Harnessing the power of partnership

Page 2

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

Number 56 May 29, 2000

Research Highlights . . .

Catching cosmic rays

This month, the European Union is putting into effect first-ever occupational safety standards to track and limit airline crew members' exposure to cosmic rays—radiation found outside the Earth's atmosphere and encountered on many commercial flights. A Richland, Wash., company is customizing cosmic ray detectors, originally developed by DOE's Pacific Northwest National Laboratory for the U.S. space program, in response to interest from several European airlines now required to characterize the types and amounts of cosmic radiation encountered during commercial flight. The detector simulates a human cell nucleus and records the energy deposited, and resulting tissue damage, as cosmic radiation passes through the body's cells.

[Dawn White, 509/375-3688, dawn.white@pnl.gov]

Fill in the "X"

A broad-based program at Stanford University will take advantage of expertise at the DOE's Stanford Linear Accelerator Center. Called "Bio-X," the new program will include research in bioengineering, biomedicine and bioscience, all of which are areas of research at SLAC's Synchrotron Division. Themes represented by Bio-X are molecular and cellular structure and function, imaging of biological systems, tissue engineering, and computational biosciences. Plans are for a main Bio-X center on the Stanford campus and a satellite at SLAC. The educational and scientific benefits of Bio-X will be impressive, enhancing new relationships among the sciences.

[P.A. Moore, SLAC, 650-926-2605 xanadu@slac.stanford.edu]

Rare nucleons go hyper at Jefferson Lab

Researchers at DOE's Thomas Jefferson National Accelerator Facility, Jefferson Lab, are completing a technically challenging experiment that looked for elusive particles present at the Big Bang—hyperons. Hyperons have a three-quark structure like protons and neutrons with one significant difference—a strange quark with slightly increased mass. Hyperons can be use as a probe to explore the behaviors of known nuclei. Researchers in this experiment were eager to understand how hyperons behave around their more conventional sub-atomic kin. Close to 100 researchers from 14 institutions spread across five countries conducted the studies who will publish results in a year.

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

Thin-film, ultralight mirrors the future of space

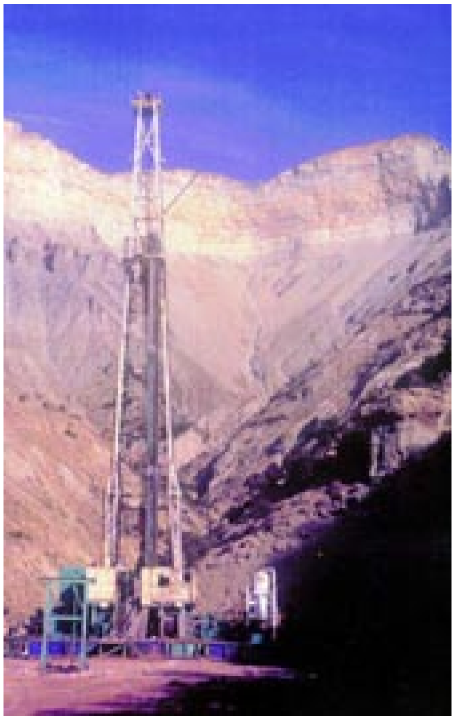
Researchers at DOE's Sandia National Laboratories and the University of Kentucky are developing enabling technologies for a new thin-film, ultralight deployable mirror that may be the future of space telescopes and surveillance satellites. Made from a "smart" material that changes shape when struck by electrons fired by a computer-controlled electron gun, it is a whole new approach to space mirrors. Unlike the Hubble and NASA's upcoming Next Generation Space Telescope, which use traditional polished glass mirrors, the new concept uses a light-weight thin film that could be folded up and carried on a small booster rocket and opened to its full diameter in orbit.

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

Life in the inferno: Identifying how microorganisms can survive in hell

Even Dante would blanch at the conditions miles below the earth's surface—temperatures climb past the boiling point of water, the weight of hundreds of atmospheres bear down, and space is so tight microorganisms can barely budge.



Drill rig in Colorado's Piceance Basin used to delve into deep, hot sandstone for microorganisms.

Yet, life persists there. Subsurface microbiologists from the DOE's Idaho National Engineering and Environmental Laboratory and Princeton University are trying to determine how microorganisms survive deep underground in some places, but not others. Understanding how microbes survive and what they do in the subsurface are key to understanding how contaminants degrade there.

Researchers know that microorganisms called extremophiles live embedded in rock thousands of feet below dry land, in deep ocean sediments and in fissures crisscrossing the ocean floor. "We're recognizing that microorganisms have remarkable abilities to colonize these environments. We're trying to understand the parameters that control that colonization," says INEEL microbiologist Rick Colwell, who collaborates with Princeton geochemist T.C. Onstott.

The three main factors limiting the depth at which extremophiles survive are temperature, pressure and access to food and water. Between the temperature—microorganisms can't live for long at 250 degrees Fahrenheit—and the pressure—extremophiles survive at 600 times atmospheric pressure—the hardy microbes should die off at around three and a half miles below the surface of dry land.

However, near geothermal hotspots such as that under Yellowstone National Park, life may survive only near the surface—unlike deep ocean sediments, where miles of cold water above keep the temperatures down below.

In arid regions such as INEEL's home on the Snake River Plain, a lack of water and chemical nutrients likely prohibits deep subsurface life. However, extremophiles may flourish deep in faults and mid-ocean ridges, where fluids and nutrients flow more freely.

Researchers are accumulating data from deep earth core samples. "In the early days it was 'Let's drill a hole and see what we find'," Colwell says. Now, they have better ideas of where to look for life in Dante's realm.

Submitted by DOE's Idaho National Engineering and Environmental Laboratory

Harnessing the power of partnership

Evguenia Rainina

Collaborations have been a mainstay in more than 30 years of scientific research for Evguenia Rainina, a senior research scientist at DOE's Pacific Northwest National Laboratory. Her experience in working with other research institutions and scientists is paying off in her role as lead scientist in a few projects Pacific Northwest is pursuing under DOE's Initiatives for Proliferation Prevention.

"I strongly believe in the power of IPP," she says of the program. "I know how much Russian scientists appreciate the support from IPP, the real collaboration with American scientists and the American companies."

Rainina understands this firsthand because she worked for more than 25 years at Moscow State University and continues to seek out opportunities to collaborate with her former colleagues. She still holds a lifetime chair at the University.

In 1993, Rainina was compelled to take a short assignment at Texas A&M University and ended up staying there for five years. During her time in Texas, Rainina built a bridge with her former colleagues at Moscow State University.

"During these years we developed strong scientific relationships between scientists from these universities and, what is more important, they became very friendly," she says. "There is no 'propaganda' that could work better than personal friendship and joint scientific interest."

Also during this time, she met Pacific Northwest scientists involved in IPP and she moved on to the laboratory in 1998. Pacific Northwest plays a critical technical role in biological and chemical weapons projects within IPP. She then became a part of the laboratory's efforts in IPP.

"Basically, I do the same at PNNL that I did at Texas A&M — building a bridge between scientists in Russia, other Newly Independent States and the United States. But now, the common goal is research through IPP," she says.

Submitted by DOE's Pacific Northwest National Laboratory