Delmar Miller

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Advanced accelerator research

DOE's Stanford Linear Accelerator Center is planning a new facility, called ORION, to explore cutting edge accelerator technologies. New experimental halls will be constructed and two laser rooms will be a major part of the ORION program. Experiments at the proposed facility will study all aspects of advanced accelerator science and technology, such as laser driven accelerators, plasma accelerators, high-brightness particle sources, and understanding the limitations of radiofrequency accelerators. Experiments will be proposed and peer reviewed. Funding for building ORION will have to come from outside the present SLAC budget.

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Trapping single atoms for a better view

A whole new technology awaits exploration with the discovery of a technique for trapping single atoms. Researchers at DOE's Oak Ridge National Laboratory and Nanocrystals Technology in Briarcliff, N.Y., have collaborated to cage single europium atoms in nanocrystals not much larger than the atoms themselves. The process enables them to study the properties of a single atom at room temperature using conventional microscopy techniques. This is far more practical than methods that require cooling the atoms to cryogenic temperatures or trapping atoms in the gas phase using ion trap mass spectrometers. Potential applications lie in computing, optical sensing and display systems.

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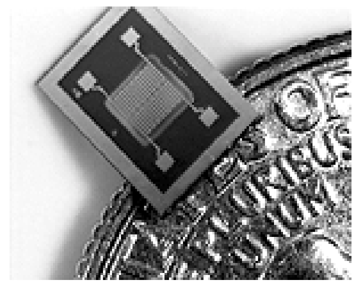
Tiny device shows promise as chemical analyzer



***TINY PRECONCENTRATOR** sits on the edge of a quarter, illustrating its miniaturized size.*

A chemical sampling device smaller than the tip of a fingernail promises big results for detecting and analyzing trace chemicals. The tool, developed by DOE's Sandia National Laboratories, is a super miniaturized version of a traditional preconcentrator used to collect sample gases for analysis. The active area of the device is only two millimeters by two millimeters. Already part of Sandia's initiative to build a hand-held "chemistry laboratory," it potentially can be integrated with other micro chemical detectors, including a mass spectrometer or an ion mobility spectrometer. The miniaturized size will allow chemical testing using small hand-held instruments, eliminating the need to send samples to a large laboratory.

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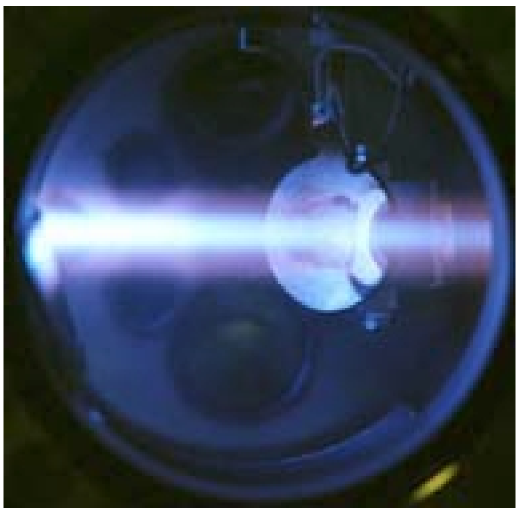
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions.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

Magnetic nozzle studied at Princeton

Scientists at the DOE's Princeton Plasma Physics Laboratory (PPPL) are using a novel experimental apparatus to study basic plasma physics phenomena with potential applications in several fields, including the development of plasma thrusters for space propulsion. This research program is being performed in collaboration with many scientists, including several at NASA.

The Magnetic Nozzle Experiment (MNX) studies the expansion of a plasma (hot ionized gas) through a constriction in magnetic field lines, called a magnetic nozzle. MNX utilizes a 30-cm long helium or argon plasma column, initially 2-cm in diameter, confined by a magnetic field. The field is compressed at one location along the column—the magnetic nozzle. The plasma is squeezed there and then expands as it flows through and out. During the expansion, the plasma cools and partially recombines into a neutral gas.



A plasma column inside the Magnetic Nozzle Experiment at Princeton.

This phase transition is of fundamental interest to scientists who hope to use the magnetic nozzle to accelerate plasma to supersonic speeds for space propulsion. The recombination phenomenon is also of interest in the fields of fusion research, materials processing, and lasers.

PPPL Physicist Sam Cohen, who heads the MNX project, said this work builds on earlier studies of recombination at Princeton. That research was motivated by the need to cool the plasma exhaust in magnetic fusion energy devices. One of the exciting results was the generation of conditions in the plasma that might it useful as a source for a new type of laser.

In a space propulsion system, it is essential for the plasma to detach itself from the magnetic field lines in the exhaust region of the nozzle. Otherwise, the exhausted plasma would return to the spacecraft, reducing the thrust. Detachment of supersonic plasma ions may be brought about by several processes, including both recombination and charge exchange of ions, or loss of magnetization.

MNX is equipped with apparatus to measure the charged and neutral particle temperatures and velocities in the expansion region. Measurements of ultraviolet light and x-rays emitted by the plasma exhaust are enabling scientists to quantify the recombination processes that occur.

Submitted by DOE's Princeton Plasma Physics Laboratory

GETTING READY FOR HIGH-ENERGY COLLISIONS

Delmar Miller has worked at Fermilab for more than thirty years. He has worked in every accelerator tunnel on site. And he has helped to install numerous beam lines and detector components.

Delmar Miller plays an important role in getting Fermilab's DZero detector ready by March 2001.

He works hard to make sure that the job gets done and that Fermilab's projects are on schedule.

Miller's job title is Operational Specialist Senior, and he leads a team of 35 mechanical support people working to upgrade the DZero detector. The improved DZero detector needs to be ready by March 2001 to record particles produced in proton-antiproton collisions when Fermilab starts operating its Tevatron accelerator with stronger and more energetic particle beams.

"We cannot even imagine what DZero would be like without Delmar Miller," said Harry Weerts, co-spokesman of the DZero collaboration, a group of 500 physicists from around the world. "He knows Fermilab inside out, and he knows how to get things done."

Delmar Miller supervises nearly all the technicians of the DZero group at Fermilab. He and his team have been essential in putting the 5000-ton DZero detector together.

Communication is also an important aspect of Miller's job. Coordinating the installation of detector parts, shipped to Fermilab from various universities and high-energy physics institutions around the world, is critical to meeting DZero's schedule.

Miller's team has grown in size over the years, and it has taken over jobs that, originally, were never planned to be on its plate.

"You can't foresee every single detail," Miller said. "In each project of this complexity, there are bumps in the road. We just have to make sure that they don't delay the project."

So far the DZero project is on schedule. Miller and his team will work hard to keep it that way.

Submitted by DOE's Fermi National Accelerator Laboratory