



# Discover LLNL

The Community Newsletter of Lawrence Livermore National Laboratory ♦ ♦ ♦ Spring 2006

## The Laboratory enhances its security

Ambassador Linton Brooks, administrator of the National Nuclear Security Administration, recently unveiled a new security asset for LLNL — a field-tested, state-of-the-art defensive weapon with a fire rate of up to 4,000 rounds per minute. The Dillon Aero gatling guns are designed as a deterrent, and will serve best if never actually used.

“Since 9/11 we have wanted to transform our security posture at nuclear institutions such as the Laboratory,” Brooks said.

The guns would be fired only in a defensive response to an actual armed assault upon the Laboratory, Brooks said. Should the need arise, these weapons would be used to protect special nuclear materials where they are housed, in central areas of the Lab, not at the perimeter or aimed toward the perimeter of the Laboratory site.

The Lab’s protection strategy for deploying the guns takes into account firing positions, lines of fire,

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Ambassador Linton Brooks, administrator of the National Nuclear Security Administration, met with the media during a special visit to the Lab recently. Brooks used the time to unveil a new security asset for the Lab — a field-tested, state-of-the-art defensive weapon with a fire rate of up to 4,000 rounds per minute.

### *Inside story: Seeing stardust*



Zurong Dai adjusts the resolution on the highest energy electron microscope for stardust evaluation. See page 2 for more on stardust.

### The Tri-Valley Science and Engineering Fair returns

The Tri-Valley Science and Engineering Fair (TVSEF), sponsored by LLNL, is celebrating its 10-year anniversary. The fair is a means for stimulating interest in science and technology among middle and high school students from public, private and parochial schools within the Dublin, Livermore, Pleasanton, San Ramon and Sunol school districts.

The public may view students’ exhibits at our new location, the Robert Livermore Community Center, 4444 East Ave., Livermore, on the following dates: Thursday, March 30, 10 a.m. to 4 p.m.; Friday, March 31, 10 a.m. to 7 p.m., and Saturday, April 1, 10 a.m. to noon. ♦

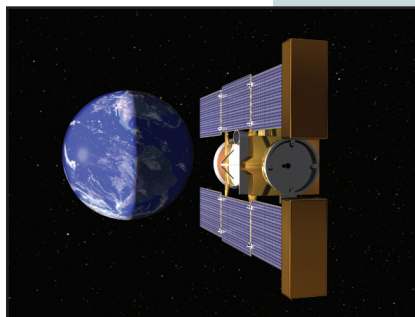
# Lab scientists examine stardust samples

A team of Livermore Lab scientists are dissecting specks of dust smaller than the human eye and from a place so far away, humans haven't even ventured there.

Led by John Bradley, director of the Lab's Institute for Geophysics and Planetary Physics, the LLNL team is part of an international group of scientists who are analyzing the dust particles that were collected and brought to Earth by the Stardust spacecraft on Jan. 15 after it landed in the Utah desert after a seven-year mission.

By trailing 'Wild 2,' a comet that was shooting materials out at 6.1 kilometers per second, the Stardust spacecraft managed to pick up cometary and interplanetary dust particles that contain the very iron that is found in every human being's hemoglobin and may provide hints to how life started on Earth.

The particles that Bradley describes as "dirt" and "cosmic crud" hold clues about the birth of our solar system and make up most of the content within the human body.



After the spacecraft landed on Jan. 15, the capsule was flown to NASA's Johnson Space Center in Houston where it was opened. The first few days were devoted to optical scanning of the aerogel tiles. Aerogel — which is a material that is made up from 99.8 percent air, provides 39 times more insulation than the best fiberglass insulation, and is 1,000 times less dense than glass — was used to ensure the samples would stay in tact as the capsule slammed into Earth at 29,000 miles per hour.

"We've collected so much stuff. We can see it. With a needle and a spatula, I could put it on the tip of my fingernail," Bradley said.

The team is conducting analysis that is very detailed. Some tracks are carved out of the aerogel with ultrasonic diamond blades (developed at the Lab). Scientists use microscopic needles to extract the dust from the tracks.

Livermore researchers use the Laboratory's transmission electron micro-



Above: Hope Ishii, a Livermore team member, displays a sample of aerogel with cometary tracks in it to members of the media, who visit the Lab recently.

Left: An artist's rendering of the Stardust spacecraft. The panels on both sides are filled with aerogel that captured millions of cometary and instellar dust.

scope and NanoSIMS — the nanometer-scaled secondary-ion mass spectrometer — to analyze the mineralogy, chemical and isotopic composition of the dust particles.

"This can help us understand where and when the particles formed," Bradley says.

There is even talk that some of the material from Stardust may point to clues about how life started on Earth. Because planets change over time — they are constantly breaking down molecularly — they are practically futile for scientists who are trying to understand how our solar system formed.

Our solar system formed — about 4.6 billion years ago — and around 3.5 to 4 billion years ago something "kicked the origin of life off real quickly on Earth soon after and the heavy bombardment by comets and chunks of asteroids subsided," Bradley said. "The organic precursors of life may have come from a comet.

"This same dust that was inherited from the galaxy into the early solar system

makes up all the atoms in your body. We're in this same interstellar dust."

Stardust is a part of NASA's series of Discovery missions and is managed by the Jet Propulsion Laboratory.

Livermore team members include Giles Graham, Alice Toppani, Hope Ishii, Zurong Dai, Sasa Bajt, Patrick Grant, Ian Hutcheon, Peter Weber, Jerome Aleon and Nick Teslich.

Stardust launched in February 1999 and set off on three giant loops around the sun. It began collecting interstellar dust in 2000 and met Wild 2 in January 2004, when the spacecraft was slammed by millions of comet particles, nearly halting the mission. But Stardust survived and has brought some of the tiniest of those particles back to Earth.

Scientists have collected thousands of meteorites and cosmic dust particles on Earth, but with few exceptions, the exact source of those materials cannot be positively identified. With the Stardust samples, scientists are starting a new chapter in astronomy. ♦

## Security

*Continued from page 1*

bullet trajectory, proper target acquisition and background. All are planned and calculated with acute awareness of nearby neighbors (many of whom are Lab families), as well as with comprehensive safeguards to protect them from rounds fired.

The cartridge chambered by the weapon is a 7.62mm NATO round, which has been deployed for years globally in urban areas. By compari-

“ . . . things like this make it clear that if terrorists try to come here, they will come here for failure rather than success.”

— AMBASSADOR LINTON BROOKS

son, local law-enforcement agencies currently carry, or deploy from their

armories, larger or more powerful munitions.

While there are several projectile options for the NATO cartridges, only rounds approved for use at DOE sites will be available to the Laboratory. Depleted uranium rounds are unavailable for the weapon.

The Livermore Police Department, which has a strong interest in the safety of Livermore citizens, supports and endorses the Laboratory's deployment of the rapid-fire rifles. ♦

LAWRENCE LIVERMORE NATIONAL LABORATORY AND SIGMA XI OF LIVERMORE

# SCIENCE ON SATURDAY

Science on Saturday is a five-week series of free lectures and demonstrations targeted at middle and high school students. The program runs March 4 – April 1.



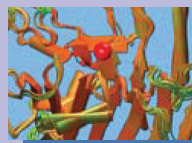
### Saturday, March 4: Waves in Nature: Lasers to Tsunamis and Beyond

Ed Moses and Rick Sawicki, LLNL Scientists • Dan Burns, Teacher, Los Gatos High School



### Saturday, March 11: Diet and Cancer: Are Cooked Meats Involved?

Mark Knize, LLNL Scientist • William Southham, Teacher, Castro Valley High School



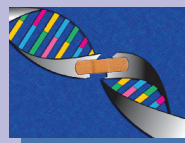
### Saturday, March 18: Life on Earth: Instructions in Three Billion (Tiny) Letters or Less

Daniel Barsky, LLNL Scientist • Frankie Tate, Teacher, Granada High School



### Saturday, March 25: Climate Change: What We Know; What We Need to Learn

Dave Bader, LLNL Scientist • Barry Marson, Teacher, Tokey High School, Lodi



### Saturday, April 1: Repairing DNA: Our Best Defense Against Cancer

John Hinz and Salustra Urbin, LLNL Scientists • Kirk Brown, Teacher, Tracy High School

SCIENCE  
ON  
SATURDAY

All lectures are held at the Amador Theater, 1155 Santa Rita Road, Pleasanton. Two presentations: 9:30 a.m. and 11:15 a.m. Seating is first come, first served. No pre-registration. For directions, see <http://education.llnl.gov/sos>  
Contact: Richard Farnsworth, Education Outreach Manager, Science and Technology Education Program, e-mail: [farnsworth1@llnl.gov](mailto:farnsworth1@llnl.gov)



## At the Discovery Center

# Experience a bit of San Francisco's Exploratorium

The Laboratory's Discovery Center has five exciting exhibits on loan from the Exploratorium now through August. Learn more about the Earth's natural phenomena:

**Rift Zone** uses air bubbling up through fine sand to create a small-scale landscape. With the turn of a knob, you are in control. Change the pressure of the air, and create different shapes and patterns that explain various kinds of rift zones and volcanoes.

**Avalanche** lets you play with cascading black sand. Rotate the orb filled



Cloud Rings

with sand to create mountainous shapes that result in avalanches, deep ravines or mountains.

**Cloud Rings** invites you to launch rings of vapor up to the ceiling.



Drawing Table



Coupled Resonant Pendula

**Coupled Resonant Pendula** shows how the movement of two pendulams is interrelated. Every time the first pendulum swings, it pulls on the lower connecting shaft and gives

the second pendulum a small tug.

**Drawing Table** calls on you to be artistic. Here, you can draw without ever touching a pen. By swinging a table that has a pen attached, you'll make beautiful complex patterns. ♦

The Discovery Center is located off Greenville Road on East Gate Drive and is open to the public Tuesday through Friday from 1-4 p.m. and Saturdays, 10 a.m. to 2 p.m. Call (925) 423-3272 for more information or visit [www.llnl.gov/llnl/community/](http://www.llnl.gov/llnl/community/)

*Discover LLNL* is a publication of the Public Affairs Office at Lawrence Livermore National Laboratory. If you would like to be included in the distribution of *Discover LLNL*, please contact Linda Lucchetti, [lucchetti1@llnl.gov](mailto:lucchetti1@llnl.gov), or call (925) 422-5815. Lawrence Livermore National Laboratory is a Department of Energy, National Nuclear Security Administration laboratory managed by the University of California.

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