PPPL's Don Monticello

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

Number 203 February 20, 2006

Research Highlights . . .

Proton radiation more dangerous than once thought

At the NASA Space Radiation Laboratory at DOE's Brookhaven National Laboratory, scientists have found that proton radiation is more damaging to cells than previously assumed—specifically, the cells' DNA. Since protons are the most abundant type of particle in deep space, this research may help scientists design spacecraft and spacesuits that can properly protect astronauts traveling far from Earth. Additionally, this work sheds light on the true nature of proton radiation, which was thought to damage tissue in a way similar to x-rays. The results of the study show, instead, that protons are as damaging to DNA as high-energy iron ions and other heavy charged particles.

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

Boson or boson lite? DZero event sets limit on Higgs boson mass

How do particles get their masses? Physicists study the Higgs field, and hence, a particle associated with this field called the Higgs boson, to answer that question. Although no direct evidence for the Higgs boson has been found, researchers at the DZero experiment at the DOE's Fermilab are searching for the Higgs boson using several production channels. Results from a recent search for simultaneous production of a Higgs boson and a Z boson suggest that the Higgs mass range should be between 100 to 140 GeV/c2, a region where the Tevatron has the capability of producing it. This limit is consistent with the Standard Model.

[Dawn Stanton, 630/840-2237, dstanton@ fnal.gov]

Gold 'shines' differently at the nanoscale

Researchers at DOE's Argonne National Laboratory have found that gold "shines" in a different way at the nanoscale, and the insights may lead to new optical chips for computers or for switches and routers in fiber networks. The Argonne researchers examined the characteristics of photoluminescence in gold nanorods, and found that they could control the wavelength of the light emitted by the material, making it possible to use as a light source inside an optical chip, allowing transmission of information through light. The gold nanorods are about 20 nanometers wide and range from 70 to 300 nanometers long.

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

Making a good thing even better

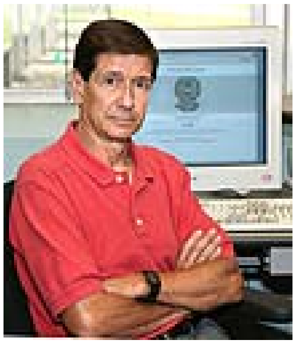
When Ames Laboratory senior metallurgist Iver Anderson patented a tin-silver-copper solder back in 1996, it was a major break-through in the search for a lead-free substitute for traditional solder. With the European Union banning lead and other hazardous materials from all appliances July 1, Ames Lab's lead-free solder has been licensed by more than 60 companies world-wide. But Anderson's DOE lab group is continuing to work to address the problem of brittleness as the solder "ages" at high temperature. By adding zinc to the tin-silver-copper mix, Anderson's initial findings show that solder joints made with the zinc-modified solder withstand much higher impacts than those made with the regular lead-free formula.

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

PPPL's Monticello focuses on the 'fourth state'

Whether his gaze is tilted toward the heavens or at a computer screen, the focus has always been plasma for Don Monticello, a scientist at the DOE Princeton Plasma Physics Laboratory (PPPL). Plasma is the fourth state of matter—a hot, gaseous, electrically charged state that makes up the sun and the stars, and is used as the fuel to produce fusion energy. At PPPL, physicists use a magnetic field to confine plasma.



Don Monticello

Monticello is a theoretical physicist whose research leads to advances in understanding the behavior of plasma and how fusion devices operate. At PPPL, his pioneering work focuses on modeling plasma disruptions and three-dimensional computational simulations of laboratory plasmas. Presently, his primary responsibility is calculating equilibria—various modes of stable plasma performance—for the National Compact Stellarator Experiment (NCSX), an experimental fusion device being constructed at PPPL. He is part of a team that has developed a computer code capable of calculating the shape a three-dimensional plasma would take in fusion devices called stellarators. This was a key tool in the design of NCSX.

He joined the Laboratory's Theory Group in 1975 after receiving a bachelor's degree and a Ph.D. in physics from the University of Rochester and spending two years at the Institute for Advanced Study in Princeton, N.J. At the Institute, Monticello and coworkers involved in computational science were among the first to do large-scale computations involving the motion of electromagnetic waves along the magnetic field lines in a plasma. At PPPL, he continued this work, developing a set of reduced equations that allowed one to simulate the evolution of the plasma in fusion devices on computers, which previously had not been feasible.

"Understanding the behavior of the plasma in fusion devices is essential in the successful design and operation of fusion devices," says Monticello, whose work has significantly contributed to this understanding.

The father of five and grandfather of six, who devotes his outside time to family, fitness, sports, and astronomy, freely shares his enthusiasm for fusion and plasma science research—as well as astronomy—with the public through talks for various groups. "It is really rewarding to work in fusion because the potential benefits to society are enormous," says Monticello. "Astronomy also is a very exciting area. It leads to our understanding of our origins and the origins of the universe."

Monticello is a Fellow of the American Physical Society and a recipient of the 2001 UT-Battelle Award for Scientific Research by a Team for research on the physics of plasma confinement in three-dimensional systems.

Submitted by DOE's Princeton Plasma Physics Laboratory

DOE labs unite for New Horizons launch

NASA's New Horizons mission to Pluto, which was launched earlier this year, was enabled, in part, by the work of three Department of Energy national laboratories. Labs in Idaho Falls, Idaho, Oak Ridge, Tenn., and Los Alamos, N. M., all played key roles in providing the radioisotope thermoelectric generator, or RTG, which powers the pioneering probe.

"Developing the technology to sustain the instruments in deep space over a long period of time required America's best and brightest minds. I'm honored that our labs' scientists and engineers could play such a significant role in helping to make this mission a success," said Secretary of Energy Samuel Bodman.

Oak Ridge National Laboratory developed the material used to encapsulate the plutonium used in the RTG. Los Alamos National Laboratory purified, pelletized into a ceramic form and then encapsulated the plutonium. And Idaho National Laboratory handled assembly and testing of the finished RTG. "This launch is a huge accomplishment for the Department of Energy, state of Idaho and our INL family," said Stephen Johnson, manager of INL's RTG program. "Workers will be able to look back 10 years from now when images are being received from the first mission to the last planet and say to their grandchildren, 'I built that right here in Idaho.'"

The radioactive decay of the plutonium inside the RTG provides the energy needed to run New Horizons' on-board equipment. NASA hopes the science probe's instruments will yield important new data about Pluto. That's likely to happen because Pluto has never been the object of a space mission before. Some previous space science missions used solar power, but energy from the sun is too weak to provide sufficient power at the outer reaches of the solar system. RTGs have been used on 25 missions over the last 40 years.

Submitted by DOE's Idaho National Laboratory