The first image of a possible extrasolar planet

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In the field of planetary science, remarkable discoveries are being made rapidly, one after the other. Just four years ago, extrasolar planets, or planets outside our own solar system, were still a matter of speculation. Now a growing wealth of data not only points to their existence but is challenging current theories on the formation of planetary systems.

Last week, another first was announced. US National Aeronautics and Space Administration (NASA) scientists released the first photograph of what appears to be an extrasolar planet — a large, gaseous object apparently being catapulted into deep space by its parent stars.

The planet, tentatively named TMR-1C, seems to be connected by a strange filament of light to a nearby binary star system, located in a star-forming region of the constellation Taurus at a distance of about 450 light years.

Susan Terebey and her team from the Extrasolar Research Corporation in Pasadena, California, made the discovery after meticulously examining photographs of young star systems taken in the infra-red spectrum using the Hubble Space Telescope.

The object may have been dismissed as a faint background star, were it not for the 130 billion-mile-long trail of light linking it to the binary pair of stars, TMR-1A and TMR-1B.

Terebey conjectures that the light trail could be a tunnel produced by the planet as it escaped from its parent stars and burrowed through the surrounding dust cloud. The tunnel would act like a fibre optic cable channelling light from the two stars deep inside their dusty surroundings.

Or, it may be caused by light reflecting from a trail of material left behind by the escaping planet. Further observations of the movement of TMR-IC and its spectrum are required to confirm that it is a planet and that it has been ejected from the binary system.

According to astrophysicist Alan Boss of the Carnegie Institution of Washington: “This is unbelievably exciting, seeing a possible extrasolar planet for the first time. This is a major, unprecedented observation. It is as important as the first indirect detection of an extrasolar planet was.”

Until now, the existence of extrasolar planets has been inferred from the gravitational effect or “wobble” caused in the motion of the stars they orbit. TMR-IC may turn out to be the first to be observed directly.

If it proves to be the same age as its apparent parent stars — a few hundred thousands years — then its mass is estimated to be 2-3 times that of Jupiter, the largest planet in our solar system. Its speed is calculated at up to 10 kilometres/second.

If the object is the same age as other nearby stars — up to ten millions years old — it could not have been ejected from the much younger binary star system. In this case, it is likely to be much more massive and may even be a brown dwarf — a star too small to sustain nuclear fusion and glow brightly.

The discovery raises crucial theoretical challenges. Conventional theories predict that giant gas planets take millions of years to condense from dust in space. More recent explanations point to another possibility — that large, low-density planets can condense very quickly out of gas clouds, at the same time as their parent star.

“If this is a planet and the system is about 300,000 years old, then the slower, conventional theory doesn’t fit. It’s like Cinderella dropping her glass slipper after the ball. That slipper is only going to fit one person. In the same way, I think the fast-track theory is the only fit for explaining the formation of this new planet,” Boss said.

Being far smaller than its two parent stars, TMR-1C may have gained enough momentum to be flung out of the stellar system by a gravitational “slingshot” effect.

The release of the photograph of TMR-1C comes

only weeks after two groups of astronomers, using telescopes in Hawaii and Chile, announced the first indirect evidence pointing to the existence of rocky earthlike planets outside our own solar system.

As many as eight other extrasolar planets have been identified since 1995, when the first signs were discovered of a planet orbiting around a conventional star. The rapid advances in the field, despite funding science cutbacks, have been possible in part through the use of sophisticated new detectors, particularly in the infra-red range.

The Hubble Space Telescope, a joint project of NASA and the European Space Agency, was launched in 1990 and only became fully functional in December 1993 after a space shuttle mission corrected its instruments for spherical aberration.

The photograph showing TMR-1C was taken with Hubble's Near Infrared Camera and Multi-Object Spectrometer (NICMOS). The highly sensitive infra-red detectors must operate at very low temperatures and are kept within a thermos bottle-like container filled with frozen nitrogen gas. The aim is to keep the detectors cold and the NICMOS operating for years, far longer than any previous space experiment.

For further information and a range of downloadable images of TMR-1C visit http://oposite.stsci.edu/pubinfo/pr/1998/19/