Astronomers shed surprising light on our galaxy's black hole

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In the most comprehensive study of Sagittarius A* (Sgr A*), the enigmatic supermassive black hole in the center of the Milky Way Galaxy, astronomers -- using nine ground and space-based telescopes including the Hubble Space Telescope and the XMM-Newton X-ray Observatory -- have discovered that Sgr A* produces rapid flares close to the innermost region of the black hole in many different wavelengths and that these emissions go up and down together.

This insight into the frequent bursts of radiation observed shooting off the black hole like firecrackers -- similar to solar flares -- will help scientists better understand the dynamics of Sgr A* and the source of its flares.

Farhad Yusef-Zadeh, professor of physics and astronomy at Northwestern University, who led a team of 11 astronomers from around the world in the study of Sgr A*, presented the team's results at a press conference today (Jan. 10) at the American Astronomical Society meeting in Washington, D.C.

"We observed that the less energetic infrared flares occur simultaneously with the more energetic X-ray flares as well the submillimeter flares," said Yusef-Zadeh. "From this, we infer that the particles that are accelerated near the black hole give rise to X-ray, infrared and submillimeter emission. In addition, not all of the material that approaches the black hole gets sucked in. Some of the material may be ejected from the vicinity of the central black hole or event horizon. Our observations hint that these flares have enough energy to escape from the closest confines of the supermassive black hole's sphere of influence."

Yusef-Zadeh and his team observed Sgr A* during two four-day periods in 2004, one in March and one in September. (2004 marked the 30th anniversary of the discovery of Sgr A*, which has a mass equivalent to 3.6 million Suns and is located in the Sagittarius constellation.) The campaign captured data across a wide spectrum, including radio, millimeter, submillimeter, infrared, X-ray and soft gamma ray wavelengths.

The astronomers also determined that the real engine of the flare activity is in the infrared wavelength. Using observations from Hubble's Near-Infrared Camera and Multi-Object Spectrometer, they found infrared activity 40 percent of the time, more than was observed at any other wavelength.

"This is not something we expected," said Yusef-Zadeh. "Other black holes in other galaxies don't show this flare activity. We believe it is the dynamics of the captured material -- very close to the event horizon of the black hole -- that produces the flares. And the flares are fluctuating at low levels, like flickers. The flare radiation results from fast-moving materials in the innermost region of the black hole. It's a way of life for Sgr A*, this frequent low level of activity."

Because flares are variable and not constant, the study required a large number of telescopes devoted to studying flare activity simultaneously. The space-based telescopes used in this observation campaign were the Hubble Space Telescope, the XMM-Newton X-ray Observatory and the International Gamma-Ray Astrophysics Laboratory (INTEGRAL). The ground telescopes used were Very Large Array (VLA) of the National Radio Astronomy Observatory; Caltech Submillimeter Observatory (CSO); Submillimeter Telescope (SMT); Nobeyama Array (NMA);

Berkeley Illinois Maryland Array (BIMA); and Australian Telescope Compact Array (ATCA).

Source: Northwestern University