LAWRENCE LIVERMORE REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory: Jan. 12-Jan 20, 2009.

LLNL and Chevron sign fuel research agreement

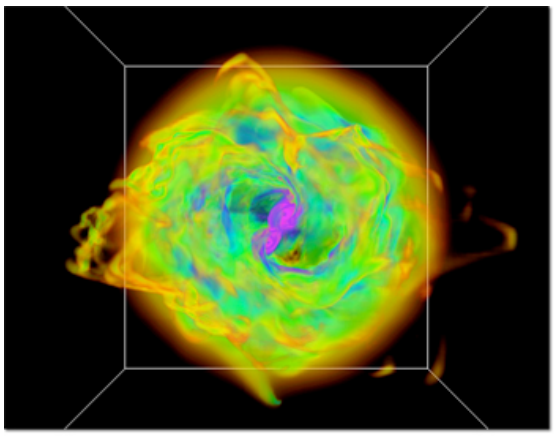
The Laboratory has signed a research agreement with Chevron to develop the next generation of catalysts for production of clean, more efficient fuels from crude oil.

The research will focus on how catalytically active surfaces form and change on contact with feed molecules and, in particular, over time, how they are influenced by promoters and impurities.

The research also will provide a better understanding of the promoter effects and impurity interactions at the atomic scale to improve catalyst efficiency, particularly effects of substitution of various metal atoms that influence catalyst selectivity and stability.

For more information, go to https://publicaffairs.llnl.gov/news/news_releases/2009/NR-09-01-03.html

Scientists gain insight on massive star formation



A volume rendering of the density field in a polar view region of the simulation at 55,000 years of evolution.

Scientists may have solved one of the most longstanding astrophysical mysteries of all times: How massive stars -- up to 120 times the mass of our sun -- form without blowing away the clouds of gas and dust that feed their growth.

New research by the Laboratory, University of California, Santa Cruz and UC Berkeley has shown how a massive star can grow despite outward-flowing radiation pressure that exceeds the gravitational force pulling material inward. The study appears in the Jan. 15 online edition of *Science Express*.

Using 3-D radiation hydrodynamics simulations, the group, which includes Livermore's Richard Klein, who also is an adjunct professor at UC Berkeley, and his LLNL postdoc Andrew Cunningham, unexpectedly discovered that these massive stars also tend to occur in binary or multiple star systems.

"Originally, we were just exploring the physics of massive star formation," Klein said. "As we were looking at the physics, we found that gravitational instabilities cause companion stars to form around massive stars."

To read more about the research, go to https://newsline.llnl.gov/_rev02/articles/2009/jan/01.16.09-stars.php

A road to safer explosives

The same explosive used in deep oil exploration may perform better and safer the next time it's used to chip away rock in search of oil.

Laboratory researchers have discovered a method to dissolve the explosive TATB to improve its quality and performance once it is reverted back to a solid.

TATB is a molecular solid with an extensive hydrogen bond network, which makes it nearly impossible to dissolve. It is a key explosive used in experiments at the Laboratory, the departments of Energy and Defense and in deep oil exploration.

"The solubility of TATB is very important in order to recrystallize TATB after its bulk production, to improve the crystal quality and the chemical purity," said T. Young-Jin Han, lead author of a paper, which appears on the cover of the January issue of the *New Journal of Chemistry*.

To read more, go to:
https://newsline.llnl.gov/_rev02/articles/2009/jan/NJC-final.pdf

LLNL models on *The Leading Edge*

The cover of the November 2008 issue of the Society of Exploration Geophysicists publication *The Leading Edge* (TLE) included images from work performed at LLNL.

The associated paper, "Characterizing Anomalous Ground for Engineering Applications Using Surface-based Seismic Methods," by researchers from the University of Nevada-Las Vegas, Ion-GX Technology, EBA Engineering, Stanley Consultants and Jeff Wagoner of the Lab's Physical and Life Sciences Directorate, was included within a special section of this *TLE* edition, devoted to near-surface geophysics.

Wagoner's 3D shallow shear wave velocity model for the Las Vegas valley is featured on the cover. The authors show that seismic surface-wave methods can be successful in developing shear wave velocity profiles for the top few tens of meters of a complex subsurface. This information is needed for meaningful characterization of sites for earthquake hazards.

To read more, go to:
http://segdl.org/getabs/servlet/GetabsServlet?prog=normal&id=LEEDFF000027000011001544000001&idtype=cvips&gifs=Yes&

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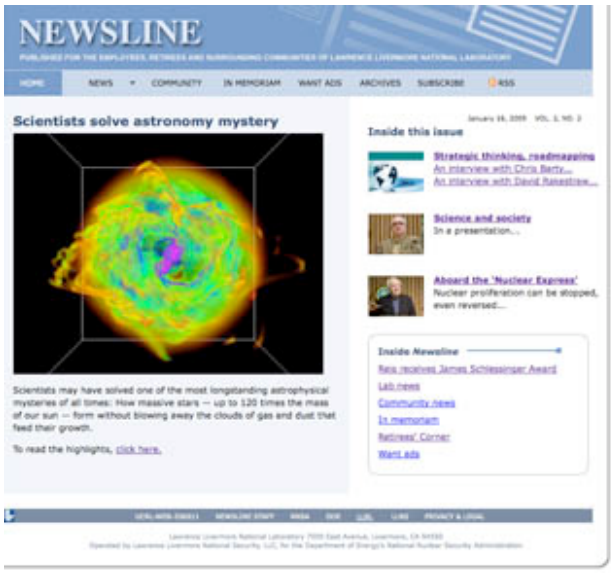

Newsline provides the latest Lab research and operations news. See the most recent issue at https://newsline.llnl.gov/_rev02/index.php

Photo of the week

Check it out: From left to right, Anders Petersson, Michael Pasyanos, Artie Rodgers, Steve Myers, Bill Walter and Rengin Gok listen in as Rodgers discusses computer simulations showing seismic disturbances in the Middle East. The simulations were made on the Lab’s supercomputers.

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.

To send input to the Livermore Lab Report, send e-mail mailto:labreport@llnl.gov.

The Livermore Lab Report archive is available at: https://publicaffairs.llnl.gov/news/lab_report/2009index.html