SLAC's Hogan researches hot topics.

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Breast probe detects malignant tumors instantly

DOE's Lawrence Livermore National Laboratory has partnered with San Jose-based BioLuminate, Inc. to develop "Smart Probe," a tool for earlier, more accurate breast cancer detection that removes no tissue and is expected to achieve accuracy levels comparable to surgical biopsies in detecting cancerous cells. The Smart Probe, smaller than the needle used in routine blood tests, is inserted into breast tissue after an initial screening indicates an area of concern. The probe looks for multiple known indicators of breast cancer, instantaneously providing physicians with information they can use to determine whether more invasive and costly tests are necessary. First human studies using the device are expected to begin this spring.

[Anne M. Stark, 925/422-9799, stark8@llnl.gov]

Clean chip making

Scientists at DOE's Los Alamos National Laboratory have developed a new technology application that could almost eliminate the use of hazardous corrosives and the production of wastewater in the fabrication of integrated circuits, or chips, for computers. In the usual process, high intensity light along with aggressive acids and corrosives are used to create a chip's tiny integrated circuits. Los Alamos researchers have demonstrated a technology using carbon dioxide at high temperature and pressure to replace the more expensive and hazardous solvents and eliminate the need for the tremendous quantities of ultra-pure water used to rinse the solvents from the chips.

[Kay Roybal, 505/665-0582, k_roybal@lanl.gov]

Greenhouse effect threatens western U.S. water

Serious water problems are projected for the western United States by the year 2049 because of an increase in atmospheric levels of carbon dioxide, say scientists with the DOE's Lawrence Berkeley National Laboratory. Warmer overall temperatures may spell more rain and less snow in the winter, which will mean more flooding in the spring and a reduced water supply for increasingly dry summers. These projections were presented by Jinwon Kim, a climatologist with Berkeley Lab's Earth Sciences Division, at the 81st meeting of the American Meteorological Society.

[Lynn Yarris, 510/486-5375 lcyarris@lbl.gov]

New seismic sources spark deep ocean shockwaves

The cost and safety of deep ocean drilling depends heavily on drillers "guessing" when to line the well hole with pipe and when to keep drilling. Engineers at the DOE's Idaho National Engineering and Environmental Laboratory are developing two new seismic sources to accurately determine borehole pressures without removing pipe or stopping drilling. In early tests, these two sources successfully directed controlled explosions below the borehole, where the information is most critical—the Regenerative Combustion Source by setting off hydrogen gas and the Capacitive Discharge Source by sparking the formation of an exploding air bubble.

[Mary Beckman, 208/526-0061, beckmt@inel.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).

Quark Matter 2001 features first RHIC results

More than 700 physicists from around the world gathered at Stony Brook University (SBU) and DOE's Brookhaven National Laboratory for the Quark Matter 2001 conference the week of January 15. The main highlight was the presentation Monday afternoon of first physics results from the four experiments at BNL's Relativistic Heavy Ion Collider (RHIC). More than 1,000 scientists—including physicists from Ames Laboratory, Argonne National Laboratory, BNL, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and Oak Ridge National Laboratory—have collaborated on these experiments, which aim to detect and study a new form of matter, the quark-gluon plasma.

At Quark Matter 2001, physicist Gunther Roland presented findings from the PHOBOS experiment at the Relativistic Heavy Ion Collider.

While none of the RHIC presenters claimed to have created quark-gluon plasma, the halls were abuzz with excited discussion of the new data, which suggest that RHIC will be able to detect the quark-gluon plasma with certainty and allow scientists to study its complicated properties. The scientists agree that the collision environment appears favorable for producing matter at high temperatures and densities, which bodes well for the future.

Among the findings so far:

- The highest energy density ever achieved in a laboratory.
- Stronger elliptical flow than has been seen before.
- A large number of particles produced.
- A higher antimatter to matter ratio than in lower energy collisions.
- A drop in the momentum of some particles, suggesting that they might be slowed down by having to traverse a new medium.

How much these early results will contribute to scientists' understanding of a possible phase transition to quark-gluon plasma is not yet clear. But the picture should start to fill in as the scientists collect and analyze more data at even higher collision energies when RHIC resumes operations this spring.

Submitted by DOE's Brookhaven National Laboratory

Hogan has a name to live up to

Mark Hogan

Mark Hogan is a postdoctoral researcher in physics at the DOE's Stanford Linear Accelerator Center. "With a last name like Hogan, I get lots of remarks. Sometimes it's the comparison to the pro wrestler Hulk Hogan, but since I'm 6'6" and 185 pounds, I guess I wouldn't make it in that sport. And TV fans always talk about Hogan's Heroes."

While he may not be a TV star, Hogan and his thesis research on self-amplified spontaneous emission (SASE) are hot stuff at SLAC right now. "The Lab is in the R&D stages of work on a free electron laser and the SASE model is an important component of that," says Hogan. A free electron laser (FEL) will use the last one-third of the two-mile accelerator to produce a new kind of light source, capable of producing 10^{10} times more X-rays than current circular accelerators. If Federal funds are secured by 2003, scientists could start using the machine to take data by 2006.

Hogan will be ready. He has already written several publications on the SASE effect and much of his doctoral work at UCLA and Los Alamos involved the building and commissioning of a linear accelerator and two SASE Free Electron Lasers.

Hogan is currently working on plasma wakefield acceleration studies in the Advanced Accelerator Research department, in a collaboration that includes SLAC, UCLA and USC. The group is looking into a variety of designs that will help guide future generations of accelerators.

After his postdoc at SLAC, Hogan plans to stick around, if invited. Besides, Hogan was born right next door to Stanford in Palo Alto and as he says, "I won't be wrestling, but I'll do triathlons, run marathons and be outdoors when I'm not working inside the lab."

Submitted by DOE's Stanford Linear Accelerator Center