

Comet dust from NASA mission under analysis at U.Chicago laboratory (Forwarded)

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Comet dust from NASA mission under analysis at University of Chicago laboratory

Scientists at the University of Chicago are among the first ever to analyze cometary dust delivered to Earth via spacecraft.

Scientists routinely examine extraterrestrial material that has fallen to Earth as meteorites, but never before NASA's Stardust mission have they had access to verified samples of a comet. The leftover debris from the formation of the solar system 4.5 billion years ago, comets consist mostly of ice, dust and rock.

"We think comets make up a huge amount of stuff out in the solar system. We'd like to know the mineral composition of this big component of the solar system that we've never seen before for sure," said Lawrence Grossman, Professor in Geophysical Sciences. "Various particles have been measured that have been inferred to be from comets, but nobody's sure. This would finally provide some ground truth."

Grossman and Steven Simon, Senior Research Associate in Geophysical Sciences, are members of the Stardust Preliminary Examination Team (PET). So are Andrew Davis, Senior Scientist in the Enrico Fermi Institute, and his colleagues Michael Pellin and Michael Savina of the U.S. Department of Energy's Argonne National Laboratory. The role of PET is to describe the samples in a general way so that the scientists can propose more detailed studies based on that information.

Davis also is a member of the Stardust Sample Allocation Committee, which will decide how to distribute the samples for additional research once the preliminary examination period ends in mid-July.

The Stardust mission launched in February 1999, carrying a set of instruments that included one provided by the University of Chicago to monitor the impact of cometary dust. On Jan. 2, 2004, the spacecraft came within 150 miles of the comet and collected thousands of tiny dust particles streaming from its nucleus. The Stardust sample-return canister parachuted onto the desert salt flats of Utah on Jan. 15 following a journey of nearly three million miles.

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During the 2004 cometary encounter, the University of Chicago's Dust Flux Monitor Instrument successfully determined the flow and mass of the particles streaming from the comet's nucleus. Based on data collected by the instrument, the University of Chicago's Anthony Tuzzolino and Thanasis Economou estimated that the spacecraft had collected at least 2,300 particles measuring 15 micrometers (one-third the size of a human hair) or larger during the flyby.

"It will take the experts many, many months before they will determine the accurate number, but I am sure that in the end their number will be close to what we have predicted," said Economou, who was at the Johnson Space Center in Houston when the samples were delivered from Utah. "Stardust was very successful beyond all expectation in all its phases."

The comet dust is now available for comparison to tiny particles constantly raining down on Earth that scientists suspect come from comets. NASA routinely collects these stratospheric dust particles with high-altitude aircraft and maintains a collection of them, Simon said. Certain types of meteorites might also originate from comets, but without having cometary material to compare, "we don't know," Grossman said.

Grossman and Simon received several samples on Feb. 7. The samples partly consist of several thin slices of one dust grain mounted in epoxy and held on a round copper grid covered by a thin film. They also received a bullet-shaped epoxy plug holding the remainder of the grain.

"They can make hundreds of slices of each individual grain," Simon said. He and Grossman are studying their slices with an electron microprobe and a scanning electron microscope (SEM). The microprobe is capable of revealing the chemical composition of microscopically small patches of material, while the SEM provides highly magnified images.

The Stardust cometary materials now join a collection of charged particles from the sun gathered by NASA's Genesis mission and returned to Earth in 2004. Davis serves as chair of the Genesis Oversight Committee, which guides the curation and analysis of that mission's extraterrestrial materials.

"Cosmochemistry is a very exciting field these days," Davis said, referring to research on the origin of the chemical elements and the chemistry of extraterrestrial materials. "It's an interesting time to get young people involved in the field." In 2004, along with colleagues at Argonne and the Field Museum, Davis organized the Chicago Center for Cosmochemistry to promote education and research in cosmochemistry.

The Stardust spacecraft, meanwhile, may someday see further cometary action. "Stardust is still very healthy and has fuel left over," Economou said. "After dropping the Space Return Canister, the spacecraft was diverted from entering the Earth's atmosphere and placed in an orbit around the sun that could bring it to another comet in February 2011."

The Stardust mission is managed by NASA's Jet Propulsion Laboratory, Pasadena, Calif. Lockheed Martin Space Systems, Denver, developed and operated the spacecraft. For more information, see

<http://stardust.jpl.nasa.gov/home/index.html>

and

<http://cosmochemistry.uchicago.edu/>

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