Argonne scientist-student team

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Solar installation approved for Beijing Olympics

Researchers at DOE's National Renewable Energy Laboratory participated in a recent Green Beijing Olympics meeting that resulted in an agreement between the United States and China to cooperate on a 100-kilowatt photovoltaic installation for the 2008 Olympics. Green Olympics means priority will be given to environmental protection in the planning, designing and construction of Olympic venues and facilities. The objective of the project is to use solar cells to provide a significant portion of the electricity that will be consumed at either the Olympic Gymnasium or the Olympic Village. DOE and NREL have agreed to provide technical assistance for this project.

[Sarah Holmes Barba, 303/275-3023, sarah_barba@nrel.gov]

Black-hole jets may induce star formation

Astronomers have discovered how ominous black holes can create life in the form of new stars, proving that jet-induced star formation may have played an important role in the formation of galaxies in the early universe. Using the Very Large Array at the National Radio Astronomy Observatory in New Mexico, the Keck telescopes in Hawaii and the Hubble Space Telescope, DOE Lawrence Livermore National Laboratory astronomers have shown that "Minkowski's Object," a peculiar starburst system in the NGC 541 radio galaxy, formed when a radio jet – undetectable in visible light but revealed by radio observations – emitted from a black hole collided with dense gas. The researchers carried out the observations after LLNL computer simulations had shown that jets may trigger the collapse of interstellar clouds and induce star formation.

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

Mapping technology aids tsunami recovery

Relief agencies working to assist victims of the Asian tsunami are using a demographic database developed at DOE's Oak Ridge National Laboratory. LandScan is a global population database that shows geographical distribution of population at one-kilometer resolution. Using population distribution maps, relief workers can easily and quickly determine the locations of potential tsunami victims who would otherwise be cut off from communication. The database system is being used to identify spatial and population numbers in the impacted tsunami areas, down to the square kilometer. Before the disaster, LandScan data was used to plan aid and recovery efforts after the 2003 earthquake that destroyed Bam, Iran.

[Ron Walli, 865/576-0226, wallira@ornl.gov]

Tunnel facility shed light on CO_2 in cold water

Researchers at DOE's National Energy Technology Laboratory presented valuable data on CO_2 behavior in cold aqueous systems based on research conducted using the High-Pressure Water Tunnel Facility. A focus of the research is deriving CO_2 solubility information and mass transfer coefficients by measuring dissolution of CO_2 in seawater at various levels of dissolved CO_2. The data are critical in understanding the thermal, physical, and thermodynamic behavior of CO_2 under the conditions anticipated in deep-ocean sequestration scenarios, and will help scientists understand the formation mechanism of CO_2 hydrate and the ultimate fate of sequestered CO_2 in deep-ocean conditions..

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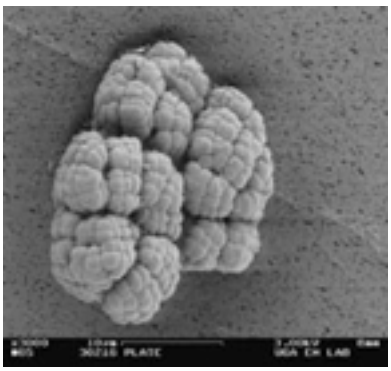
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions.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

SRNL learns lessons from radiation-resistant bacteria

The extremely hostile environment of a high-level radioactive waste tank is the last place you would expect to find life, but researchers at DOE's Savannah River National Laboratory have found an astonishingly resilient microorganism that thrives in that unlikely environment, and are eagerly learning what the tiny creature can teach.



The rough, tough **Kineococcus radiotolerans**

A few years ago, a slimy substance was found on a monitoring probe in one of the Savannah River Site's high-level waste tanks; analysis of this material later indicated the possibility of some type of microorganism. Samples were examined in SRNL's shielded cells, and SRNL researchers working with personnel from the University of Georgia discovered *Kineococcus radiotolerans*: a microorganism able to withstand radiation doses thousands of times the dose that is lethal to humans. It is also capable of withstanding UV exposure and prolonged desiccation, along with various chemical toxins that have proven lethal to previously discovered radiation-resistant bacteria. It is able to do these things because it has powerful self-repair mechanisms that simply repair cell damage caused by radiation and other toxic agents.

Learning more about these self-repair mechanisms that allow it to withstand high radiation may prove useful in a variety of fields, from environmental cleanup to space exploration and medicine.

SRNL researchers are studying *Kineococcus radiotolerans* and its capabilities. The microorganism also is currently undergoing genome sequencing at the DOE Joint Genome Institute (JGI). Insight into the genome of this unique bacterium will provide important clues into strategies for life and survival in high-level waste and radiation resistance. Interestingly, the content of the *Kineococcus* genome suggests purposeful adaptations to the HLW environment.

These capabilities may lend this bacterium as a potentially useful candidate for in-tank biodegradation of problematic HLW constituents. So far, it appears that it can degrade organics, like solvents and herbicides, while in the presence of radiation and other toxic agents.

Submitted by DOE's Savannah River National Laboratory

Student, scientist illuminate future

William Thompson, left, and Argonne's Rex Gerald have been collaborating on research since William was 12.

When Rex Gerald, at chemical physicist at DOE's Argonne National Laboratory, first met William Thompson at a regional science fair, the tall, serious, and reserved eighth grader made an immediate impression on Gerald. "My initial thoughts about William were that he was a bit defensive and arrogant," Gerald said. "He probably had a similar opinion of me."

Maybe the perceived arrogance was really just confidence. After all, William had a reason to be confident. His project achieved the Best in Physics award at the Chicago Regional Science Fair.

On June 5, 2004, more than two years and handfuls of science awards later, Thompson and Gerald were honored for their work.

William, now a high school junior at St. Ignatius College Preparatory School in Chicago, received the ComEd 100 Science Award for his work with toroid cavities. The award honors students who exhibit a strong interest in science and develop an exemplary scientific project.

The program also recognizes leading mentors who actively support these students. Gerald received one of five Illinois statewide Illuminator Awards, after William nominated him.

William's collaboration with Gerald has most recently centered on nuclear magnetic resonance, which allows researchers to obtain information about the physical, chemical and electronic properties of molecules in complex systems.

"It can determine the flavor of a jelly bean and the color of a jelly bean based solely on the properties of the response," William said. "Rex brought me into this esoteric field and taught me NMR, how to use the device, and the whole science behind it."

In his essay nominating Gerald for the Illuminator Award, William wrote: "Dr. Gerald is a gifted scientific intellectual and an intrepid scientific researcher, explorer and inventor, is axiomatic. What is not readily known is his unique gift for encouraging young scientists to persevere in the face of inevitable experimental failures, challenging them to think 'outside the box,' or the confines of orthodoxy, to find the answers to surmounting the obstacles that loom so large in front of them."

Submitted by DOE's Argonne National Laboratory