Fermi Lab's Rob Plunkett

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DOE Pulse

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Research Highlights . . .

New century of thirst for world's mountains

By the year 2100, the Andes range in South America will have less than half its current winter snowpack, mountains across Europe and the U.S. West will have lost nearly half of their snow-bound water and New Zealand's picturesque snowcaps will all but have vanished. Such is the dramatic forecast from a new, full-century computer model from DOE's Pacific Northwest National Laboratory done at the W.R. Wiley Environmental Molecular Sciences Laboratory. Declining snow-water from climate change will mean less spring and summer runoff and pressure on people worldwide who depend on summertime melting of the winter snowpack for irrigation and drinking water. The model differs from past attempts in that it generates snow information for small areas—5 kilometer grids—on mountain ranges worldwide over a century rather than a few months.

[Bill Cannon,509/375-3732, cannon@pnl.gov]

Mapping the pion's charge

Scientists in the Fpi collaboration at DOE's Jefferson Lab are studying how the strong force combines nature's fundamental building blocks into the lightest particle built of quarks: the pion. The pion's structure is mapped out by a single quantity, Fpi. To measure Fpi, JLab experimenters sent electrons into a hydrogen target, where electrons interacted with a cloud of pions in the hydrogen nucleus. Detectors, about the size of a small house, measured the resulting charged pions and scattered electrons. The result is the most precise pion electroproduction data that can now be used to describe the pion's charge distribution.

[Kandice Carter, 757/269-7263, kcarter@jlab.org]

Software detects files hidden in digital images

Researchers at DOE's Ames Laboratory's Midwest Forensics Resource Center have developed software that can quickly analyze and detect whether a digital image has computer data hidden within it. Criminals or terrorists can use readily available steganography programs to secretly embed payload files within ordinary digital images. The payload files can be almost anything from illegal financial transactions to sleeper cell communications or child pornography. Using a form of artificial intelligence called an artificial neural network, researchers taught the program to statistically distinguish altered images from normal images with a database of more than 10,000 images.

[Kerry Gibson, 515/294-1405, kgibson@ameslab.gov]

Watching materials grow leads to new understanding

A new environmental chamber constructed at DOE's Argonne National Laboratory allows researchers to watch materials as they grow step-by-step while interacting in elevated-temperature, reactive-gas environments. The first experiment in the new chamber provided information about how copper oxidizes at the nano-level and established a new basic model for understanding oxidation. The initial study found that clean copper surfaces are more resistant to oxidation than previously expected when exposed to oxygen. These findings could lead to improved electronic components, now that manufacturers know the copper won't degrade. The chamber may also help researchers find better ways to produce hydrogen from hydrocarbons.

[Catherine Foster, 630/252-5580, cfoster@anl.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).

GLAST software developed at SLAC

Some of nature's most violent processes emit gamma rays. The most energetic form of light, gamma rays come from the hottest regions of the universe including intense supernova explosions, strongly magnetized neutron stars, and powerful jets created by giant, spinning black holes.

Soon a powerful new observatory will orbit the Earth, capturing and tracking these extremely energetic photons. The Gamma-ray Large Area Space Telescope (GLAST) will explore the space's high-energy frontier to help solve the mysteries of dark matter, supermassive black holes, and the evolution of stars.

One important component of GLAST is the Large Area Telescope (LAT), assembled at DOE's Stanford Linear Accelerator Center as part of the NASA-led project. This instrument will record gamma rays at energies greater than any previous space-based mission.

Nearly 350 miles above the Earth's surface, a perpetual storm of particles will bombard the LAT, which in turn will record the path and strength of each particle that strikes. This hail of particle collisions creates 10 megabytes of data every second. Running on a processor about a tenth as powerful as a consumer laptop, computer software will shrink this data down to less than 150 kilobytes per second.

The LAT's flight software will sift through the millions of "events" registered on the instrument's detectors, keeping only those potentially caused by gamma rays.

"To do this without losing information, we have to apply physics knowledge on the fly," says SLAC's Tony Waite, who along with J.J. Russell, led the team that developed the flight software. "We can't just use a standard data compression program like g-zip."

While the craft is in space, researchers will have about an hour of contact with it each day. This will be the only time available for the flight software to transmit the compressed data to Earth.

The flight software configures the LAT to work in two modes: looking at the entire sky to construct a "gamma sky map," or zeroing in on gamma ray bursts, which last anywhere from a few seconds to a few hours.

The LAT took a 3,000 mile journey from SLAC in California to the U.S. Naval Research Laboratory in Washington, D.C., last month. "We've cleared the Rockies and we're on to the Gamma Rays," said Ev Valle, SLAC's DOE Site Office Federal Project Director. GLAST is expected to launch in 2007.

Submitted by DOE's Stanford Linear Accelerator Center

MINOS COSPOKESPERSON MUST KNOW ABOUT MORE THAN JUST NEUTRINOS

Rob Plunkett

Rob Plunkett, formerly the run coordinator for the MINOS neutrino experiment at DOE's Fermi National Accelerator Laboratory, has been elected as the new MINOS cospokesperson. "You're always honored that your colleagues show that trust in you, but it also makes you feel quite humble," Plunkett said.

In his new role, Plunkett says he will have to be familiar with all aspects of the experiment. "It's challenging—you want to understand the individual needs of the collaboration on scientific, institutional, and personal levels," he said said. Externally, he will act as an advocate for the experiment with the laboratory, and must be prepared to defend the collaboration's decisions to the scientific community at large.

He will also play an active role in smoothing the decision process within the MINOS collaboration, helping physicists reach consensus and making sure the well-being of younger scientists is looked after. "They're the ones who on a day-to-day basis are making conclusions, [and are] relying on senior people for overall direction," Plunkett said. He will be responsible for the safety of MINOS collaborators, and for helping the collaboration to maintain focus—and have fun. He added: "You set the tone and direction of the experiment."

MINOS—the Main Injector Neutrino Oscillation Search—sends a beam of neutrinos from the Fermilab site in Batavia, Illinois through the earth to a 5,000-ton detector a half-mile below the surface in a former iron mine located in the Soudan (Minn.) Underground Laboratory. Plunkett will finish the term of former cospokesperson Doug Michael of Caltech, who passed away in December 2005.Plunkett, who will serve alongside current cospokesperson Stan Wojcicki, will help guide the collaboration through a "particularly interesting period" at MINOS. With a year's worth of data stored away and more on the way, MINOS scientists are ready to explore their creation's potential. Says Plunkett: "I expect to be busy."

Submitted by DOE's Fermi National Accelerator Laboratory