DOE Pulse
Science and Technology Highlights from the DOE National Laboratories
Number 52 April 3, 2000

Still "a thrill" after 50 years

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Research Highlights . . .

Accelerator tunnel moves with the tide

For 30 years, a fixed landmark for commuters in the San Francisco area has been the two-mile-long accelerator at DOE's SLAC. In reality, this fixture moves daily, although commuters won't notice a movement less than the width of a human hair, or one-half of one-thousandth of an inch. The movement results from forces exerted by the sun, moon, and tides, according to recent measurements. Subatomic particle collisions require extreme precision and movement could cause particle beams to miss the desired collision point. Scientists make instrument corrections to ensure that movements do not endanger experiments, but the phenomenon could influence decisions about where future accelerators are built.

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Sandia creates world's first diamond micromachines

Two researchers at DOE's Sandia National Laboratories have created what are believed to be the world's first diamond micromachines. The machines are etched from a surface of amorphous diamond, the hardest material in the world after crystalline diamond, in a manner compatible with current silicon chip and surface micromachine manufacturing techniques. Diamond interests researchers because of its superior wear-resistant qualities, resistance to stiction—a combination of stickiness and friction—and potential as a biocompatible material that could be used inside the human body for medical purposes without generating an allergic reaction.

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Ten years of hard labor bears fruit

An experiment at the DOE's Thomas Jefferson National Accelerator Facility that has been in the planning stages since 1989 is finally getting its chance to shine. A collaboration of 150 scientists from 14 countries are hoping to see a nucleon pair that forms a kind of supersized, six-quark "bag." This would be evidence of something that is not a nucleon as currently envisioned and would have very different properties. The trick is to see it. This experiment is using most sophisticated tools in existence and hopes to open up new vistas for scientists.

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

The answers are blowing in the wind tunnel

The first-ever tunnel test of a full-scale research wind turbine is scheduled to begin next month. Researchers from DOE's National Renewable Energy Laboratory and NASA engineers will set up the experiment in the world's largest wind tunnel at NASA's Ames Research Center in California to find out more about the aerodynamics of rotating blades. That information will be incorporated into computer models, helping to design and build state-of-the-art wind turbines. "If we can better understand the aerodynamics of rotating airfoils, then we can more accurately predict how the wind turbines will behave," said Dave Simms, NREL project director. "This research will help us learn how to build better turbines."

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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).

DOE labs advance lithography

Consumers have come to expect computers to get faster, cheaper and more powerful every few months. Unless something is done soon, though, such steady boosts may get harder to come by.

One way manufacturers improve computer performance is by cramming more circuits onto computer chips, the brains of the machine. The problem is, current technology for printing circuitry is nearing the limit for how many circuit lines it can place on a chip.

Enter Extreme Ultraviolet Lithography (EUVL), a technology that uses very short wave lengths of light to print circuits. EUVL can put more lines on a chip than current technology by making the lines thinner—down to a thickness of one four-hundredth the width of a human hair.

Enter now a unique "Virtual National Laboratory" of researchers pulled from DOE's Lawence Livermore, Lawrence Berkeley and Sandia National Laboratories who have teamed with semiconductor giants Intel, Advanced Micro Devices, Motorola and Micron to develop EUVL as the next-generation lithography technique.

The 10-foot-tall EUVL engineering test stand being developed by the Virtual National Laboratory at Sandia/ California will integrate technologies into a prototype with all the elements necessary to print microchip circuits using extreme ultraviolet lithography.

Progress has been so good—a prototype EUVL system is expected early next year—that the semiconductor consortium International SEMATECH recognized EUVL as the leading candidate to replace conventional lithography technology.

"The semiconductor industry has given our project very high marks," said James Glaze, head of the Virtual National Laboratory. "There are other, competing technologies out there, but it appears we're in front. "

Glaze, formerly vice president for Technology with the Semiconductor Industry Association, credits the unique collaboration of "Virtual National Lab" researchers and industrial experts for the project's success.

"This is really a model for how government and industry can work together to meet national challenges," said Glaze.

"We've shown you can bring together talented individuals from different institutions and business cultures and build teams that can solve problems with national and global impact."

Submitted by DOE's Lawrence Livermore National Laboratory

STILL "A THRILL" AFTER 50 YEARS

Darleane Hoffman

In 1946, when she was an undergraduate at Iowa State University, Darleane Hoffman, 73, a nuclear chemist with DOE's Lawrence Berkeley National Laboratory (Berkeley Lab), was taught a course in chemistry for home economics by "a wonderful woman professor named Nellie Naylor." The following year Hoffman was introduced to nuclear chemistry.

"We had a 68 MeV (million electron volt) synchrotron that was just being finished there," she says, "and so we could go and do experiments and find new isotopes. You had the thrill because you were seeing something that nobody had seen before!"

Hoffman switched her major from applied art to chemistry and never looked back. This year, she has become only the second woman in the 125-year history of the American Chemical Society to receive its highest honor, the Priestley Medal, named for Joseph Priestley, who reported the discovery of oxygen in 1774.

Hoffman is an internationally recognized expert in the study of transuranic elements—chemical elements heavier than uranium. After nearly 50 years in the field, she still gets a thrill from her work.

"One of the reasons why I don't *really* want to retire is that it's a really exciting time for both the nuclear and the chemical aspects of nuclear chemistry," she says.

This past summer, Hoffman was a member of the team that discovered elements 118 and 116. She called this discovery "one of the most exciting of my career" because the radioactive decay patterns of 118 and 116 provided strong support for the existence of the "island of stability" that theorists have long predicted for superheavy elements.

Hoffman who is a professor with the University of California at Berkeley also continues to enjoy teaching. "The more people you can teach about these things, the better educated the general public will be," she says.

Submitted by DOE's Lawrence Berkeley National Laboratory