PPPL's Ned Sauthoff

Page 2

DOE Pulse

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Research Highlights . . .

Seeing soft tissues with X-rays

Scientists at DOE's Brookhaven National Laboratory are helping to develop a novel x-ray imaging technology capable of "seeing" soft tissues invisible to conventional x-rays. Conventional radiography produces images based on how x-rays are absorbed by tissue. The new technique, called Diffraction Enhanced Imaging (DEI), looks at how intense x-rays from a synchrotron such as the National Synchrotron Light Source bend and scatter as they pass through the tissue. Diffraction and scattering angles vary more subtly between tissue types, making soft tissues such as skin, fat, and blood vessels – as well as bone and other hard tissues – visible with just one technique.

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Quantum investigations

DOE's Ames Laboratory physicist Viatcheslav Dobrovitski and his collaborators have been using supercomputers to simulate the behavior of quantum states subject to interactions with an environment. This is a topic of crucial importance for the successful operation of so-called quantum computers, where the integrity of quantum states can be destroyed (decohered) by interaction with surrounding nuclear spins, lattice vibrations and other "environmental perturbations." Dobrovitski's work shows that in certain instances there can be a large degree of decoherence in the system, yet some of the quantum mechanical memory is maintained, with quantum oscillations lasting well beyond an initial decoherence period.

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Precise measurements give clues to astronomical X-ray bursts

Physicists at DOE's Argonne National Laboratory have precisely measured the masses of nuclear isotopes that exist for only fractions of a second. Some isotopes had their masses accurately measured for the first time. The results help explain the X-ray spectrum and luminosities of strange astronomical objects called "X-ray bursters." X-ray bursters comprise a normal star and a neutron star. Neutron stars are as massive as our sun but collapsed to 10 miles across. The neutron star's ferocious gravitational field pulls gas from its companion until the neutron star's surface ignites in a runaway fusion reaction. For a few tens of seconds, the light from the explosion may be the most brilliant source of X-rays in the sky.

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Fermilab aids data management for sky surveys

Richard G. Kron, professor of astronomy and astrophysics at the University of Chicago and scientist at Department of Energy's Fermilab, is the new director of the Sloan Digital Sky Survey - a collaboration of 13 institutions around the world and 200 astronomers. By 2005, the SDSS collaboration will complete the digital imaging and spectroscopic survey of one quarter of the entire sky, determining the positions and absolute brightnesses of more than 100 million celestial objects. In May an SDSS study provided the most direct evidence yet that galaxies reside at the center of giant, dark matter concentrations that may be 50 times larger than the visible galaxy itself. All SDSS data is stored at and distributed by Fermilab.

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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).

MINOS detector plates erected

On June 5, Main Injector Neutrino Oscillation Search technicians erected the last of the project's 485 steel and plastic detector planes in the Soudan Underground Laboratory in Soudan, Minnesota.

"The technicians carried out the work faster and less expensively than estimated," said manager Bill Miller in charge of hiring and supervising technicians at the Soudan laboratory.

The underground detector will observe cosmic rays and atmospheric neutrinos penetrating the half-mile of earth above. In 2005, the MINOS experiment enters its next stage. The detector will "catch" neutrinos that researchers will shoot from Fermilab in Batavia, Illinois, 450 miles away, to Soudan's underground laboratory. The neutrinos will travel through rock – no tunnel required. The equipment to produce the neutrino beam is under construction. Researchers will study how muon neutrinos oscillate into tau neutrinos or electron neutrinos in laboratory conditions.

MINOS experiment

The detector's planes are arranged in the 100-foot long, 6,000-ton detector like slices in a bread loaf. Each 25-foot high and one-inch thick plane is a steel sheet with one surface covered by a half-inch layer of scintillating plastic.

The project began in July 1999 with the groundbreaking of the cavern that houses the detector, and the first plane was installed in August 2001. Detector components, no more than seven feet wide, came into the cavern, half a mile underground in a former iron mine, through an old, narrow mine shaft.

"It was like building a ship in a bottle," said Stanley Wojcicki, a Stanford University professor and MINOS spokesperson.

Things were complicated further because of limited underground storage space and because the Soudan mine is a State Park with 30,000 visitors every year. Materials were brought in as needed during the night when there were no visitors around.

The collaboration includes four Department of Energy laboratories – Argonne, Brookhaven, Fermilab, and Lawrence Livermore. The MINOS project is on schedule and on budget.

Submitted by Fermi National Accelerator Laboratory

Sauthoff heads ITER planning for U.S.

Ned Sauthoff

In February, DOE officials appointed Ned Sauthoff, a researcher at the DOE Princeton Plasma Physics Laboratory (PPPL), the U.S. ITER Planning Officer.

ITER is a major international magnetic fusion research project with a mission to demonstrate the scientific and technological feasibility of nuclear fusion as an inexhaustible, safe, and environmentally attractive source of energy. ITER could begin construction in 2006 and be operational in 2014, with fusion research lasting up to 20 years. The parties include Canada, China, the European Union, Japan, Korea, the Russian Federation, and the U.S.

As U.S. ITER Planning Officer, Sauthoff is assisting in negotiations for ITER management, and procurement allocations and systems, as well as in determining possible U.S. contributions to the project. His first task is to help form a multi-institutional working team of people from around the U.S. fusion program to assist in the ITER effort.

"The team will be structured in a way that invites participation by the full U.S. fusion community," said Sauthoff, adding that he hopes all U.S. fusion researchers will be involved in the international project. "Fusion physicists and engineers should see ITER as an opportunity to pursue the study of burning plasmas and to advance fusion technology." A plasma is a hot ionized gas which serves as the fuel in which fusion occurs.

Presently, the desired roles for U.S. ITER involvement are being formulated. "During negotiations with the other international partners, we want to assure that the U.S. fusion community can pursue its interests on ITER," the U.S. ITER Planning Officer said.

Sauthoff came to PPPL in 1972. He received a bachelor's degree in physics from the Massachusetts Institute of Technology (MIT), a master's in nuclear engineering from MIT and a Ph.D. in Astrophysical Sciences from Princeton University.

Submitted by DOE's Princeton Plasma Physics Laboratory