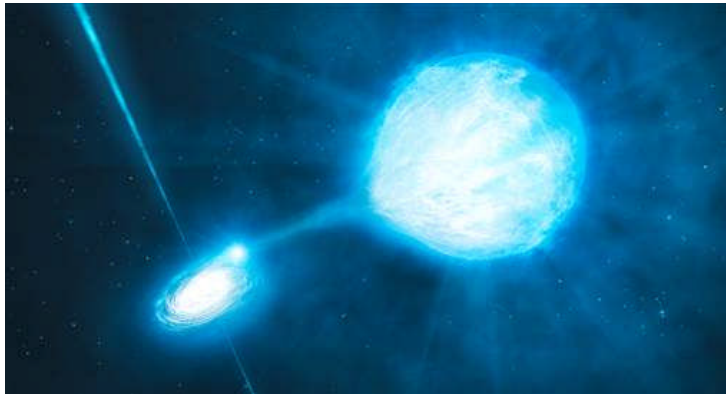


# Scientists extend black-hole frontier

## Telescope spots most distant stellar-mass black hole in a dance of death

updated 12:41 p.m. PT, Wed., Jan. 27, 2010



L. Calçada / ESO

This artist's impression depicts the newly discovered stellar-mass black hole in the spiral galaxy NGC 300. The black hole has a mass of about 20 times the mass of the sun and is associated with a Wolf-Rayet star — a star that will become a black hole itself.



### Black-hole warp

When a supermassive star dies, its corpse collapses into a knot so tight, not even light can escape.

Space.com

A newfound black hole that's left over from the explosion of a star is the most distant yet to be discovered by astronomers. The newly discovered black hole, which is about 15 times the mass of our sun, is also the second most massive of its kind on record.

And if that wasn't enough, the black hole is entwined with a star that will also soon become a black hole.

Up until now, the only stellar-mass black holes known to astronomers were found within the confines of our local cluster of nearby galaxies, the Local Group. These black holes weigh in at up to 10 times the mass of the sun.

The newfound black hole is leaving these records in the dust.

"This is the most distant stellar-mass black hole ever weighed, and it's the first one we've seen outside our own galactic neighborhood," said astronomer Paul Crowther of the University of Sheffield, one of the researchers who made the discovery.

Stellar-mass black holes are the final remnants of very massive stars. They are much smaller than so-called supermassive black holes, which are found at the center of most galaxies and can reach up to a billion times the mass of the sun.

X-ray signs

The new black hole was spotted in the spiral galaxy NGC 300 — 6 million light-years from Earth — with the European Southern Observatory's Very Large Telescope (VLT) in Chile. X-ray measurements made in 2007 with NASA's Swift observatory first hinted at the possible existence of the black hole as scientists probed the region around the galaxy's brightest X-ray source.

"We recorded periodic, extremely intense X-ray emissions, a clue that a black hole might be lurking in the area," said team member Stefania Carpano, an astronomer with the European Space Agency. The new VLT observations confirmed the scientists' suspicions and showed that there was indeed a black hole, and that it had an odd stellar companion locked with it in a gravitational dance.

The companion is a type of star known as a Wolf-Rayet star. These are massive stars near the end of their lives that expel most of their outer layers into their surroundings before they explode as supernovas. Their cores implode to form black holes.

The ESO team found that the black hole and Wolf-Rayet star (which has a mass about 20 times that of our sun), orbit each other once every 32 hours. As they circle, the black hole siphons off matter from the companion star.

But how the two wound up in such a unique cosmic embrace isn't known.

"This is indeed a very 'intimate' couple," said team member Robin Barnard. "How such a tightly bound system has been formed is still a mystery."

Other examples?

Only one other system of this type has been seen before, but other systems that feature a black hole with a companion star are not uncommon. Such systems show a connection between black hole mass and the chemistry of galaxies.

"We have noticed that the most massive black holes tend to be found in smaller galaxies that contain less 'heavy' chemical elements," Crowther said. "Bigger galaxies that are richer in heavy elements, such as the Milky Way, only succeed in producing black holes with smaller masses." Astronomers think that a higher concentration of heavy elements influences how massive stars evolve and cause them to shed more matter as they age, which makes for a smaller black hole when the remnant of the star finally implodes.

The newfound black hole's companion will go supernova, basically explode, in less than a million years, ultimately collapsing into a black hole itself. That eventual explosion could cause the two black holes to get closer — much closer.

"If the system survives this second explosion, the two black holes will merge, emitting copious amounts of energy in the form of gravitational waves as they combine," Crowther said.

That merger would take several billion years, though, so astronomers won't be able to watch it happen. But other such systems could exist and could be detected by that signature of gravitational waves, Crowther said.

The finding is detailed in the journal *Monthly Notices of the Royal Astronomical Society*.

© 2010 *Space.com*. All rights reserved.