DOE Pulse

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Livermore's cosmic couple

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DOE Pulse's 100th issue html version has highlights from the 16 national labs.

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).

Case of the "missing spin"

A recent experiment at DOE's Jefferson Lab took data to learn how much the spin of the quark contributes to the proton or neutron spin. Surprising the expectation of scientists and simple models, the quark's spin seems to only contribute 25 percent or less. This "missing spin" was probed in the experiment involving more than 100 collaborators and took data around the clock for 7 months. Results of this experiment should enable nuclear scientists to take a big step in understanding the proton and neutron structure.

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

Detector system boosts antiterror effort

Anti-terrorism efforts may get a boost from DOE's Princeton Plasma Physics Laboratory. Researchers there are developing a miniature nuclear detection system to scan objects such as cars, luggage, and vessels for specific nuclear signatures associated with materials employed in nuclear weapons. This system could be installed at tollbooths and airports, as well as in police cruisers. The PPPL team configured off-the-shelf components—a solid-state detector, multi-channel analyzer, hand-held computer, pre-amp, and amplifier—into a unique system that can determine various radiation energies, thus identifying radionuclides. It will be tuned to flag suspect signatures only; normal nuclear signatures from medical isotopes and radiography equipment would not give false positives. This capability to differentiate radionuclides with a high degree of spatial resolution in a device that is light, small, robust, and portable makes the PPPL application unique.

[Anthony R. DeMeo, 609/243-2755, ademeo@pppl.gov]

Labs do homework on linear collider

For two decades, physicists at the DOE's Stanford Linear Accelerator Center have been developing a new breed of particle accelerator called a linear collider in cooperation with other laboratories. Now a distinguished panel of physicists has recommended that the United States play a major role in building a large linear collider as the top priority in its high-energy physics program. Stretching 18 miles, the proposed new instrument will boost electrons and their antimatter counterparts (called positrons) to energies of hundreds of billions of volts and collide them inside sophisticated particle detectors. Physicists expect experiments at this facility to provide revolutionary insights about energy, matter, space and time.

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Microchain drive fabricated at Sandia

A microchain that closely resembles a bicycle chain—except that each link could rest comfortably atop a human hair—has been fabricated at the DOE's Sandia National Laboratories. Because a single microchain could rotate many drive shafts, the device would make it unnecessary to place multiple tiny microelectromechanical (MEMS) motors in close proximity. Usually, a separate driver powers each MEMS device. Sandia technician Ed Vernon, who has received a patent for the silicon microchain, says it could be used to power microcamera shutters, in mechanical timing and decoding, and the powering of a MEMS device from a motor situated at a distance, saving considerable space on the MEMS-bearing chip.

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

Cosmic couple joins a terrestrial team

What do astronauts do when they're done flying in space and are hungry for new adventure? Two of them landed at DOE's Lawrence Livermore National Laboratory, where their new horizons stretch to the cutting edge of science and technology

Tammy Jernigan and Jeff Wisoff

Between them, Tammy Jernigan and Jeff Wisoff have 30 years at NASA and nine space shuttle flights. They've done spacewalks, tested jetpacks and worked on the International Space Station.

When it was time to come down to Earth, the married couple chose Lawrence Livermore because, according to Jernigan, "here at the Lab, we can utilize more of our physics backgrounds, at an institution that does superb science and also has a great record for executing large programs."

A laser scientist, Wisoff joined Livermore's National Ignition Project, helping build the world's largest laser. He is NIF's deputy associate project manager for Systems Engineering.

"The space program is a team effort in the same way that NIF is a team effort," Wisoff says. "It's a huge undertaking that involves lots of people and I think that's the attractiveness of these big projects."

Jernigan joined Livermore's Physics and Advanced Technologies Directorate as assistant associate director for special projects, helping direct program development.

The two joined the Lab shortly after the tragic events of September 11.

"I have a tremendous sense of satisfaction in the contributions we make here to national security," Jernigan said. "Just after September 11, people said we must be glad to be going to the Lab because now we could do so much to help bolster the country's defense."

But blasting off into space is not easily forgotten.

"Spacewalks are like having a full-screen IMAX theater in your face," Wisoff said. "The views are incredible."

"And when those solid rocket boosters light, it's a real kick in the pants," Jernigan said.

Submitted by DOE's Lawrence Livermore National Laboratory

National Labs help chemical processors streamline operations

The chemical-processing industry is getting help from no less than five national labs and six universities as it uses ideas generated from computer calculations to cut costs and become more energy efficient. The overall goal is to help the industry improve its manufacturing processes, which, in turn, enables it to produce better products and use raw materials more wisely. In Dow Corning's case, for example, that means creating ultra-pure silicon, which, among other applications, is used to make computer chips, cosmetics and caulking materials.

Enter the national labs. DOE's National Energy Technology Laboratory and Oak Ridge National Laboratory are simulating chemically reacting fluidized beds using MFIX, a computer code based on computational fluid dynamics (CFD). It is a computer model that shows how particles and fluids interact in a bubbling fluidized bed, explains Thomas O'Brien, NETL senior scientist. CFD, he says, is best described as "understanding fluid behavior by applying computational solutions of the mathematical equations that govern fluid flow." Los Alamos, Sandia and the Pacific Northwest National Laboratories are using a similar approach to improve circulating fluidized-bed processes.

CFD has proven to be a very useful tool for many industries in the last 20 years. Car makers, for example, use the technology in design, ranging from fuel-injection systems to windshield wipers. However, those are single-phase flows, O'Brien notes. The labs have elevated CFD to a multi-phase flow that could ultimately introduce better, more energy-efficient fluidized beds.

This is keeping in step with Agenda 2020's policy that crosscutting technologies be developed to help specific industries that consume large amounts of energy. In 1998, this consortium of six companies, six universities and five national labs was formed to accelerate the use of CFD as a means of designing ways to curb excessive energy consumption in chemical-processing companies. If successful, the effort could save the industry as a whole as much as $330 million a year by 2020.

Submitted by DOE's National Energy Technology Laboratory