Mike Shaevitz has been part of NuTeV since the beginning.

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

New Breast Cancer Diagnostic Tool on Horizon

A new diagnostic tool is being developed to help detect breast cancer using licensed technology developed at DOE's Jefferson Lab for its nuclear physics mission. This tool will use nuclear medical imaging known as scintimammography to pinpoint cancerous breast tissue. Tumors as small as 4 millimeters in diameter can be detected with this technology as opposed to mammography X-rays that usually can't go smaller than 7 millimeters. This technology will be used when X-rays mammograms show an abnormality and will prevent some breast biopsies. Testing of the device is currently under way.

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

Ritalin in the Brain: Righty-Lefty Counts!

A dose of Ritalin is only half-effective in the brain, research at DOE's Brookhaven National Laboratory's Center for Imaging and Neurosciences has found. That's because only the molecules with a "right-handed" orientation can bind effectively to brain-cell receptors and help control the flow of the brain communication chemical dopamine—the action that alleviates the symptoms of Attention Deficit Disorder in children who take the drug. Currently available Ritalin is a mixture of right- and left-handed molecules. Chemist Yu-Shin Ding and her colleagues used Positron Emission Tomography, or PET, brain scans to make the discovery, which may apply to many other pharmaceuticals.

[Kara Villamil, 516/344-5658, karav@bnl.gov]

Mass Spec for Finding Chemical, Biological Agents

DOE's Oak Ridge National Laboratory and the Army are working together to build a new tool for better detection of deadly chemical and biological warfare agents. The Block II Chemical and Biological Mass Spectrometer, to be developed by 2001, will be smaller, lighter, faster, cheaper, more sensitive and yet more rugged than current technology. It will distinguish among a wider variety of warfare agents without sounding false alarms; some testing with actual agents will be conducted at ORNL to refine the instrument's capabilities. Civilians will be able to use the Block II to map pollutants, rapidly identify hospital bacteria, and detect bacterial contamination in food.

[Carolyn Krause, 423/574-7183, krausech@ornl.gov]

Cleaning Up with Carbon Dioxide

A North Carolina company has teamed with DOE's Pacific Northwest National Laboratory to produce a new, environmentally-friendly system for dry cleaning clothes. The MiCARE Garment Cleaning System utilizes the laboratory's discoveries related to the behavior of compressed carbon dioxide, which has a density like water, a viscosity similar to a gas and the ability to reach places water and chemical solvents can't. Pacific Northwest's discoveries, combined with the firm's special detergents, boost cleaning power and could replace conventional, solvent-based cleaning with processes that use no water, have low energy requirements and employ no toxic substances.

[Tim Ledbetter, 509/375-5953, tim.ledbetter@pnl.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*** is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

DOE Labs Collaborate on New Magnetic Fusion Device

A groundbreaking ceremony will be held for the DOE-funded National Spherical Torus Experiment (NSTX) on May 18 at DOE's Princeton Plasma Physics Laboratory (PPPL) in Princeton, New Jersey. NSTX—an innovative magnetic fusion device—is being constructed by PPPL in collaboration with the Oak Ridge National Laboratory (ORNL), Columbia University, and the University of Washington, Seattle.

Scheduled to begin operation in April 1999, NSTX will be used to study the physics principles of spherically shaped plasmas—hot ionized gases in which nuclear fusion will occur under the appropriate conditions of temperature, density and confinement in a magnetic field. Fusion is the energy source of the sun and all the stars. Scientists believe it can provide an inexhaustible, safe, and environmentally attractive source of energy on earth.

Magnetic fusion experiments use plasmas composed of one or more of the isotopes of hydrogen. For example, in 1994, PPPL's Tokamak Fusion Test Reactor (TFTR) produced a world-record 10.7 million watts of fusion power from a plasma comprised of equal parts of deuterium and tritium, the fuel mix likely to be used in commercial fusion power reactors. NSTX is a "proof of principle" experiment and therefore will employ deuterium plasmas only. If successful it will be followed by similar devices, eventually including a demonstration power reactor, burning deuterium-tritium fuel.

"The completion of experiments on TFTR in April 1997 marked the end of one of the most productive eras in U.S. fusion energy research. We now look forward to a strong innovative plasma confinement program beginning with NSTX," noted PPPL Director Rob Goldston.

NSTX will produce a plasma that is shaped like a sphere with a hole through its center, different from the "donut" shape of conventional tokamaks like TFTR. This innovative plasma configuration may have several advantages, a major one being the ability to confine a higher plasma pressure for a given magnetic field strength. Since the amount of fusion power produced is proportional to the square of the plasma pressure, the use of spherically shaped plasmas could allow the development of smaller, more economical fusion reactors. NSTX's attractiveness may be further enhanced by its ability to produce a high "bootstrap" electric current. This self-driven internal plasma current would significantly reduce the power requirements of externally driven plasma currents required to heat and confine the plasma.

To save time and money, NSTX is being built at PPPL to take advantage of existing equipment and infrastructure from TFTR. Components and structure have been designed for ease of removal and replacement for repairs, upgrades, and the tailoring of experiments in response to new information obtained through experiment and theory.

Individual NSTX components including the vacuum vessel, magnetic field coils, and support structure are now being manufactured. Most of the machine assembly will be completed by the end of 1998, and systems commissioning will be carried out during the first quarter of 1999.

ORNL's Martin Peng is serving as NSTX program director. A national team is being assembled for NSTX research. DOE is considering proposals from the national laboratories, universities, and industry.

Visit the NSTX web site at www.pppl.gov/oview/pages/NSTX.html

Submitted by DOE's Princeton Plasma Physics Laboratory

Shaevitz Has Mixed Feelings As NuTeV Goes Out With A Bang

As a kid in Columbus, Ohio, Mike Shaevitz liked to build things, and he liked to take things apart. In 1975, as a Cal Tech postdoctoral researcher and an experimenter at DOE's Fermilab, he helped build a neutrino detector with 1,000 tons of steel. Now he has to help take it all apart—symbolically, at least. The NuTeV experiment (for "Neutrinos at the Tevatron"), which began in 1990, is ending its run as an active experiment.

"I hate to see it go," said Shaevitz, now a professor of physics at Columbia University and co-spokesman for NuTeV. "But it's time to go on to other things. And we're terminating with a bang." The "bang" is the data from NuTeV's final neutrino experiment, which used beams of the elusive subatomic particles known as neutrinos as probes to study other particles.

Now, results from NuTeV have helped physicists pinpoint the mass of the force-carrying particle known as the W boson. The W's mass is an important piece of information because it is linked to the mass of another particle, the hypothetical Higgs boson, the particle that is theorized as the origin of mass and that is regarded as the "holy grail" of particle physics. Results from NuTeV and other experiments point to a relatively light estimate for the mass of the Higgs—with important implications for Fermilab.

"If the Higgs mass is light enough, it's possible the colliders here at Fermilab might be able to see it in the next Tevatron run," says Shaevitz. "Which would be very nice." The next collider run at the Fermilab Tevatron, the world's most powerful particle accelerator, will begin in 2000.

Besides his role as a Fermilab experimenter and physics professor, Shaevitz is the director of Nevis Laboratories, the particle physics, nuclear physics and astrophysics research facility for Columbia University's Physics Department.

Submitted by Fermilab