PPPL physicist Hutch Neilson, Project Head of NCSX.

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DOE Pulse

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Research Highlights . . .

Just say 'no' to adenovirus

Biologists at Brookhaven Lab are looking for ways to "Just Say NO" to human adenovirus, the culprit behind some forms of pink eye, cold epidemics, disabling diarrhea, and opportunistic infections. Their method: Enlist the infected cells' own arsenal of nitric oxide (NO) to destroy a key viral enzyme. The team has shown that NO, a chemical made by many normal cells, inhibits adenovirus protease, an enzyme that cleaves scaffolding proteins to complete the process of virus maturation. Adenovirus particles treated with NO were much less infectious. The findings may one day lead to easily administered treatments that boost NO production to battle adenovirus.

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

Pentaquark: Strongest confirmation to date

Research carried out at DOE's Jefferson Lab and published in January provides the best evidence to date of the pentaquark's existence. Ordinary matter is composed of particles that contain quarks in bunches of two or three, while the pentaquark particle contains five quarks. It's difficult to detect, because it decays into other particles so quickly after forming. By directing a photon beam at a hydrogen target, CLAS (CEBAF Large Acceptance Spectrometer) Collaboration physicists were able to account for each of the expected particles from the reaction that signals the production and decay of the pentaquark, providing the most sensitive detection of the pentaquark yet.

[Kandice Carter, 757/269-7444, kcarter@jlab.org]

Counting atoms that aren't there, in stars that no longer exist

Researchers at DOE's Argonne National Laboratory have reached for the stars – and seen what's inside. Argonne scientists examined stardust from a meteorite and found remnants of now-extinct technetium atoms made in stars that lived and died before the solar system formed. Each tiny grain carries a chemical record of nuclear reactions in its parent star. The work was made possible by a one-of-a-kind instrument at Argonne called CHARISMA. It will later be used to examine samples of the solar wind captured by Genesis as well as dust grains from a comet's tail collected in the Stardust mission.

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

First mice born in ORNL's new house

The first litter of mice in ORNL's new mouse house, the William L. and Liane B. Russell Laboratory for Comparative and Functional Genomics, was born Feb. 21. The mouse "pups" were re-derived through the implantation of frozen two-cell embryos into mother mice. The result is the beginning of a new, specific-pathogen free mouse population free of common viruses, bacteria and parasites. This year approximately six to ten thousand mice will be re-derived in the new facility. The new Russell Lab is also a barrier facility, which means there are several levels of protection against entry by outside pathogens.

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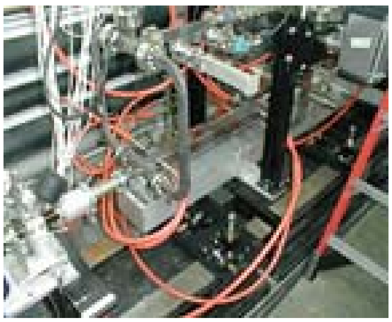
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***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).

Fermilab, SLAC team up on international Linear Collider collaboration

Research and development for the Linear Collider is making progress at the Department of Energy's Fermilab, including a joint project with DOE's Stanford Linear Accelerator Center. The proposed 20-mile-long electron-positron accelerator is envisioned as the next-generation discovery machine in particle physics, operated as a global laboratory with design specifications being formulated by committees in the Americas, Europe and Asia under the auspices of the International Committee for Future Accelerators (ICFA).



FXB006 being tested at SLAC.

SLAC, the site of the Next Linear Collider Test Accelerator (NLCTA) facility, is currently testing Fermilab's newest RF structures. These devices are stacks of precision-machined copper discs with holes in the center that transfer energy from a power source to a beam of electrons. The R&D focuses on manufacturing discs that achieve the highest acceleration per meter with the most reliability.

FXB006, one of the latest Fermilab RF structures sent to SLAC, has passed a critical test. "FXB006 is the first structure ever produced that has simultaneously met the 65 megavolts per meter and less than 0.1 breakdowns per hour requirements," said Shekhar Mishra of Fermilab's Technical Division. "The breakdown rate of this structure after more than 200 hours of processing is 0.05 per hour." Its brother, FXB007, follows closely behind with a breakdown rate of 0.16 per hour.

"It took us, as part of the NLC Collaboration, four years to develop and produce this set of prototype discs," said Dave Finley, group leader of Fermilab's X-band (FX) accelerator structure team. Finley noted that the resources developed at Fermilab could be applied to either a room-temperature or a superconducting linear collider.

Fifty-two discs make up one 60-cm-long structure. The NLC would use 18,000 structures. With help from Fermilab, Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory and KEK, the Japanese High Energy Accelerator Research Organization, researchers at SLAC are advancing accelerator design at their NLC Test Accelerator. The RF structures are being produced at Fermilab in collaboration with KEK and SLAC. A newer version of the RF structure, designated FXC, contains slotted disks and is currently undergoing testing at the NLCTA. Finley quipped: "The NLC's motto seems to be: The better is the enemy of the good enough."

Submitted by DOE's Fermi National Accelerator Laboratory

PPPL's Neilson: Star Generator

PPPL physicist Hutch Neilson, Project Head of NCSX.

For more than two decades, Hutch Neilson has been fascinated by the physics of a class of fusion devices called stellarators. Now Neilson, a physicist at DOE's Princeton Plasma Physics Laboratory (PPPL), is at the helm of the National Compact Stellarator Experiment (NCSX).

NCSX is planned as the centerpiece of the U.S. effort to develop the physics and determine the attractiveness of the compact stellarator as the basis for a fusion power reactor. The NCSX will be built at PPPL in partnership with Oak Ridge National Laboratory (ORNL). The project operations are scheduled to begin in 2008.

"What interests me about stellarator physics is the three-dimensional structure of the magnetic field and the plasma shape," said Neilson, NCSX Project Head. "The cross-sectional shape of a three-dimensional plasma depends on where the torus is sliced, while the cross-sectional shape of a tokamak - another fusion machine configuration that is a two-dimensional torus - is always the same. Consequently, stellarator physicists have three degrees of freedom to tailor the plasma shape for good performance. There are only two degrees of freedom in a tokamak." Plasmas are hot, ionized gases used as the fuel for fusion devices. The NCSX will help fusion researchers understand the physics of three-dimensional magnetized plasmas.

Neilson, who joined PPPL in 1996, became interested in stellarators in the early 1980s while at ORNL. PPPL founder Lyman Spitzer, Jr., coined the phrase "stellarator," which means star generator. Dramatic advances in magnetic confinement physics and computational capabilities have led researchers to return to this new version of the concept called the compact stellarator.

"I think it is fitting that the Laboratory, after making historic advances with tokamaks, has turned to the task of expanding our understanding of toroidal configurations to find the best solution for magnetic fusion reactors," Neilson said.

Submitted by DOE's Princeton Plasma Physics Laboratory