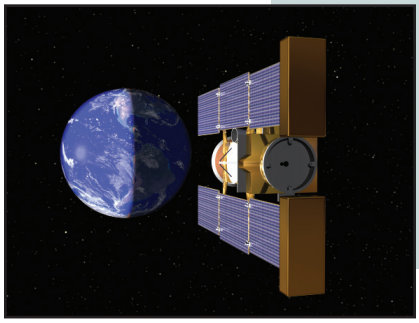
Lab scientists examine stardust samples

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 tailing '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.



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.

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 slamed 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 microscope 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. ◆