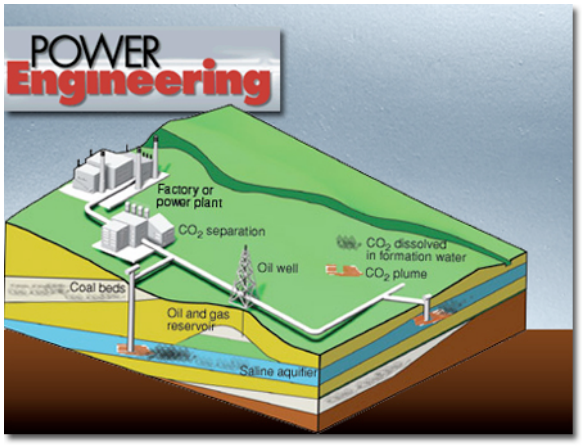
LAWRENCE LIVERMORE REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory: Feb. 9-Feb. 17, 2009.

Carbon sequestration rocks



One approach to help stem the increase of carbon dioxide in Earth's atmosphere is to capture it at the source and inject it into an underground formation.

The Lab's Julio Friedmann recently described how carbon capture and sequestration (CCS) works when carbon dioxide is injected into a geological formation.

Many utility suppliers are interested in clean coal technology and one of the ways to get energy while limiting the amount of CO2 emitted into the atmosphere is by capturing the carbon at the source.

At a conference late last month, Friedman said rather than injecting a gas into rock formations, CCS injects a dense, pore-filling liquid. "You are injecting liquid into a rock, not into space," Friedmann said in a *Power Engineering* article.

To read more, go to http://pepei.pennnet.com/Articles/Article_Display.cfm?Section=ARTCL&PUBLICATION_ID=6&ARTICLE_ID=352792&C=INDUS&dcmp=rss

Lab scientist's research appears in prestigious journal

Kevin Moore

The Lab's Kevin Moore, who teamed with a United Kingdom collaborator, has published an article in *Reviews of Modern Physics*, which refines decades of actinide science and may just become the preeminent research paper in the field.

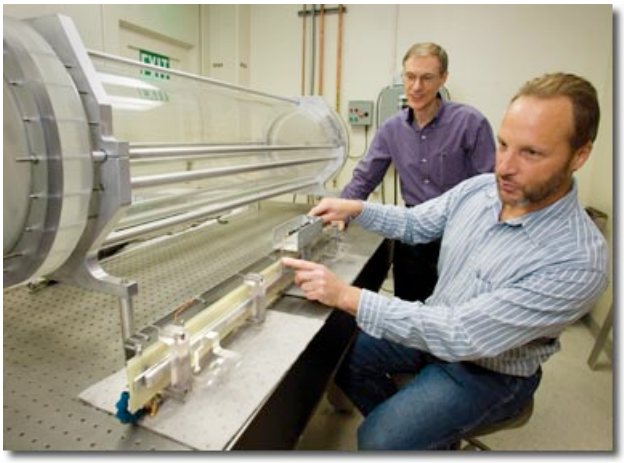
Reviews of Modern Physics is the premier journal for physics research. It is the fifth highest ranked journal out of all fields and only publishes 32 invited papers a year. Each year, one or more of the invited papers are used in part as acceptance speeches for the Nobel Prize in physics.

Moore of LLNL and Gerrit van der Laan at the Diamond Light Source in the United Kingdom wrote "Nature of the 5f States in Actinide Metals," which describes the electronic, magnetic and crystal structure of actinides and demonstrates the importance of actinide science to a broad class of scientists. It appears in the Feb. 6 edition of *Reviews of Modern Physics*.

Actinides encompass the 15 chemical elements that lie between actinium and lawrencium on the periodic table, with atomic numbers 89-103. The actinide series derives its name from the first element in the series, actinium. The 5f states are complicated electron wave functions.

To read more on the research, go to *Reviews of Modern Physics* at http://scitation.aip.org/getpdf/servlet/GetPDFServlet?filetype=pdf&id=RMPHAT000081000001000235000001&idtype=cvips&prog=normal

Proton therapy could become the norm in cancer treatment



Engineer Mark Rhodes (seated) and physicist George Caporaso adjust a prototype Blumlein transmission-line generator, which will supply power to the high-gradient insulators forming the beam tube dielectric walls in LLNL's compact proton accelerator.

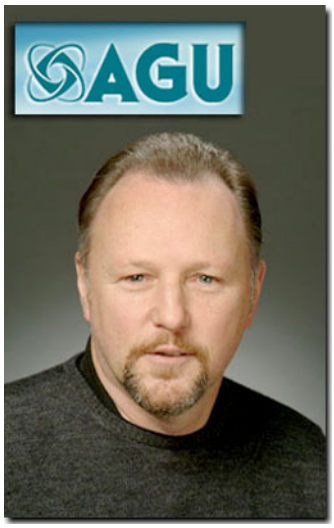
Though doctors struggle to discover new cancer treatments, LLNL high-energy physicists have discovered a tool originally used to model bombs that can be transformed for cancer treatment.

While looking for ways to make this accelerator smaller and cheaper, scientists came up with the Dielectric Wall Accelerator. It's basically a tube for carrying a particle beam, explains George Caporaso, beam research program leader at Lawrence Livermore. What's different about this beam tube is that the inner wall consists of alternating rings of electrical insulators and conductors. This allows the creation of a very strong electric field that permeates the inside of the tube; in principle it could boost protons to the energies needed for cancer treatment in just two meters.

The technology is being developed by Compact Particle Accelerator Corp. in Madison, Wis., a spinoff of the radiation therapy company TomoTherapy.

An article about the history of proton therapy for cancer treatment appears in *Symmetry Magazine*, which is published by Fermilab and the Stanford Linear Accelerator. To read more, go to http://www.symmetrymagazine.org/cms/?pid=1000673.

Lab's Rick Ryerson selected as fellow of the AGU



Rick Ryerson

LLNL scientist Rick Ryerson of the Physical and Life Sciences Directorate was recently selected to become a new fellow of the American Geophysical Union (AGU), a worldwide scientific community that advances the understanding of Earth and space for the benefit of humanity.

Ryerson's citation reads: "for contributions to our understanding of transport processes in minerals, magmas and crustal rocks at all scales."

Ryerson leads the Lab's Basic Energy Sciences-Geosciences program and is the Experimental and Applied Geophysics group leader in the Atmospheric, Earth and Energy Division. His current work includes mineral-fluid equilibrium and diffusion kinetics in the Earth's interior, focusing on geochemical applications of high-spatial resolution secondary ion mass spectrometry.

"Like many people at the Lab, I've worked on a lot of different problems over the years, and often wondered if I'd spread myself too thin to be selected as an AGU fellow," Ryerson said. "Needless to say, I was surprised and elated when I received the notification."

To read more about AGU, go to http://www.agu.org/

Into the heart of darkness to secure radiological sources

Carolyn Mac Kenzie and her team often find that source storage facilities like the one seen here are in dire need of physical security upgrades.

Want to see the world and travel to exotic places? Don't join the Navy -- become a health physicist. That's what Carolyn Mac Kenzie did.

Mac Kenzie, who joined the Lab in 1996, currently leads the LLNL team that is securing radiological sources in Africa. The team is part of the International Nuclear Materials Protection Program. Their work is supported by the National Nuclear Security Administration (NNSA) Global Threat Reduction Initiative (NA-21).

Mac Kenzie recently returned to the Laboratory after a leave of absence during which she worked first at the International Atomic Energy Agency (IAEA) in Vienna for three years and then at NNSA headquarters in Washington DC for NA-21 for another year.

While in Vienna, she led the IAEA Orphan Source Search and Secure Program and worked in more than 35 countries to establish strategic plans for locating and securing orphan and legacy radiological sources. "Orphaned sources are a serious concern because they are outside regulatory control," said Mac Kenzie. "We're particularly focused on the large, highly radioactive sources -- 100s to 1000s of curies -- that can seriously injure or kill people."

To read more, go to : https://newsline.llnl.gov/rev02/articles/2009/feb/02.13.09-africa.php

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Photo of the week

Eye on the prize: Engineer Elizabeth Dnezitis of the National Ignition Facility target fabrication group inspects one of the NIF targets. The official NIF dedication is scheduled for May.

LLNL is managed by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy's National Nuclear Security Administration.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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