

## Star orbit nails black hole

Astronomers find best evidence yet for supermassive black hole at the Galactic centre.

Philip Ball

The discovery of a star orbiting the centre of our Galaxy confirms the presence of an immense black hole there.

Astronomers know that there is an awesome amount of matter at the hub of our pinwheeling Galaxy. The most likely interpretation is that it is all crammed into a black hole several million times as massive as the Sun. But until now there have been other ways to explain the data - for example, that all that mass is packed into a dense cluster of dark, star-like objects.

The orbiting star seen by Rainer Schödel of the Max-Planck Institute for Extraterrestrial Physics in Garching, Germany, and co-workers<sup>1</sup> seems to rule out such alternatives.

Schödel's team has been tracking the movement of stars near the Galactic Centre for the past ten years. In 1992 they began to follow the motion of a star called S2. Over the ensuing decade it has traced out two-thirds of an elliptical orbit around an astrophysical object called Sagittarius A. Sgr A is widely believed to lie at the Galactic Centre and may correspond to the supermassive black hole itself.

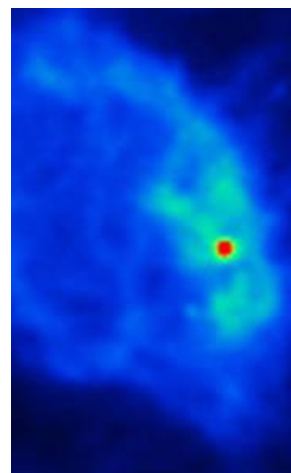
**Sgr A, 30,000 light years from Earth, emits intense radio waves. These are thought to be produced when matter surrounding the putative black hole gets sucked in. In support of this notion, X-rays have also been detected recently from the same location as the Sgr A radio source. X-ray emission would be expected to occur as matter falling into the black hole heats up.**

Such observations have led astronomers to conclude that there are probably similar black holes at the centres of many galaxies. The orbit of S2 is the clinching evidence, however.

Schödel and colleagues say that the elliptical path perfectly matches that predicted if S2 were moving around a small central object about two and a half million times the mass of the Sun. Earlier observations of other stars close to Sgr A \* suggested that there is an object precisely this massive at the Galactic Centre.

If the central mass were not a compact supermassive black hole but a more spread-out cluster of discrete, high-density objects, such as smaller black holes or neutron stars, their combined density would have to be implausibly large to account for the shape of S2's orbit. "Such a dark cluster model can now be safely rejected," say the researchers.

S2 makes a complete orbit around the Galactic Centre in about 15 years - nearly four years longer than it takes for Jupiter to pass once around the Sun.



Sagittarius' radio source (red dot) is probably an immense black hole.

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### References

1. Schödel, R. *et al.* A star in a 15.2-year orbit around the supermassive black hole at the centre of the Milky Way. *Nature*, **419**, 694 - 696, (2002). | [Article](#) | [ChemPort](#) |