

Cosmic 'Death Star' is destroying a planet

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In this artist's conception, a Ceres-like asteroid is slowly disintegrating as it orbits a white dwarf star. Astronomers have spotted telltale signs of such an object using data from the Kepler K2 mission. It is the first planetary object detected transiting a white dwarf. Within about a million years the object will be destroyed, leaving a thin dusting of metals on the surface of the white dwarf. Credit: Mark A. Garlick

The Death Star of the movie Star Wars may be fictional, but planetary destruction is real. Astronomers announced today that they have spotted a large, rocky object disintegrating in its death spiral around a distant white dwarf star. The discovery also confirms a long-standing theory behind the source of white dwarf "pollution" by metals.

The results are reported in this week's *Nature*.

"This is something no human has seen before," says lead author Andrew Vanderburg of the Harvard-Smithsonian Center for Astrophysics (CfA). "We're watching a solar system get destroyed."

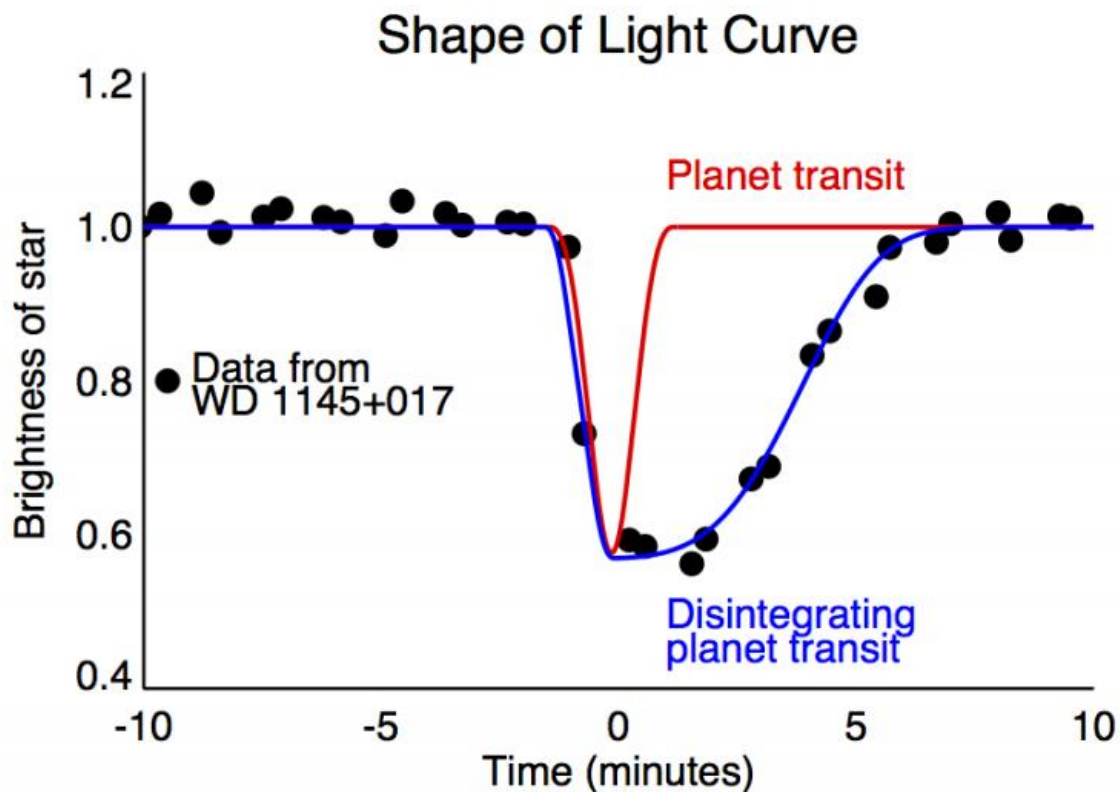
The evidence for this unique system came from NASA's Kepler K2 mission, which monitors stars for a dip in brightness that occurs when an orbiting body crosses the star. The data revealed a regular dip every 4.5 hours, which places the object in an orbit about 520,000 miles from the white dwarf (about twice the distance from the Earth to the Moon). It is the first planetary object to be seen transiting a white dwarf.

Vanderburg and his colleagues made additional observations using a number of ground-based facilities: the 1.2-meter and MINERVA telescopes at Whipple Observatory, the MMT, MEarth-South, and Keck.

Combining all the data, they found signs of several additional chunks of material, all in orbits between 4.5 and 5 hours. The main transit was particularly prominent, dimming the star by 40 percent. The transit signal also showed a comet-like pattern. Both features suggest the presence of an extended cloud of dust surrounding the fragment. The total amount of material is estimated to be about the mass of Ceres, a Texas-sized object that is the largest main-belt asteroid in our solar system.

The white dwarf star is located about 570 light-years from Earth in the

constellation Virgo. When a Sun-like star reaches the end of its life, it swells into a red giant and sloughs off its outer layers. The hot, Earth-sized core that remains is a white [dwarf star](#), and generally consists of carbon and oxygen with a thin hydrogen or helium shell.



The diagram depicts a model of light curve shapes. The red line indicates the symmetric shape of a typical planet transit while the blue line is the asymmetric shape of a disintegrating planet. The black dots are measurements recorded by the K2 mission of WD 1145+017. Credit: CfA/A. Vanderburg

Sometimes, though, astronomers find a white dwarf that shows signs of heavier elements like silicon and iron in its light spectrum. This is a mystery because a white dwarf's strong gravity should quickly submerge

these metals.

"It's like panning for gold - the heavy stuff sinks to the bottom. These metals should sink into the white dwarf's interior where we can't see them," explains Harvard co-author John Johnson (CfA).

Theorists speculated that white dwarfs showing evidence of heavy metals became "polluted" when they consumed [rocky planets](#) or asteroids. However, the evidence was often circumstantial. A fraction of polluted [white dwarfs](#) showed signs of surrounding debris disks, but the origin of the disks was uncertain. This system shows all three: a polluted white dwarf, a surrounding debris disk, and at least one compact, rocky object.

"We now have a 'smoking gun' linking white dwarf pollution to the destruction of rocky planets," says Vanderburg.

Questions remain about the origin of these rocky objects. The most likely scenario is that an existing planet's orbit became unstable and it was kicked inward.

What is certain is that the remaining objects will not last forever. They are being vaporized by the intense heat of the white dwarf. They also are orbiting very close to the tidal radius, or distance at which gravitational tides from the white dwarf can rip apart a rocky body. Within the next million years or so, all that will remain of these asteroidal bits is a thin metal dusting on top of an innocent-looking [white dwarf star](#).

More information: *Nature*, [DOI: 10.1038/nature15527](https://doi.org/10.1038/nature15527)

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