“Some White Dwarfs Might Have Possessed Earth-Like Planets”
By Raphael Rosen

Using the infrared detectors on the Spitzer Space Telescope, a team of researchers based in the U.K. and in the United States have found that at least 1-3% of all white dwarf stars of a certain age are surrounded by dust and rocky debris, strongly implying that those stars used to have rocky, Earth-like planets.

The team of researchers, including Dr. Jay Farihi, from the University of Leicester; and Michael Jura and Ben Zuckerman, both from UCLA, believes that the dust is produced when the asteroids surrounding the star are pushed and pulled apart by the force of the star’s tidal gravity. The dust then forms a disk of orbiting, rocky material.

The findings suggest that at least 1-3% of main-sequence A and F stars -- stars slightly hotter and larger than the Sun -- have rocky planets, like Earth.

According to Farihi, the lead author of the research paper, the rocky bodies circling white dwarfs seem to be asteroids, because of “their implied minimum mass and their inner orbits.” But, since asteroids are the “building blocks” of rocky planets, and Earth is a rocky planet, at least some white dwarfs might have Earth-like planets.

Also, for the rocky bodies to be destroyed by the gravitational effects of the white dwarf, they would have to be knocked out of their orbits, towards the star. Farihi and his team believe that, although “in principle this could be a terrestrial planet,” a large gas giant planet like Jupiter would “do this job more efficiently.” Therefore, the small percentage of white dwarfs that might possess rocky planets also probably possess larger, gas-giant-like planets.

And, since white dwarfs primarily develop from A- and F-type stars, Farihi believes that the presence of asteroids orbiting white dwarfs show that between 1 and 3% of A- and F-type stars have the material that can combine to form rocky, Earth-like planets.

White dwarfs are the remnants of relatively low-mass stars that have passed through their red giant stage. Stars are composed mostly of hydrogen, and, during their lives, they burn more and more of the hydrogen until very little is left. Then, the star begins to burn helium. When the supply of helium runs out, the star burns heavier and heavier elements, until it produces iron, which cannot be burned. At this point, the star’s contraction -- due to its gravity -- and its expansion -- due to the energy produced by its thermonuclear reactions -- become unbalanced, and the outer layers of the star puff out. Over time, the layers blow out into space, leaving behind a small core, which, because of the extreme gravity, compresses until it is extraordinarily dense. This core is called a “white dwarf.” A white dwarf may be the size of the Earth, but contain the same mass as the Sun. This star remnant is so dense, in fact, that one teaspoon of white dwarf material would weigh several tons. Over 90% of all stars -- including our Sun -- will end their lives as white dwarfs.

According to Farihi and his team, studying white dwarf stars is a good way to study planetary systems outside of our own Solar System. First, a white dwarf star is relatively small -- about the size of Earth -- so its heat won't outshine the heat emitted by any planets or dust orbiting it. Second, white dwarf stars do not contain large amounts of heavy elements, like metals, so if metals are detected in a white dwarf, one can assume that the white dwarf has been absorbing those elements from surrounding debris.

This research paper was written by Jay Farihi, at the University of Leicester, UK; and Michael Jura and Ben Zuckerman, both at UCLA.

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NASA's Jet Propulsion Laboratory, Pasadena, Calif., manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology, also in Pasadena. Caltech manages JPL for NASA. For more information about Spitzer, visit http://www.spitzer.caltech.edu/spitzer and http://www.nasa.gov/spitzer .