

Nobody knows how these baby stars got so close to our black hole

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By [Leah Crane](#)



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A SWARM of baby stars live just a fraction of a light year from our galaxy's central [supermassive black hole](#). But no one can explain how they ended up so close in their short lifetimes.

Stars form by coalescing out of a cloud of dust and gas. But this can't happen close to the Milky Way's centre as [the gravity from the supermassive black hole rips apart nearby clouds](#) before any stars can grow.

"These stars are so close to the black hole that no formation mechanism could work there, so you need some time to bring them in from somewhere else," says Maryam Habibi at the Max Planck Institute for Extraterrestrial Physics in Garching, Germany.

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Previous explanations had suggested that the stars might not be young after all, but old ones in disguise, giving them more time to move into position. They could appear younger thanks to mergers with other stars, tidal heating or by having their outer envelopes of gas stripped away.

To investigate further, Habibi and her colleagues took a closer look at the stars. Since they are almost 25,000 light years away and too dim to examine in visible wavelengths, it is difficult to get any detailed information about them. To get around this, Habibi's team looked at 12 years of data from the infrared portion of the stars' light.

The team found that the stars have masses between 8 and 14 times that of the sun, have bulk temperatures ranging from 20,700 to 28,200°C – more than three times as hot as the sun – and rotate at 60 to 170 kilometres per second at the equator.

The stars are also far younger than the sun. By comparing their observations with models of star evolution, the researchers found that the stars are less than 15 million years old (arxiv.org/abs/1708.06353). This rules out the possibility that they are older than they look. In comparison, the sun is about 4.5 billion years old.

“There's very little wiggle room now for these to be anything other than garden-variety massive stars,” says Don Figer at the Rochester Institute of Technology in New York. “The problem is that they're in a very odd place.”

“It's still not clear whether they formed outside the danger zone and wandered in or if they formed there”

One previous idea for how they got so close to the galaxy's supermassive black hole is that they formed in binary systems much further out in the galaxy. Then, when the pair of stars was disrupted by a black hole or other massive object, one shot away from the centre of the galaxy and one shot towards it and was trapped in orbit.

That process would require the stars to travel for a long time toward the galaxy's centre, however – potentially longer than their current ages. “I was hoping that maybe the ages would be older, so we could solve this by saying that these stars are old and there's more time to bring them in,” says Habibi.

Instead, the stars' youth implies that they must have formed in a kind of middle ground closer in, possibly in a disc of stars and dust that orbits just a few light years from the black hole. If they started there, they could have migrated even further inward as drag from the material in the disc slowed down their orbital speed.

Even that process might take too long, though. “It’s still not clear whether they formed outside of the danger zone and then wandered in or whether they actually formed in the danger zone,” says Figer. While the colossal gravitational pull of the supermassive black hole makes it unlikely that the stars could have formed where they are, Figer says that it might be possible.

“This is presenting a paradox,” says Habibi. “We might have to come up with a new theory to answer how these stars at these young ages could get there.”

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