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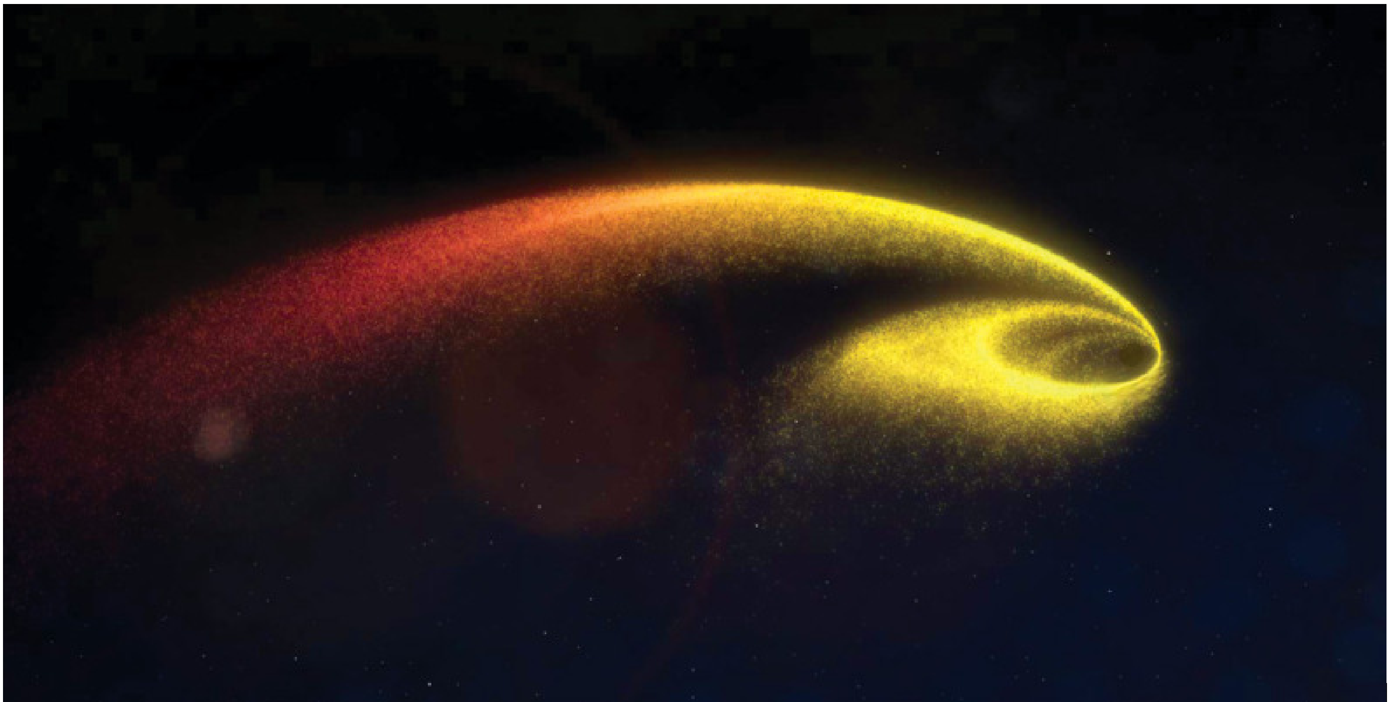

▲ Illustration of a star shredded by a black hole's tidal pull. The trailing part of the stream-that-was-a-star escapes the system, while the leading part swings back around.

NASA'S GODDARD SPACE FLIGHT CENTER / CHRIS SMITH (USRA / GESTAR)

BLACK HOLES

Shredded Star Reveals Elusive, Middle-Mass Black Hole

ASTRONOMERS HAVE USED the death of a star to uncover details about a black hole that weighs in between stellar-mass black holes and the leviathans that lurk in massive galaxies' centers.

Observers have found a few dozen candidate *intermediate-mass black holes*, with masses equivalent to tens to hundreds of thousands of Suns. But we know next to nothing about them.

Sixiang Wen (University of Arizona) and colleagues have now taken a closer look at one of those candidates. The middling black hole appears to sit in a star cluster near a galaxy about 740 million light-years away in the constellation Aquarius. Normally the black hole is invisible, but astronomers spotted it when it tore up and swallowed a star, skirting itself in the glowing debris and lighting up in an event dubbed 3XMM J215022.4−055108.

As this tutu of hot gas swirled around and fell into the black hole, it heated up, emitting X-rays. The team used observations spanning 12 years from the XMM-Newton and Chandra X-ray space telescopes to watch the cataclysm unfold.

Using an approach originally designed for stellar-mass black holes, the team calculated this heftier black hole's approximate mass and spin: 20,000 Suns and 80% of the maximum, respectively. The results appear in the September 10th *Astrophysical Journal*.

Astronomers have used star-shredding calamities, called *tidal-disruption events*, to measure supermassive black holes' spins before — but they've never done it for an intermediate-mass black hole. What's truly curious about this result, though, is the value of the spin. A black hole's spin can tell us how it grew, but the team has no good explanation for the observed value.

The spin is slightly too high to match what's expected if the black hole was made by merging smaller ones, far too high for the black hole to have grown by munching intermittent gas snacks, yet too low to have grown by eating a steady stream of gas.

Wen personally favors either a runaway collision of stars or direct collapse, in which a large, pristine gas cloud crumples in on itself. The black hole has the right mass to fit in the direct-collapse scenario, which vies with a couple of others as a favored origin for black hole seeds in the early universe (*S&T:* Jan. 2017, p. 24).

Future eROSITA X-ray observations will help the team find more events like this one.

■ CAMILLE M. CARLISLE