Dense, swirling winds help supermassive black holes grow

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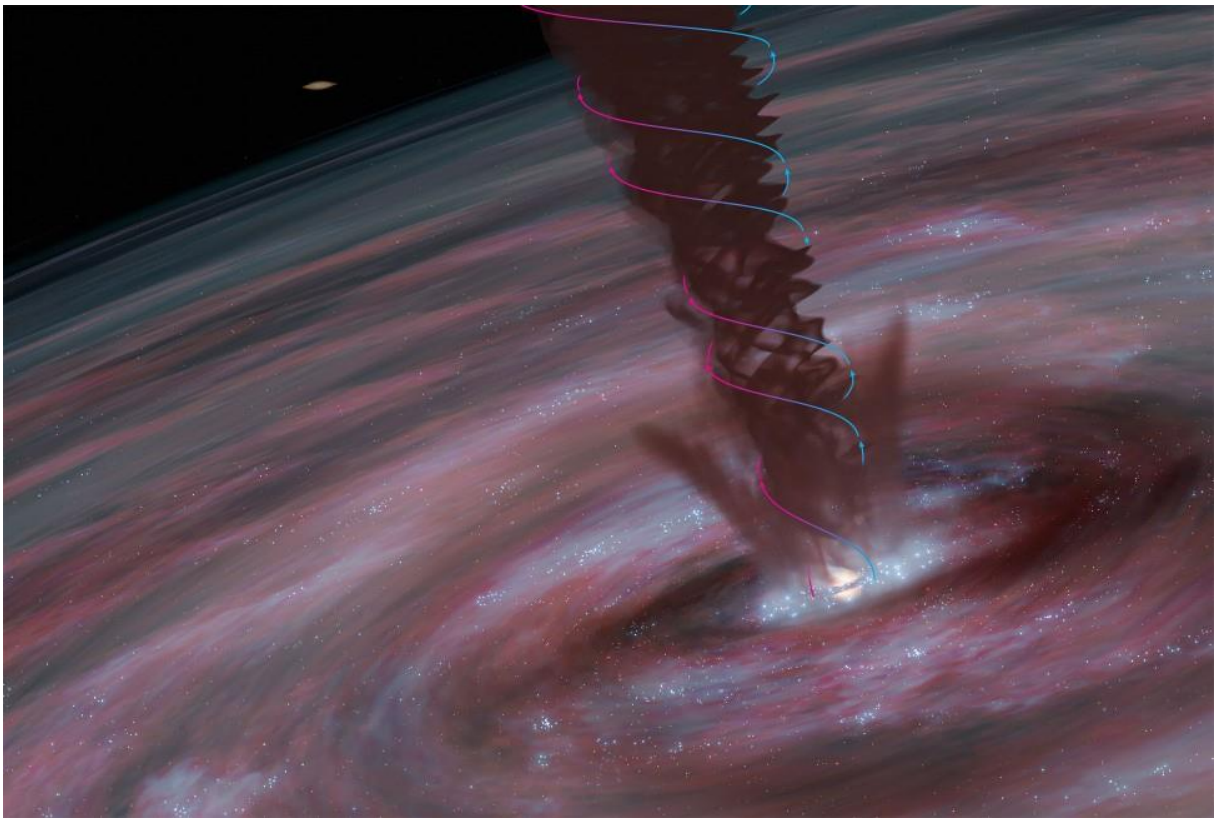

Figure : A spiralling, dense wind could help scientists understand why supermassive black holes are as massive as they are. Credit: M. D. Gorski/Aaron M. Geller

By studying nearby galaxy ESO320-G030, a team of international astronomers led by Mark Gorski, and including a researcher from Paris Observatory, has discovered extremely powerful rotating, magnetic winds that they believe is helping the galaxy's central supermassive black hole to grow.

The process is strikingly similar to the birth of new stars and planets, which are fed by swirls of gas and dust. The new discovery provides a previously unknown clue to solving the long-standing mystery of how supermassive black holes grow to weigh as much as millions or billions of stars.

Most galaxies, including our own Milky Way, have a supermassive black hole at their centers. How these mind-bogglingly massive objects grow into super sizes has remained an unsolved mystery.

In the search for clues, Gorski and his collaborators looked to relatively nearby galaxy ESO320-G030, located just 120 million light years from Earth. ESO320-G030 is a highly active galaxy, forming stars 10 times faster than the Milky Way. The astronomers examined the galaxy using telescopes at the Atacama Large Millimeter/submillimeter Array (ALMA) Observatory in Chile.

Since this galaxy is very luminous in the infrared, telescopes can resolve striking details in its center. They measured light from molecules carried by winds from the galaxy's core, hoping to trace how the winds are launched by a growing — or soon to be growing — supermassive black hole. By using ALMA, they were able to study light from behind thick layers of dust and gas.

To examine the dense gas that closely hovers around ESO320-G030's central black hole, the scientists studied light from hydrogen cyanide molecules. Using Doppler effect technology, the researchers imaged fine details and trace movements in the gas, which revealed patterns suggesting the presence of a magnetized, rotating wind.

While other winds and jets typically push material away from a galaxy's central supermassive black hole, the newly discovered wind adds another process, which instead feeds the black hole and helps it grow.

The researchers liken the matter traveling around a black hole to water circling a drain. As matter approaches the black hole, it first collects in a chaotic, spinning disk. There, magnetic fields develop and grow stronger. The magnetic fields help lift matter away from the galaxy, creating a vortex of wind. As matter is lost to the wind, the spinning disk slows, which turns the slow trickle of matter into a stream — meaning that matter flows more easily into the black hole.

Reference : A spectacular galactic scale magnetohydrodynamic powered wind in ESO 320-G030, 2024, Gorski, M. D., Aalto, S., König, S., Wethers, C. F., Yang, C., Muller, S., Onishi, K., Sato, M., Falstad, N., Mangum, J. G., Linden, S. T., Combes, F. et al. A&A 684, L11