Companion's comets the key to curious exoplanet system?

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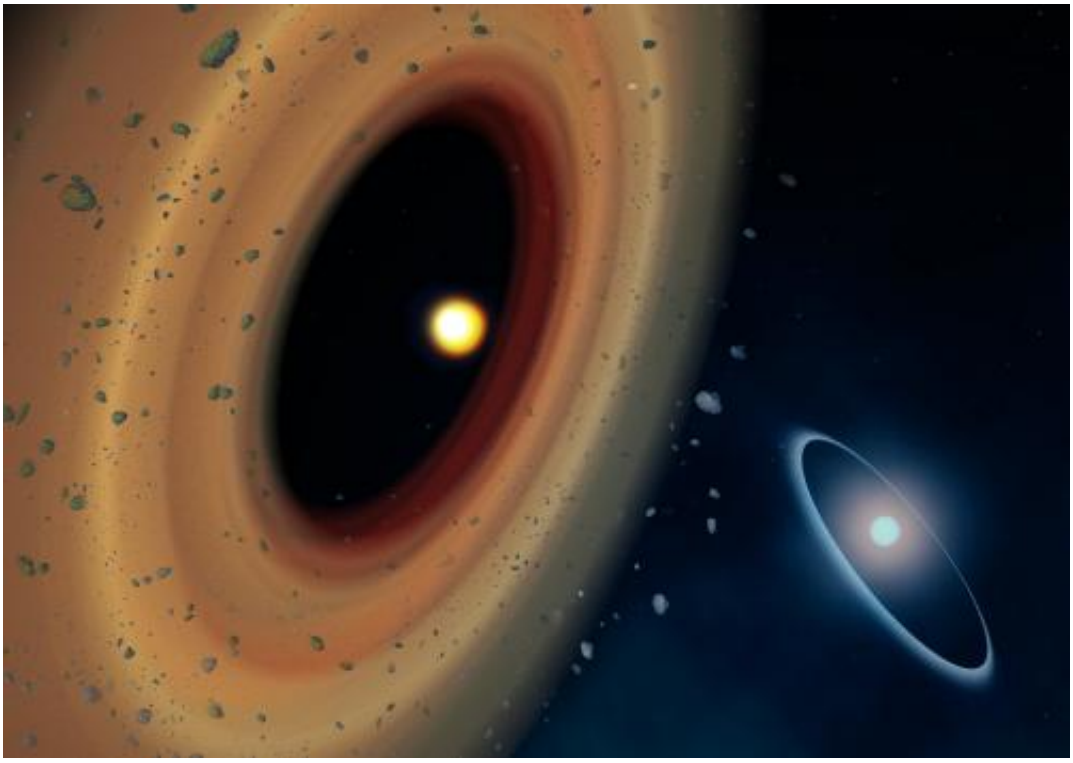


Artist's impression of the Fomalhaut system. The newly discovered comet belt around Fomalhaut C is shown to the left. The comet belt around Fomalhaut A is in the distance to the right. The belt around Fomalhaut A is offset slightly, a signature of the elliptical orbits in the belt, which may have been caused by past interactions with the star Fomalhaut C. Credit: Amanda Smith.

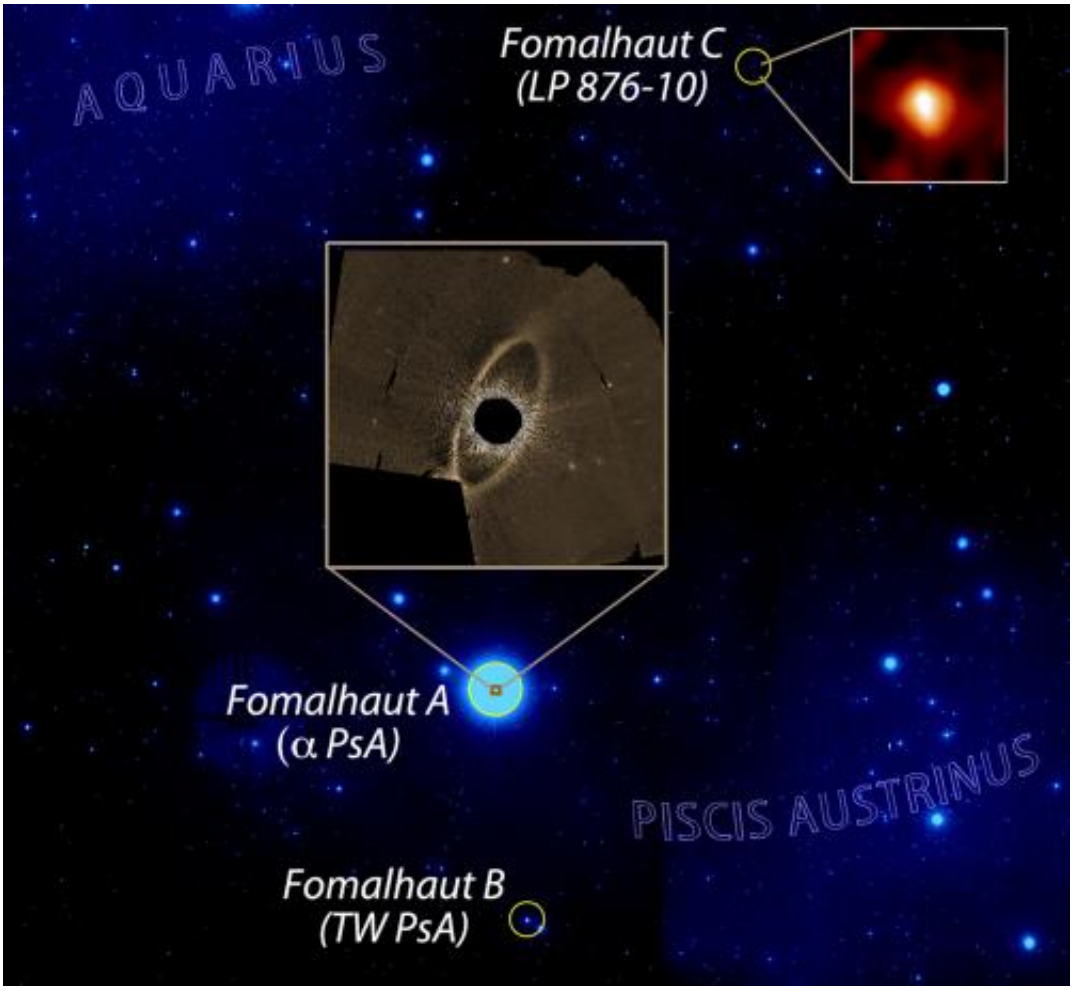
(Phys.org) —The nearby star Fomalhaut A hosts the most famous planetary system outside our own Solar System, containing both an

exoplanet and a spectacular ring of comets. Today, an international team of astronomers announced a new discovery with the Herschel Space Observatory that has made this system even more intriguing; the least massive star of the three in the Fomalhaut system, Fomalhaut C, has now been found to host its own comet belt. The researchers published their results today in a letter to the journal *Monthly Notices of the Royal Astronomical Society*.

Fomalhaut A is one of the brightest stars in the sky. Located 25 light years away in the constellation of Piscis Austrinus, it shines with a blue-white colour and is prominent from the southern hemisphere. From northern latitudes it appears low down in the south during autumn evenings. In contrast, Fomalhaut C, also named LP 876-10, is a dim red dwarf star invisible without a telescope, and was only found to be part of the Fomalhaut system in October this year.

Fomalhaut A's prominence made it a key target for the Hubble Space Telescope, which astronomers used to find the ring of comets, hints of and then a direct image of the planet, Fomalhaut b, in 2008 (astronomers use uppercase letters for stars, and lowercase letters are used for planets, so 'Fomalhaut b' is a planet, and 'Fomalhaut B' is the second star in the system).

The new discovery might hold the key to some of the mysteries of the Fomalhaut system. The lead author Grant Kennedy, an astronomer at the Institute of Astronomy at the University of Cambridge, said, "It's very rare to find two comet belts in one system, and with the two stars 2.5 light years apart this is one of the most widely separated star systems we know of. It made us wonder why both Fomalhaut A and C have comet belts, and whether the belts are related in some way." To get a feeling for how far 2.5 light years is, light from the Sun takes only 8 minutes to get to the Earth, and 5.5 hours to get to Pluto, and the nearest star to the Sun, Proxima Centauri, is only 4 light years away.



View of the Fomalhaut triple star system from Earth. The small inset shows a zoom of the newly discovered comet belt around Fomalhaut C as seen at infrared wavelengths by Herschel. The large inset shows a zoom of the much larger comet ring around Fomalhaut A as seen at optical wavelengths by Hubble. Telescope resolving power is lower at the infrared wavelengths observed by Herschel, so the size of the belt around Fomalhaut C is not well known. Image Credit: Grant Kennedy (Cambridge) & Paul Kalas (UC Berkeley).

This discovery may help solve the major mystery in the Fomalhaut system: the orbits of the comet ring and planet around Fomalhaut A are elliptical (which simply means that the orbits aren't circular). The

elliptical orbits are thought to be the result of close encounters with something else in the system, perhaps with another as yet undetected planet or perhaps with one of the two other stars, B or C.

The discovery of the comet belt around C is important because such encounters can not only make the comet belts elliptical, they can also make them brighter by causing the comets to collide more often, releasing massive amounts of dust and ice. Stars are rarely seen to have such bright comet belts, so their detection around both A and C suggests that they may have had their brightnesses enhanced by a previous close encounter between the two.

Paul Kalas of the University of California discovered the orbits are elliptical and is involved in the new work. He said, "We thought that the Fomalhaut A system was disturbed by a planet on the inside - but now it looks like a small star from the outside could also influence the system. A good test of this hypothesis is to measure the red dwarf's exact orbit over the next few years."

The stellar interaction scenario isn't as unusual as it sounds. Comet ISON, which disintegrated following a close encounter with our Sun at the end of November, may have been put on a Sun-grazing orbit by a star that passed near to the Solar System in the past. Similarly, the proposed encounters between the stars in the Fomalhaut system may have sent a few comets onto star-grazing orbits. You might imagine that if there were any habitable planets around Fomalhaut A or C, their inhabitants might be luckier than us and see truly spectacular comet shows in their night sky.

The Herschel Observatory, which observed the Universe in infrared light ran out of helium coolant and stopped observing in April this year. This was seven months before Fomalhaut C was identified as part of the triple star system, but fortunately the telescope had imaged it back in 2011, so

the astronomers have plenty of data on it already.

Kennedy has actually known about the comet belt for several years; "Over the last few years we used Herschel to look for comet belts around many stars within a few hundred light years of the Sun. At that stage Fomalhaut C was just called LP 876-10 and we thought it was a lone red dwarf with a comet belt. It was interesting because such discoveries are very rare, but didn't tell us why it was there. After the discovery that this star was part of the Fomalhaut system, the existence of its comet belt made us think harder about connections between the two stars, and it may be that it helps solve the mystery of the elliptical comet belt around Fomalhaut A."

Kennedy and his team are now trying to check the stellar encounter idea with computer simulations and more detailed observations of the Fomalhaut C belt. The apparent absence of a belt around Fomalhaut B remains a mystery. But if the simulations are in line with what the astronomers see, then this would be a 'smoking gun' for a stellar interaction and proof that other stars can affect how planetary systems form and evolve.

More information: The new work appears in, "Discovery of the Fomalhaut C debris disc", G. M. Kennedy, M. C. Wyatt, P. Kalas, G. Duchêne, B. Sibthorpe, J.-F. Lestrade, B. C. Matthews and J. Greaves, *Monthly Notices of the Royal Astronomical Society*, in press. A copy of the paper is available from mnrasl.oxfordjournals.org/cont … rasl.slt168.full.pdf

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