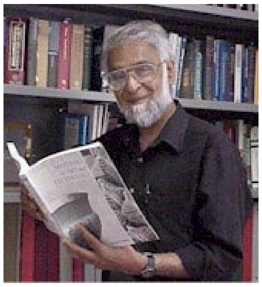

*Rohit Trivedi bridges the art-science gap.*

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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# Research Highlights . . .

## Ames Lab expands analytical arsenal

A unique Auger electron spectroscopy microscope at DOE's Ames Laboratory is giving researchers new insights into critical materials used in semiconductors, automobiles, catalysts, optics, thin films, computer hard disks and elsewhere. The instrument allows scientists to understand the composition of surface layers as well as the distribution of elements in materials. Such capability is important to researchers evaluating material properties, failure, corrosion, surface cleanliness and other factors. The system, which has a spatial and energy resolution 10 times greater than older instruments, is operated by Ames Lab's Materials Preparation Center and is the first of its kind in the United States.

*[Susan Dieterle, 515/294-1405, dieterle@ameslab.gov]*

## Fermilab finds first direct evidence for tau neutrino

An international collaboration of scientists at DOE's Fermi National Accelerator Laboratory has seen the first direct evidence for the subatomic particle called the tau neutrino, the third kind of neutrino known to particle physicists. On July 21, the collaboration reported four instances of a neutrino interacting with an atomic nucleus to produce a charged particle called a tau lepton, the signature of a tau neutrino. Although earlier experiments had produced convincing indirect evidence for the particle's existence, no one had directly observed the tau neutrino, a massless or almost massless particle carrying no electric charge and barely interacting with surrounding matter.

*[Mike Perricone, 630/840-5678, mikep@fnal.gov]*

## New test for radiation-induced damage clusters in DNA

Brookhaven biologists have devised a method for measuring radiation damage to DNA, including clusters of oxidized bases, strand breaks and abasic sites, which may turn out to be more harmful than breaks through both strands of the DNA double helix. Such forms of clustered damage have long been hypothesized, but no one had a way to measure them until now. The technique, which uses special enzymes to cut and count the kinds of damage, could help distinguish low-level radiation damage from changes caused by normal living, assess the radiation risks faced by astronauts, and improve the cancer-killing potential of radiation therapy.

*[Karen McNulty, 631/344-8350, kmcnulty@bnl.gov]*

## Reactor-based system to manufacture hydrogen fuel

DOE's Argonne National Laboratory will spearhead development of a proliferation-resistant and economical nuclear-based energy supply system for use in industrialized and developing nations after the year 2020. "The basic concept is to use clean nuclear energy as the heat source for manufacturing hydrogen, a clean chemical fuel that burns without releasing carbon dioxide or other greenhouse gases that contribute to global warming," said Dave Wade, director of Argonne's Reactor Analysis Division. Working with Argonne are Texas A&M University, General Electric, and research institutes from Japan and Italy. The three-year project will receive about $465,000 for the first year's work under DOE's Nuclear Energy Research Initiative.

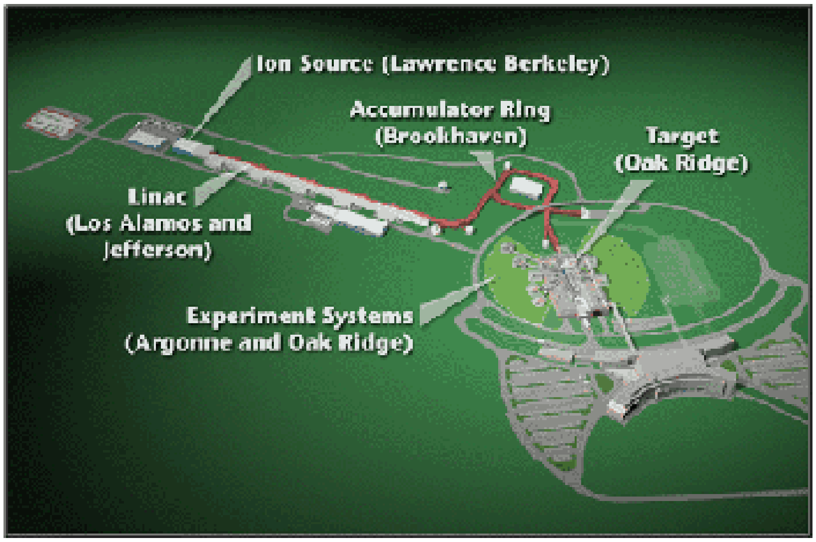
*[Catherine Foster, 630/252-5580, cfoster@anl.gov]*

***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).

# Jefferson Lab joins SNS Project

There's a new kid on the superconducting technologies block, and DOE's Jefferson Lab is part of the neighborhood welcoming committee.

Jefferson Laboratory has joined national labs Argonne, Brookhaven, Lawrence Berkeley, Los Alamos and Oak Ridge to assist in the design, engineering and construction of the $1.4 billion Spallation Neutron Source (SNS) in Oak Ridge, Tenn. The SNS will provide the most intense pulsed-neutron beams in the world for scientific research and industrial development. Funding is being provided by the DOE's Office of Science, with $8 million in additional monies coming from the state of Tennessee.



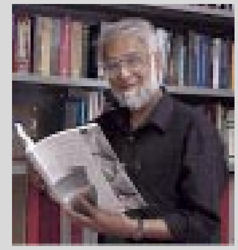

"This is a great opportunity for us to keep our lead in Superconducting Radiofrequency (SRF) technology and help us prepare for future," says Christoph Leemann, Jlab's deputy director. "Being a part of this effort helps us showcase our technology in support of a science project of national importance."

The baseline design calls for an accelerator system consisting of an ion source, a full-energy linear accelerator and an accumulator ring that will combine to produce short, powerful proton pulses. The pulses will strike a liquid mercury target to produce neutrons through a process known as spallation. Neutrons freed by spallation will be slowed down in a device known as a moderator and then guided through beam lines to areas containing specialized neutron detectors and other experimental devices. Once distributed, neutrons can be used in a variety of experiments.

As at JLab, SRF techniques and advanced accelerator components will be incorporated into the SNS design to enable low-cost, high efficiency accelerator operations. "From a JLab standpoint, our core technology is superconducting," says Claus Rode, the Lab's senior team leader for the SNS project. "We have an obligation to the taxpayer to transmit our expertise to other labs. It's an investment that's certainly paid off for us, and we expect similar benefits at the SNS."

***Submitted by DOE's Thomas Jefferson National Accelerator Laboratory***

## The Science of Art



When Rohit Trivedi gazes at a metal sculpture, he appreciates more than its aesthetic qualities.

His eye discerns processing techniques handed down from generation to generation. Today's artists and artisans use these techniques with metals and ceramics, although many aren't aware of the science involved.

Trivedi, a senior scientist at DOE's Ames Laboratory and a professor of materials science and engineering at Iowa State University, is trying to bridge that gap. He wrote, "Materials in Art and Technology," a book describing the evolution of materials-processing techniques dating back to the discovery of fire.

"Many of the techniques we use today were developed very early in civilization," Trivedi says. "Casting, joining, forging—all of these techniques were nicely developed by the early artisans. We have only perfected these techniques."

Trivedi notes that craftsmen—not scientists—were the first to take advantage of the properties of metals and ceramics. He marvels at their ingenuity in learning to manipulate the materials. "In some cases, they did things that we could not reproduce," he says.

His 1998 book is based on a college course he taught for 20 years after listening to an ISU art teacher describe problems in producing metal castings on cloudy days. Trivedi explained that the problem wasn't the clouds—it was the humidity that absorbed hydrogen, causing bubbles in the castings. The teacher asked Trivedi to teach his students the basics of materials science, and the class soon gained popularity throughout the campus.

"The challenge was to put together this course without using mathematics or complex science because the students hadn't taken those types of courses," he notes. "I tried to separate scientific concepts from mathematical equations so that they could learn science through the ideas rather than formulas, and that's what appealed to them."

***Submitted by DOE's Ames Laboratory***