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ARTICLE

White dwarf shreds and vaporises asteroid

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An asteroid has been ripped to shreds and vaporised after straying too close to a hot white dwarf star, observations suggest. The asteroid was probably flung towards the white dwarf by the gravity of one or more unseen planets, astronomers say.

Stars like the Sun become bloated red giants when they age, then gradually blow off their outer layers until only a dense, inactive core called a white dwarf is left.

Scientists are interested in signs of planets and asteroids around these stellar embers because they offer a preview of what will eventually happen to solar systems like our own.

Astronomers have previously seen other white dwarfs orbited by dusty debris discs and with unusually large amounts of metal on their surfaces, suggesting they are absorbing asteroids that have wandered too close to them and been torn apart (see *Rocky planets may circle many white dwarfs*).

Now, researchers led by Boris Gaensicke of the University of Warwick, UK, have found the best evidence yet of an asteroid being consumed by a white dwarf. The evidence comes in the form of a hot ring of metallic vapour around a white dwarf called SDSS 1228+1040.

Surface gravity

The researchers found signs of the disc in light spectra from the white dwarf acquired by the Sloan Digital Sky Survey's 2.5-metre telescope at Apache Point, New Mexico, US, the 4.2-metre William Herschel Telescope in the Canary Islands, and by Caltech's orbiting Galaxy Evolution Explorer (GALEX).

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The spectra indicate that a disc containing calcium, magnesium, and iron gas is orbiting the white dwarf at a distance 100 times closer than Mercury's orbit around the Sun. At this distance, intense radiation from the white dwarf heats the gas to 5000 Kelvin.

The spectra also show that the white dwarf's atmosphere is enriched in magnesium. That indicates material from the disc is falling onto the star, since the star's own surface gravity is so great that its own heavy elements should have already sunk towards its centre – and out of sight.

Unseen planets

To explain all of this, Gaensicke's team proposes that an asteroid was flung towards the white dwarf and was ripped apart by the white dwarf's gravity, with the resulting metal-rich dust heated until it was vaporised.

The location of the disc supports this idea, according to previous calculations, says team member Tom Marsh, also of the University of Warwick. "It turns out that asteroids should get torn up at this sort of distance," he told **New Scientist**.

The destruction of the asteroid also hints that unseen planets are lurking in this system. In the star's previous red giant phase, it should have bloated up so much that it purged everything out to the distance of Mars in our solar system.

So the very fact that the asteroid is so close to the white dwarf now requires it to have been nudged there by something in the outer regions of that solar system. The researchers suggest that one or more planets survived the red giant phase and gravitationally flung the asteroid towards the white dwarf.

Benjamin Zuckerman of the University of California in Los Angeles, US, who has previously published evidence with colleagues about dusty discs around white dwarfs, says the new results are the clearest evidence yet of an asteroid or other object thrown towards a white dwarf and destroyed.

Planetary survivors

"It shows that likely many planets and asteroids can survive the red giant and planetary nebulae phases of stellar evolution," he told **New Scientist**.

Ted von Hippel of the University of Texas in Austin, US, who has also researched white dwarf discs, agrees that the new evidence makes a good case for the destruction of an asteroid, or perhaps even a rocky planet, given the uncertainty in the original object's mass. The gravitational influence of one or more unseen planets is a likely explanation for this, he says.

It is also possible that the disc is just material shed by the star in the late part of its life, although the lack of hydrogen in the disc would be difficult to explain in this case, he says.

If the disrupted asteroid or planet idea is right, it will shed new light on the fate of planetary systems like our own, he says.

A glowing ring of metal vapour is all that remains of an asteroid that strayed too close to a hot white dwarf star (Illustration: Mark A Garlick)

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"There's been very little work about what would happen to planetary systems when a star goes to red giant and white dwarf," he told **New Scientist**. "This is giving us insight into the late stages of a planetary system – you could say planetary system destruction," he says.

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