Study shows first evidence of winds outside black holes throughout their mealtimes

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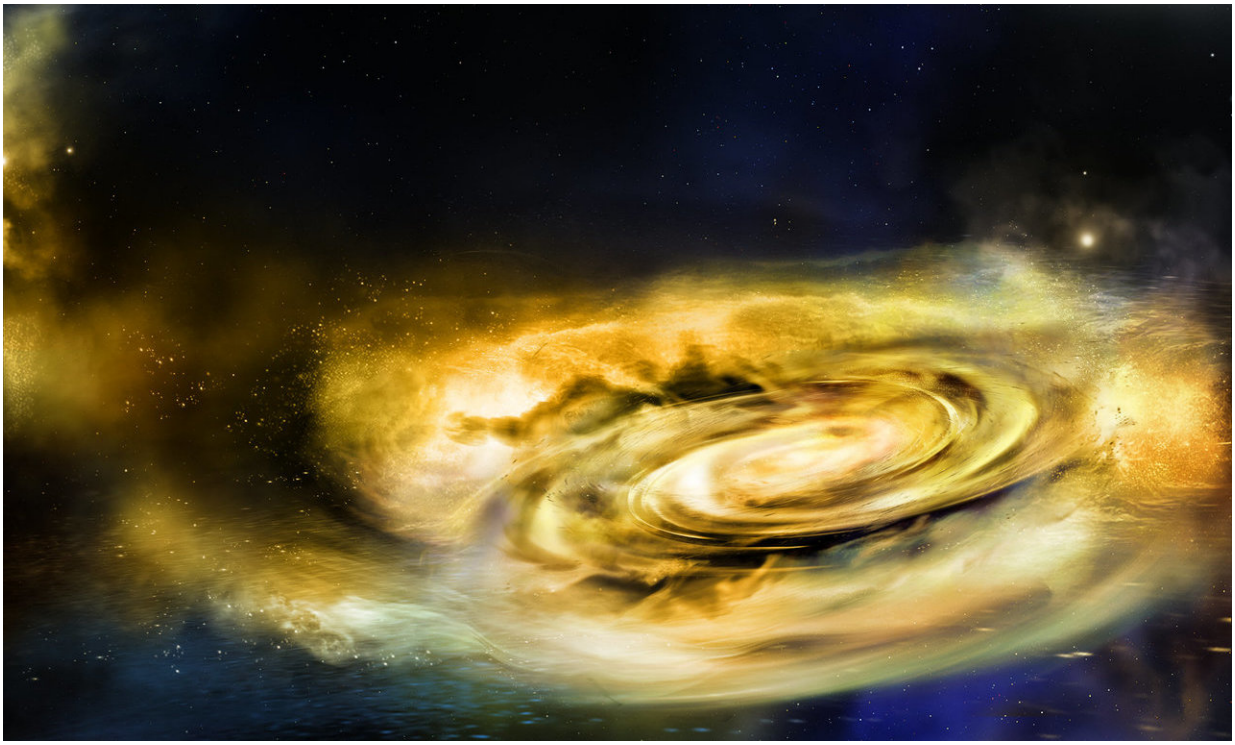

Artistic rendition of strong winds disrupting the outer disc of material surrounding a stellar-mass black hole. The disk material (mostly in yellow) is first pulled from the outer parts of a nearby star (upper right-hand). The stellar-mass black hole sits at the center of the approximately 5 million kilometer disc, but it only consumes the material if and when it reaches the central 30 kilometers. Credit: NASA/Swift/A. Simonnet, Sonoma State University

New research shows the first evidence of strong winds around black holes throughout bright outburst events when a black hole rapidly consumes mass.

The study, published in *Nature*, sheds new light on how mass transfers to black holes and how black holes can affect the environment around them. The research was conducted by an international team of researchers, led by scientists in the University of Alberta's Department of Physics.

Using data from three international space agencies spanning 20 years, the scientists used new statistical techniques to study outbursts from stellar-mass black hole X-ray binary systems. Their results show evidence of consistent and strong winds surrounding black holes throughout outbursts. Until now, strong winds had only been seen in limited parts of these events.

"Winds must blow away a large fraction of the matter a black hole could eat," described Bailey Tetarenko, PhD student and lead author on the study. "In one of our models, the winds removed 80 per cent of the black hole's potential meal."

Depending on their size, stellar-mass black holes have the capacity to consume everything within a 3 to 150 kilometre radius. "Not even light can escape from this close to a black hole," explained Gregory Sivakoff, associate professor of physics and co-author. Other, much larger black holes, called supermassive black holes, appear to have affected the formation of entire galaxies. "But even supermassive black holes are smaller than our solar system. While they are small, black holes can have surprisingly large effects," explained Sivakoff.

So, what exactly causes these winds in space? For now, it remains a mystery. "We think magnetic fields play a key role. But we'll need to do

a great deal of future investigation to understand these winds," explained Craig Heinke, associate professor of physics and co-author.

"Strong disk winds traced throughout outbursts in black-hole X-ray binaries" will be published online January 22 in *Nature*.

More information: Strong disk winds traced throughout outbursts in black-hole X-ray binaries, *Nature* (2018). nature.com/articles/doi:10.1038/nature25159

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