a revolutionary new technique that can be used in manufacturing liquid-crystal displays. According to Praveen Chaudari of IBM's Thomas J. Watson Research Center and Joachim Stöhr, Deputy Director of the Stanford Synchrotron Radiation Laboratory at SLAC, this technique promises to yield high-clarity panels for laptop computers at substantially reduced costs.

The key to the new method involves using ion beams to irradiate the two amorphous-carbon surfaces between which liquid-crystal molecules are trapped. This process establishes a precisely controllable orientation of the carbon bonds near the surfaces. These bonds then determine the alignment of the rod-shaped liquid-crystal molecules — which in turn affects the transmission of light through the panel. Such alignment has thus far been achieved by rubbing of polymer surfaces with a velvet cloth, a fairly dirty process that is not very conducive to large-scale manufacturing.

"The new process has resulted in the highest-resolution large displays available today," says Stöhr, who used SLAC's polarized x-ray beams to examine the orientation of chemical bonds at the polymer and carbon surfaces. The detailed understanding of the mechanisms responsible for liquid-crystal alignment that resulted from his research proved to be one of the keys to the breakthrough.

Stöhr has had a long love affair with synchrotron-radiation research ever since working as a postdoc at DOE's Lawrence Berkeley National Laboratory in the mid-1970s. After stints in industrial research at EXXON and IBM during the 1980s and 90s, he came to SLAC on the first day of January 2000. In addition to pursuing his own work on the physics of surfaces, he oversees the chemical and materials-science research programs at the synchrotron laboratory.

Submitted by DOE's Stanford Linear Accelerator Center