Stardust older than the Earth and sun found in Australian meteorite

By Hannah Devlin, The Guardian, adapted by Newsela staff on 02.11.20
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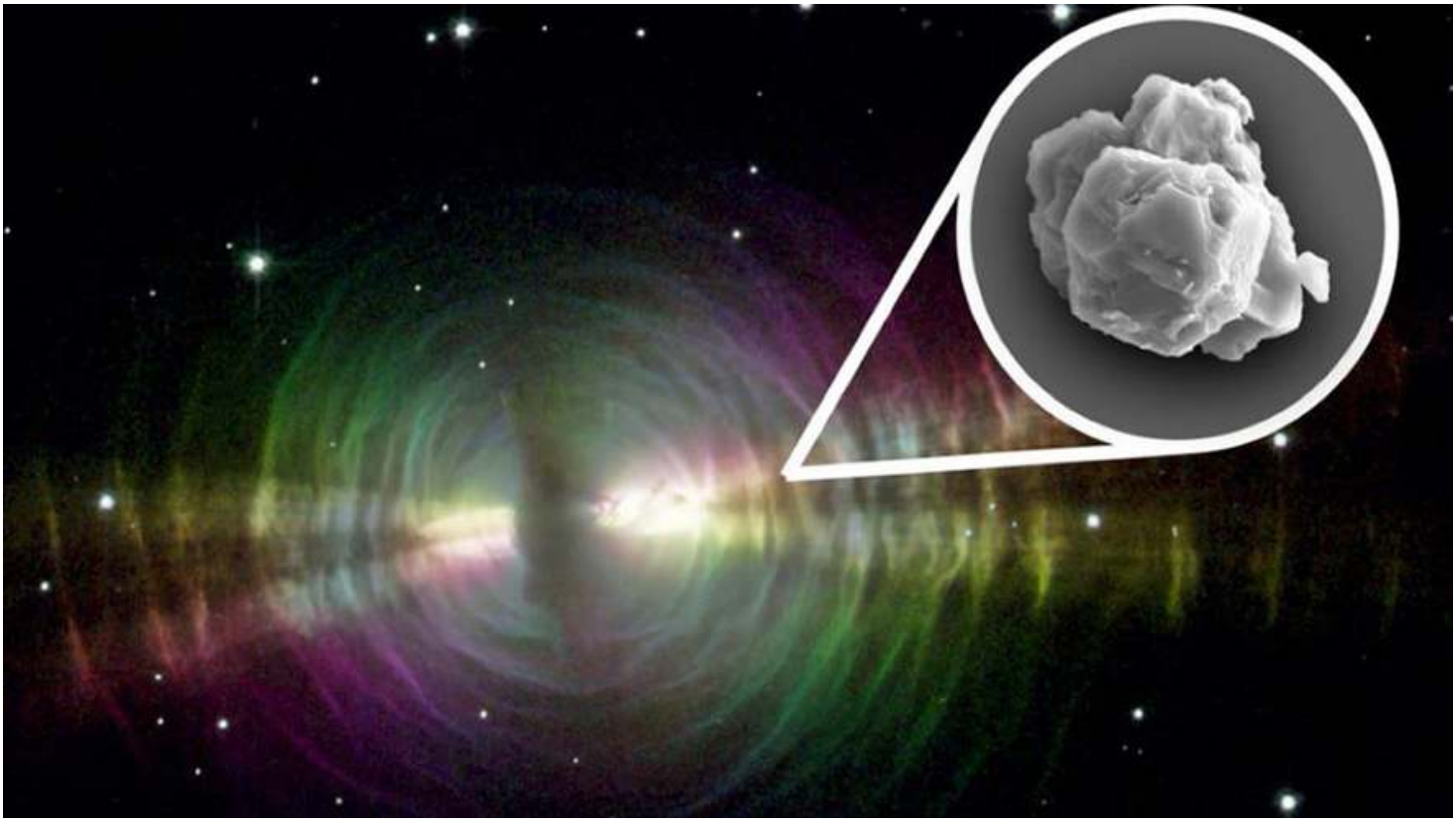

An example of a nebula and, inset, the presolar grains that have been discovered. Image: W. Sparks and R. Sahai/NASA, Inset: Janaina N. Avila

Stardust that formed long before the birth of the Earth and the sun was found on a meteorite that crashed in Australia. The dust was created more than 5 billion years ago. It is the oldest known solid material on the planet.

The tiny granules of stardust, shed by ancient stars as the stars died, reveal clues about how stars formed in our galaxy, the Milky Way. The meteorite gathered the stardust during the billions of years it spent soaring through space. In 1969, it crashed near the town of Murchison, Australia.

Solid Samples Of Stars

"They're solid samples of stars, real stardust," said Philipp Heck. He is the lead author of a study on the particles and a curator at the Field Museum in Chicago, Illinois. The museum acquired the largest pieces of the Murchison meteorite. "These are the oldest solid materials ever found, and they tell us about how stars formed in our galaxy."

The meteorite was known to contain presolar grains, which are minerals cast off by stars at the end of their lives. The age of the sample has not been verified until now.

In order to date the stardust, fragments of meteorite were crushed down into a paste. The scientists said the paste had an unpleasant smell "like rotten peanut butter." It was then dissolved with acid until only stardust grains remained.

Cosmic Ray Exposure

The scientists analyzed how cosmic ray exposure had changed the samples over time. Cosmic rays are high-energy particles that fly through space and, when they interact with solid matter, can split the nuclei of atoms to form new elements. So the longer a sample is exposed, the more secondary elements are formed.

The oldest grains were dated to more than 5.5 billion years ago, long before the sun formed 4.6 billion years ago. The age range of the grains also intrigued the scientists. The majority were from 4.6 billion to 4.9 billion years ago. The finding suggests that an unusually high number of new stars formed in the Milky Way about 7 billion years ago. The lifetime of a star is typically a few billion years.

"We have more young grains that we expected," said Heck. The scientists hypothesize that most of those grains formed during a period of increased star production, where 50 percent more stars than normal were forming.

Helio Jaques Rocha-Pinto is a professor at the Valongo Observatory in Rio de Janeiro, Brazil. He was not involved in the latest work but described the finding as "very compelling." Rocha-Pinto previously found evidence for an increase in star formation around the same time period. His work is based on astronomical survey data, which is the general mapping of the night sky.

"An amazing aspect of this finding is that it is based on direct measurement of decay products," he said. Typically, indirect chronological methods are the main tools scientists have for dating stars since they cannot bring stars into a laboratory.

Recent observations by the European Space Agency's Gaia mission have revealed a possible prompt for the boost in star formation. The mission uncovered evidence for a past collision. It took place between the Milky Way and an ancient dwarf galaxy called Gaia-Enceladus. The remains of the encounter, which can still be traced out in the Milky Way, are known as the Gaia sausage.