INL's Harold McFarland

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

New discovery improves waste processing

DOE Idaho National Laboratory researcher Jay Roach is collaborating with researchers at the Saint Petersburg Electrotechnical University to solve an unusual radioactive waste processing challenge. The team has modeled, designed, and successfully demonstrated a prototype drain valve that functions without moving parts to process high temperature molten materials. The valve uses induction energy to form varying thicknesses of the waste itself on cooled valve walls; thus opening, closing and providing modulated flow. The team's next steps will be to demonstrate the ability to control flow rates via optimized design and energy deposition. The result of this discovery is that processing systems could become more robust and reliable in immobilizing radioactive waste.

[Reuel Smith, 208/526-3733, Reuel.Smith@inl.gov]

Scientists predict starquakes

Scientists at DOE's Los Alamos National Laboratory have discovered a remarkably simple, predictive pattern to earthquake-like events in pulsars called glitches. The dense remains of exploded stars, pulsars contain our sun's worth of mass all compacted into a sphere roughly 20 miles across. While pulsars are born spinning, they gradually slow down over time and have frequent glitches. During a glitch, the pulsar's spin rate speeds up and then slows down again. Based on observations of one particular pulsar called PSR J0537-6910, the scientists believe the glitches are caused by cracks in a pulsar's dense surface crust, which momentarily increases its spin rate.

[Kevin Roark, 505/665-9202, knroark@lanl.gov]

New X-ray delivery method could improve radiation therapy

Researchers at DOE's Brookhaven Lab and collaborators say they've improved "microbeam radiation therapy" (MRT), an experimental form of radiation treatment that uses parallel arrays of planar x-ray beams (picture the slats of open window blinds) to control malignant tumors in animals with high radiation doses while sparing adjacent normal tissue. A synchrotron is required to produce ultra-thin beams, but thicker beans could be generated by specialized x-ray tubes of extremely high voltage and current. The scientists demonstrated that such thicker beams "interlaced" within well-defined "target" tissue could effectively kill target tissue while minimizing collateral damage. These improvements could eventually make MRT available in hospitals.

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

Fermilab's CDF finds that avoiding a break-up pays off

Scientists of the CDF collider detector at the DOE's Fermilab have found evidence of a new kind of particle reaction, resulting from a process which could be used in the future to detect the Higgs boson.

In the Tevatron collider, protons and antiprotons break apart into quarks when they collide, producing new particles. But this time, the proton and antiproton each remained intact, glancing off each other in a process which created two high-energy photons and nothing else.

CDF researchers believe a similar process could also produce the elusive Higgs and allow for its measurement at CERN's Large Hadron Collider, due to begin operations in 2007.

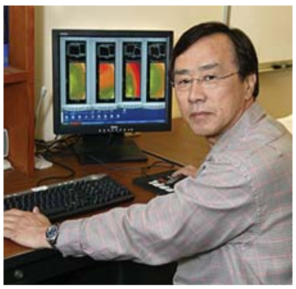
[Mike Perricone, 630/840-5678, mikep@fnal.gov]

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 collaboration yields important fusion advance

Researchers at DOE's Princeton Plasma Physics Laboratory with colleagues from the Netherlands and the University of California, Davis, report a major advance in understanding the so called 'sawtooth' instability — one of the most important plasma physics phenomenon.

A plasma is a hot ionized hydrogen gas confined in a magnetic field. A hydrogen plasma heated to 100 million degrees centigrade will serve as fuel for fusion energy. The new results may substantially benefit future fusion reactors.



Hyeon Park

"The sawtooth instability derives its name from the pattern of the x-ray signal coming from the core of the plasma. The repetitive up and down (sawtooth) pattern of the X-ray signal is due to the relatively slow build up and rapid collapse of the central plasma pressure at regular intervals," said PPPL physicist Hyeon Park.

In recent work was performed on the TEXTOR fusion device in Germany, two-dimensional pictures of microwaves emitted from core of the plasma showed that during the sawtooth collapse, heat from the center of the plasma flows outward via a small disturbance in the confining magnetic field. Park explained the importance of this for future fusion power plants.

"The sawtooth instability will cause helium produced in fusion reactions to be exhausted from the center of the plasma to its edge. The helium ash will hold 20% of the fusion energy produced, and in a fusion reactor, this energy will be the predominant source of plasma heating. Once it has imparted its energy to the bulk plasma, the helium must be swept out to the edge of the plasma and removed. Otherwise it will build up, cool the plasma, and the fusion reaction will stop. However, if the sawtooth instability is not properly controlled, the helium will be swept out prematurely. So it would really be great, if we had a 'knob' on the fusion reactor to turn the instability on and off and to regulate its amplitude and frequency," he said.

In addition to its importance in developing a magnetic fusion reactor, understanding the sawtooth oscillation will be highly beneficial for solar and interstellar physics which both involve magnetically-confined plasma phenomena.

Submitted by DOE's Princeton Plasma Physics Laboratory

McFarlane leads space programs looking to future

Harold McFarland

The serene countryside of southeastern Idaho has been home and workplace to Dr. Harold McFarlane for more than 30 years. With decades of nuclear engineering experience to aid him, the newly appointed president of the American Nuclear Society (ANS) relishes his role in the future of nuclear energy.

McFarlane is the Deputy Associate Laboratory Director of Nuclear Programs at DOE's Idaho National Laboratory. He also directs the Space Nuclear Systems and Technology Division, which oversees the radioisotope power systems program, whose main focus is radioisotope thermoelectric generators (RTGs). McFarlane's program assembles generators for NASA's solar system exploration probes.

The INL space systems program works closely with the Center for Space Nuclear Research (CSNR), also located in Idaho. CSNR is developing possibilities of nuclear reactors in space and one day launching rockets from the moon, where less resistance and lower gravity could improve efficiency and speed of space exploration and travel. The center also researches the technology innovations that would enable humans to live in space.

INL assembled its first RTG for the New Horizons mission to Pluto to expose the planet's well-hidden mysteries. More in-depth information on Pluto will help scientists understand the history and composition of our solar system. McFarlane initiated the transfer of the RTG assembly operations from Ohio to INL in 2004 and witnessed INL's first product launch to Pluto in early 2006.

McFarlane's experience includes 20 years of fast reactor development and 12 years leading nuclear fuel cycle research explaining his excitement about the Department of Energy's Global Nuclear Energy Partnership. He has served as the Argonne National Laboratory-West site manager, assistant laboratory director for environment, safety and health and program manager for the Zero Power Physics Reactor.

Submitted by DOE's Idaho National Laboratory