



LLNL's  
Steve  
Suppe

# Research Highlights . . .



Science and Technology Highlights from the DOE National Laboratories

## Solar cell sets efficiency record

Scientists at DOE's [National Renewable Energy Laboratory \(NREL\)](#) have set another [world record in solar cell efficiency](#) with a photovoltaic device that converts 40.8 percent of the light that hits it into electricity. The new solar cell differs significantly from the previous record holder – also based on a NREL design. Instead of using a germanium wafer as the bottom junction of the device, the new design uses compositions of gallium indium phosphide and gallium indium arsenide to split the solar spectrum into three equal parts. Those are absorbed by each of the cell's three junctions for higher potential efficiencies. The new cell, which is extremely thin and light, is a natural candidate for use on space satellites and in solar concentrators on Earth.

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## Garbage in, fuel out?

To get bacteria to turn biomass into biofuels or other chemicals, researchers need to understand what the bugs eat and what byproducts they produce. But processing samples introduces delays during which these so-called metabolites can change. Scientists at DOE's [Pacific Northwest National Laboratory](#) developed a system that uses a bioreactor sitting in a nuclear magnetic resonance (NMR) instrument. Bacteria grow and metabolize under controlled conditions, and researchers can take NMR snapshots of the whole caboodle without having to manipulate the sample. Initial use of the system revealed significant amounts of a previously unreported metabolite. The work took place at DOE's [EMSL](#) user facility at PNNL and appeared on the cover of the May 2008 [Journal of Magnetic Resonance](#).

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## PPPL team takes flight on "Weightless Wonder"

Four students from The College of New Jersey who are collaborating with the DOE's [Princeton Plasma Physics Laboratory](#) took their Dusty Plasma Experiment (DPX) on a special zero gravity flight in June. Team DPX went to NASA's Microgravity University in Houston to carry out, "Using Fluorescent Dust to Obtain a Three-Dimensional Analysis of a Dusty Plasma," aboard a DC-9 plane affectionately known as the "Weightless Wonder." Plasma is the fourth state of matter; dusty plasmas are prevalent throughout the universe, including in comet tails and the rings of Saturn. The experiment studied the science of dusty plasmas in microgravity —how dust and plasma interact, and the effects of gravity on dust particles. The DOE Office of Science-Fusion Energy Sciences provided some funding and PPPL donated equipment.

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## Plug-in hybrid electric vehicle demos amassing data

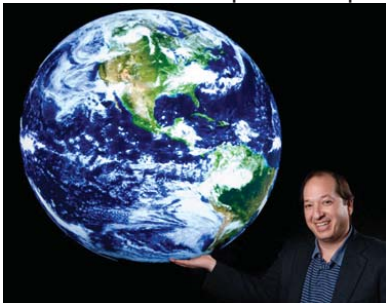
As plug-in hybrid electric vehicles (PHEVs) ride the cusp of commercialization, [field tests are revving up](#). Public and private vehicle fleets using plug-in hybrids are sending day-to-day driving data to DOE's [Idaho National Laboratory](#) for analysis. PHEVs use larger batteries than conventional hybrids and recharge from a standard electrical socket. By the end of 2008, more than 140 PHEVs from across the nation will be transmitting data to INL about gasoline and electricity use, average and top speeds, miles driven per charge, and charge duration. [INL's analysis](#) will help gauge PHEV potential for reducing petroleum use and gaining wide acceptance.

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## Science on a Sphere tells the energy story

At its Visitors Center, DOE's National Renewable Energy Laboratory recently unveiled one of the world's newest—and coolest—science communications tools—Science on a Sphere (SOS®). It looks like the Earth is hanging from the ceiling, but SOS is actually a room-sized, global display system that uses computers and video projectors to display planetary data and other animations onto a sphere-shaped screen. It was



**Former DOE Assistant Secretary Andy Karsner made it possible for NREL to acquire Science on a Sphere.**

invented by Dr. Alexander "Sandy" MacDonald, the director of the NOAA Earth System Research Laboratory in Boulder, CO, as a way for scientists to explore environmental data using new visualization techniques. But its potential for educating the public on large-scale earth

sciences events and issues was quickly obvious. The initial systems were installed two years ago for public programs at a few prominent U.S. science museums. NREL is the first DOE national laboratory to use the system. The lab has joined a growing international SOS community, which now includes the Smithsonian Institution and the NASA Goddard Space Flight Center, as well as science museums in Singapore, South Korea and Taiwan.

For its NREL debut, the laboratory produced a brisk animated program called Energy Planet that examines both the world's growing energy problem and the leading role that NREL and renewable energy technologies play in its solution. Energy Planet is designed to be an overview program for lab visitors and tour groups, but it also has been distributed to other sphere intuitions.

NREL also is producing a second program for Sphere institutions, *NREL: Delivering Renewable Energy* that combines a half-dozen unique maps and animations into a program about renewable energy resources and related topics, as well as NREL research. The Sphere can be manually operated by a host speaking live to an audience, and controlling the system with a Wii remote control. The Sphere itself is a hollow ball made of carbon fiber. It weighs 45 pounds and is suspended from the ceiling by tree thin wires.

**Submitted by DOE's National Renewable Energy Laboratory**

## LLNL's STEVE SUPPE TAKES HIS WORK TO ISRAEL

Schools and libraries in Israel are about to get a much needed boost in basic computer support thanks to the volunteer efforts of a Lawrence Livermore National Laboratory scientist.

Computer scientist Steve Suppe has traveled to Haifa, Israel, where he will study advanced techniques in information retrieval. Suppe, of LLNL's Computation Directorate, was awarded a Fulbright Student Grant to study at the University of Haifa.



**Steve Suppe**

The Fulbright Program is sponsored by the U.S. State Department and allows students, scholars and career professionals access to graduate study, advanced research and teaching opportunities at institutions around the world.

Suppe was selected out of thousands of candidates for the prestigious grant and will work in conjunction with IBM Research Labs, also in Haifa. His Fulbright proposal emphasized both research and community service.

On the research front, he will study advanced techniques in information retrieval and data mining of unstructured text. He will focus on the representation, storage, organization and retrieval of unstructured data, with an emphasis on textual documents.

In his spare time, Suppe plans to volunteer for a variety of activities, from helping with basic computer support for schools and libraries to working in a broader role to help make the community a better place.

"I am hoping to venture outside of my comfort zone and make some real friends in the area," Suppe said. "The computer science part is so exciting, but learning about Israel and the people there — a place with such a deep knowledge of its history — is what excites me more than anything."

At LLNL, Suppe is a member of the Global Security Principal Directorate's Counterproliferation and Oplntel Support Program.

He was the architect of the distributed system, designing the basic topology and data flow using the IBM/Apache Unstructured Information Management Architecture (UIMA). His experience using UIMA is what drew him to Haifa, and it was the focal point of his Fulbright proposal.

**Submitted by DOE's Lawrence Livermore National Laboratory**