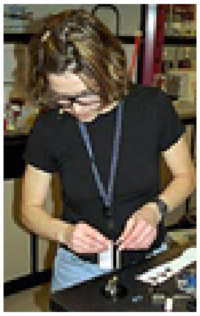


*Suzanne Ferrere dyes for solar cells,*

*Page 2*

DOE Pulse
Science and Technology Highlights from the DOE National Laboratories
Number 70 December 11, 2000

# Research Highlights . . .

## Fusion in a beer can?

Researchers at DOE's Los Alamos National Laboratory are trying to create fusion energy in a beer-can-sized cylinder. The process uses an electrically neutral, high-temperature ionized gas injected into an aluminum cylinder. An electrical current compresses the cylinder. As the fast-moving solid metal wall collapses, the fuel burns in a few millionths of a second at pressures millions of times greater than that of the Earth's atmosphere. With magnetized target fusion, scientists hope to produce tiny amounts of fusion energy at a cost that is far less than current approaches. The work is funded by DOE's Office of Fusion Energy Sciences.

*[Kay Roybal, 505/665-0582., k_roybal@lanl.gov]*

## INEEL teams with Russia to explore biodiversity potential

DOE's Idaho National Engineering and Environmental Laboratory and four Russian biological institutes are working with private industry to establish a Russian Ecological Biotrade Center to explore that country's biodiversity potential for developing new commercial products. The center, the first of its kind in Russia, employs former Soviet weapons scientists. Diversa Corporation of San Diego is the third partner in the program designed to use biomolecular techniques to evaluate the range, extent and potential value of Russia's microbial diversity, according to Rob Rogers, the INEEL's principal project investigator.

*[Teri Ehresman, 208-526-7785, ehr@inel.gov]*

## "Most distant galaxy" not as far away

Astrophysicists at DOE's Lawrence Livermore National Laboratory, with a team of colleagues from several universities and observatories, have stripped a galaxy near the Big Dipper of its title as the "Most Distant Object Known" by showing that the initial distance estimate was incorrect. Wil Van Breugel and Wim De Vries discovered that STIS 123627+621755 is actually 9.8 billion light years, a distance of approximately 2.7 billion light years closer to the Earth than astronomers found in 1999 when they measured the same galaxy using NASA's Hubble Space Telescope. The team used the W.M. Keck Observatory's 10-m telescopes in Hawaii to obtain the deep images earlier this year.

*[Anne M. Stark, 925/422-9799, stark8@llnl.gov]*

## Sequencing the fugu fish

Scientists mining the human genome data for genes will soon have a valuable new treasure map courtesy of the Japanese delicacy known as Fugu, or the puffer fish. An international consortium, led by researchers at DOE's Joint Genome Institute (a consortium of Berkeley, Livermore and Los Alamos national labs) in Walnut Creek, California, has announced a collaborative agreement to sequence the Fugu genome. Although the Fugu contains essentially the same genes as the human genome, it has much less DNA to sort through. This makes finding Fugu genes a much easier task, and the information can be used to help identify comparable genes in the human genome.

*[Lynn Yarris, 510/486-5375, lcyarris@lbl.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).

# Berkeley helps Jefferson Lab prevent "flashover"

To inject energetic electrons into the Thomas Jefferson National Accelerator Facility's free electron laser, scientists there built a Photo-Emission Electron Gun designed to operate in vacuum at half a million volts.

The gun's "barrel" is a pair of cylindrical ceramic insulators, known as accelerator columns, made of pure alumina and capable of withstanding the high voltage. No matter how good an insulator may be in bulk, however, at high electric field strength its surface is vulnerable to catastrophic failure known as flashover.

"Flashovers not only bring operations to a halt, they can do expensive damage," says Jefferson Lab's Larry Phillips. One way to prevent flashover is to add some conductivity to the surface of the insulator, so charge can bleed away before it builds up.

Ian Brown's group in the Accelerator and Fusion Research Division at DOE's Lawrence Berkeley National Laboratory had developed a vacuum-arc ion source which, says Brown, "is very good at putting metal into alumina." Brown, Phillips, and their colleagues at both labs joined forces to lick the flashover problem by modifying the surface resistivity of the electron gun's accelerator columns.

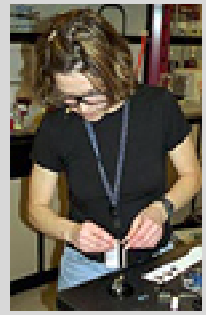
After tests had confirmed the practicality of the ion-implantation approach, the Jefferson Lab team built a special cradle to fit on the target end of the Berkeley Lab implanter. The cradle was tilted to hold the cylinder at a 55-degree angle to the ion beam and fitted to slowly rotate it as the broad beam played over the entire inner surface. The device was immediately nicknamed the "rotisserie."

Several columns have been implanted and two have already been assembled in the electron gun at Jefferson Lab. "We've had no problems whatsoever," says Larry Phillips.

Indeed, the gun quickly began operating at far higher efficiency than before. So encouraging are the results that a second electron gun is planned.

***Submitted by DOE's Lawrence Berkeley National Laboratory***

## A SOLAR CELL TO DYE FOR



***Suzanne Ferrere dyes for solar cells.***

Suzanne Ferrere, a chemist with the National Renewable Energy Laboratory, has spent the past two years developing dyes that can be used in a potentially low-cost and efficient solar electric device based on a process involving dye molecules.

This device, called a photochemical solar cell, contains a photoelectrode made of an extremely thin layer of titanium dioxide on a transparent glass substrate. Titanium dioxide often is found in such household products as paint, sunscreen and toothpaste. "Titanium dioxide alone only absorbs the ultraviolet light from the sun," said Ferrere. "The dye allows the titanium dioxide to absorb both ultraviolet light and the visible light portion of sunlight." Dye molecules are absorbed on the surface so that when they are exposed to light, they inject electrons into the semiconductor material and are then collected as electric current.

"There are several great things about this project," said Ferrere. "With the dye, solar cells can be produced in a variety of colors and the cost of these types of solar cells are considerably less expensive than conventional cells."

Ferrere completed her post doctorate work at NREL after earning a doctorate in chemistry from Colorado State University. After completing her post doc, Ferrere applied to NREL's Director's Discretionary Research and Development Program (DDRD) for seed money to work on the photochemical solar cell. The DDRD project ended last spring and Ferrere has been working on a grant in the hopes of obtaining money from Basic Energy Science (BES) program at NREL to continue the solar cell research.

The photochemical solar cells currently have several novelty applications and are being used in watches and bathroom scales. "An advantage to working at a national lab is that I'm working on something that has a social good," Ferrere said.

***Submitted by DOE's National Renewable Energy Laboratory***