Peter Agbakpe pursues dream in theoretical physics.

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Coatings mean new flexibility for electronic displays

If television screens and computer or cell phone displays were made from plastic they would be lighter, more rugged and someday might be flexible enough to roll up. Unfortunately, oxygen and water vapor permeate plastic and damage the device. Now, two barrier coating products developed at DOE's Pacific Northwest National Laboratory may allow plastics to play a significant role in the display industry. Without the coatings, moisture in the air would cause sensitive Organic Light Emitting Devices to fail within days. However, coated OLED test units have survived months of continuous operation in air. With additional improvements, researchers expect plastic electronics to meet or exceed the performance of conventional displays.

[Susan Bauer, (509) 375-2561, susan.bauer@pnl.gov]

DOE satellite begins research mission

DOE's Multispectral Thermal Imager satellite, developed by a Sandia-led government and industry team and launched March 12 from Vandenberg AFB, has begun its research and development mission. The satellite carries an advanced ground-imaging system that measures the "brightness" of various features in 15 visible and infrared spectral bands. The imaging instrument was assembled and tested at Sandia and calibrated at Los Alamos National Laboratory. Data collected over the next three years will be used to develop techniques that could be employed in future satellite systems to address numerous national needs.

[Howard Kercheval, 505/844-7842, hckerch@sandia.gov]

Fastest computer to aid defense research

Research at IBM and DOE's Lawrence Livermore National Laboratory has produced the world's fastest supercomputer, called ASCI White, which will use complex 3D tools to simulate the aging and operation of the nation's nuclear weapons. Capable of 12 trillion operations per second, it is an IBM RS/6000 SP supercomputer that requires 28 tractor-trailer trucks for delivery and covers two basketball courts. It is one of a series of increasingly powerful supercomputers being developed under the Accelerated Strategic Computing Initiative by computer companies working with DOE's national defense labs. Goal is to reach 100 trillion operations per second within four years.

[David Schwoegler, 925/422-6900, schwoegler1@llnl.gov]

Short pulses of light

The Free Electron Laser at DOE's Thomas Jefferson National Accelerator Facility was operated at its shortest wavelength to date on July 15, 2000, generating 100 watts of average power at 1 micron. This accomplishment makes the device the most powerful sub-picosecond FEL at one micron by more than a factor of five. High repetition rate, sub-picosecond lasers have been shown to be very useful for materials processing and basic science studies in atomic and chemical physics. The Department of Navy recently funded a $10 million upgrade for the FEL facility to extend the power and wavelength range of the current FEL.

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

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).

At last—the Light Fantastic!

Members of the Midwest Universities Collaborative Access Team are catching some great rays these days—the most powerful X-ray beams in the world. They're using the brilliant, highly focused beams to investigate the molecular makeup of materials ranging from magnets, ceramics and soils to proteins, drugs and asteroid dust.

After a 10-year cooperative effort, the MUCAT undulator beam line is up and running at the Advanced Photon Source, located at DOE's Argonne National Laboratory near Chicago.

"The beam line is operational. We're taking data, getting results and writing papers," says Alan Goldman, an Ames Laboratory senior physicist and chair of the Iowa State University department of physics and astronomy. Goldman heads MUCAT, a group of scientists from eight Midwestern universities and one German institute who developed the undulator beam line for one of the 35 sectors making up the APS experiment hall.

MUCAT member institutions are Ames Lab/ISU, University of Missouri-Columbia, Washington University, State University of New York at Stony Brook, University of Wisconsin, Michigan State University, Kent State University, Georgia Tech and the F.Z. Juelich institute.

Through the new beam line, MUCAT researchers can tap into the synchrotron radiation generated by the APS storage ring's electron beam and use the strong X-rays the beam sheds with a variety of specialized equipment.

Goldman and fellow researchers Doug Robinson, Eric Zoellner and Didier Wermeille, all Ames Lab/ISU MUCAT members, are using a four-circle diffractometer to perform magnetic X-ray scattering measurements that will help better determine the magnetic structure of various materials.

An innovative compact furnace designed by Ames Lab researchers will fit on the four-circle diffractometer to take advantage of the strong X-rays funneled through the undulator beam line. The furnace allows high-temperature and high-energy powder diffraction studies of complex materials at various temperatures, while maintaining laboratory processing conditions.

Coming on-line at the beam line is the liquid surface reflectometer developed by Ames Lab physicist David Vaknin. The novel device will be used with APS X-rays to study the structure of ultrathin layers of organic materials.

A new surface science chamber funded by the National Science Foundation will be installed this summer by MUCAT members from the University of Missouri-Columbia and Georgia Tech. It will be used to study the surface properties of new materials.

Also this summer, the F.Z. Juelich institute will fund and install a high-energy side station that will supply X-rays with energies up to 120 kilovolts, allowing deeper penetration of the sample under investigation.

Recently, MUCAT received funding to build a bending magnet beam line that will make possible a wide variety of standard scattering and spectroscopy techniques. Construction of the new beam line will be done by Ames Lab/ISU, Michigan State University, University of Wisconsin and Washington University.

"The APS is a remarkable tool," says Goldman. "It has wide applications to many fields, allowing for collaborative research efforts among different disciplines. We're going to welcome anyone to come out and do some work."

Submitted by DOE's Ames Laboratory

Jefferson Lab graduate student on the move

Peter Agbakpe owes much of the progress he has made in the field of theoretical physics to his family. "There was a lot of competition in my house, in terms of academics. My four brothers and four sisters were brilliant students," he says.

Peter, who grew up in Ghana, in west Africa, is currently a Ph.D. candidate in theoretical physics at Hampton University and is a graduate in the Theory Department at DOE's Thomas Jefferson National Accelerator Facility.

Peter was interested in science and engineering from the beginning. Even though his parents never went to school at all—his mother was a baker; dad was a farmer—they insisted that their children study and do well in school.

"They saw it as the only way to be independent when you grow up," he says.

He obtained his bachelor's degree from Ghana's University of Science and Technology and subsequently attended a conference organized to help bridge the gap between African-Americans and Africans. A professor there asked him if he might be interested in coming to America to study physics.

Peter selected Hampton University, where he earned a master's in applied mathematics and then decided to go into nuclear theory.

"All my life I've been a mathematician," he says. "I don't know how I'd do (as an experimentalist) sitting and watching things happen. Theoretical nuclear physics is very close to what I used to do. Physics is challenging."

Peter is about to finish school and has accepted a faculty position at Norfolk State University in mathematics. He loves teaching and wants to keep teaching and making a difference in the lives of students.

In his spare time, he is a volunteer teacher at a local high school. He wants to understand, he says, how American students, particularly African-American students, understand and use mathematics and science.

Submitted by DOE's Thomas Jefferson National Accelerator Facility