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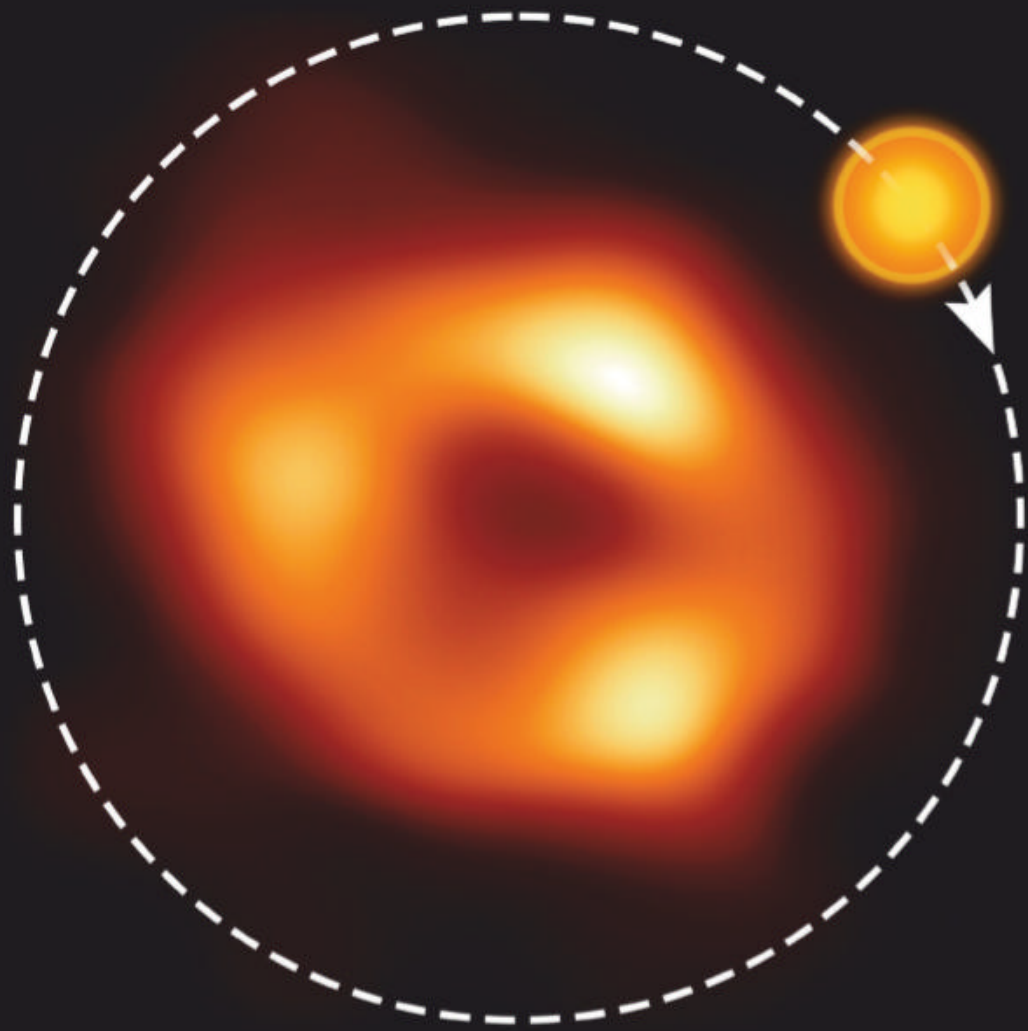
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BLOB OF GAS SWIRLS AROUND SAGITTARIUS A*

Corresponding to an X-ray flare, the hot spot has key implications for how our galaxy's supermassive black hole feeds.



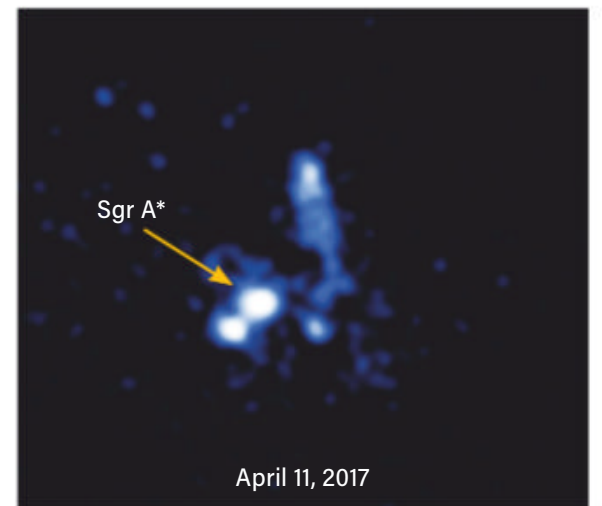
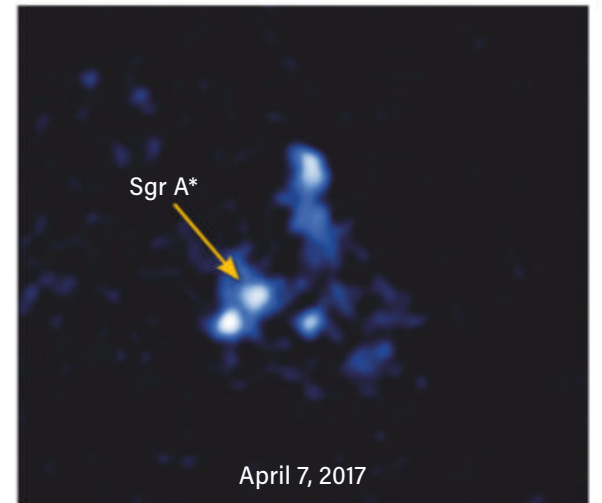
» Tucked away in the heart of the Milky Way galaxy is a slumbering giant known as Sagittarius A* (pronounced “A-star”). While some supermassive black holes are extremely active, devouring large quantities of gas and dust that glow brilliantly in X-rays, Sagittarius A* — or Sgr A* for short — is rather lethargic in comparison.

But, occasionally, Sgr A* will put on a fleeting show.

Astronomers captured one such

SPIRALING BLOB. While observing the Milky Way's black hole as part of the Event Horizon Telescope in 2017, ALMA spotted a hot bubble of plasma. The location and orbit of the hot spot in relation to Sagittarius A* is shown in this artist's concept. EHT COLLABORATION, ESO/M. KORNMESSE (ACKNOWLEDGMENT: M. WIELGUS)

display in April 2017. During this period, the Event Horizon Telescope's (EHT) network of radio telescopes had its eyes trained on Sgr A*, collecting data to create the first image of our galaxy's supermassive black hole. But the EHT was also joined by an armada



FORTUITOUS FLARE. NASA's Chandra X-ray Observatory watched Sgr A* with the EHT in April, recording an X-ray flare. NASA/CXC/A. HOBART

of other telescopes in varying wavelengths, as part of a wider campaign to study a variety of aspects of Sgr A*. And, on April 11, NASA's Chandra X-ray Observatory spotted a burst of powerful X-rays (above) from the black hole.

The Atacama Large Millimeter/sub-millimeter Array (ALMA) was taking radio observations of Sgr A* for EHT when that X-ray flare occurred, and its data indicated a hot, bright blob was orbiting the black hole. Astronomers think this so-called hot spot is the first detection in radio waves of a counterpart to an X-ray flare from Sgr A*. The observation, published Sept. 22 in *Astronomy & Astrophysics*, also contains clues for how such flares occur.

MYSTERIES AROUND

Black holes are objects with gravity so strong that not even light can escape. The event horizon, or “surface” of the black hole, marks this boundary of no return. Astronomers can only theorize about what goes on beyond this point.



CTIO/NOIRLAB/DOE/NSF/AURA; T.A. RECTOR (UNIVERSITY OF ALASKA ANCHORAGE/NSF'S NOIRLAB), J. MILLER (GEMINI OBSERVATORY/NSF'S NOIRLAB), M. ZAMANI & D. DE MARTIN (NSF'S NOIRLAB)

COSMIC CRUSTACEAN

Within the constellation Scorpius lies the Lobster Nebula (NGC 6357), located about 8,000 light-years away and photographed here by the Dark Energy Camera on the Víctor M. Blanco 4-meter Telescope at Cerro Tololo Inter-American Observatory in Chile. The resulting image of the galactic arthropod showcases swirls of colorful gas, while the open star cluster Pismis 24 peeks out from the center, displaying a host of young, massive stars. To construct the image, researchers captured many shots through different filters before layering them to create a composite. —SAMANTHA HILL

And although we can see the material circling the black hole outside the event horizon, this region isn't free of mysteries, either.

Scientists don't fully grasp what causes flares like these, but suspect the magnetic field surrounding the black hole plays a role. In Sgr A*'s case, researchers think the magnetic field acts as a barrier, preventing the black hole from devouring as much material as it otherwise would. This magnetic blockage causes gas and dust to clump up around the black hole.

Eventually, built-up tension causes one of the magnetic field lines to temporarily break, eliminating the barrier and allowing the black hole to gorge itself. The breakage also releases energy into the surrounding material, forming a hot bubble of plasma.

Initially, these hot spots might primarily emit the X-rays observed during flares, lead author Maciek Wielgus of the Max Planck Institute for Radio Astronomy in Bonn, Germany, tells *Astronomy*. "Maybe it needs a bit of time to cool down to show up at low frequencies corresponding to millimeter [radio] wavelengths," Wielgus says.

A hot spot typically survives for a single orbit before being sheared apart by the black hole's gravity. In this case, the clump of gas zipped around at some 30 percent the speed of light and scientists were able to observe it for 105 minutes before it was torn apart.

"Hopefully, one day," Wielgus said in an ESO press release, "we will be comfortable saying that we 'know' what is going on in Sgr A*." —C.B.

CO₂ DISCOVERY

The James Webb Space Telescope has made the first clear detection of carbon dioxide on a world outside our solar system. The gas is in the atmosphere of WASP-39 b, a hot gas giant orbiting a Sun-like star 700 light-years away in Virgo.

LONG-TERM FORECAST

New high-resolution climate models predict that major observatory sites in Hawaii, Chile, the Canary Islands, Australia, South Africa, and Mexico will experience higher specific humidity (atmospheric moisture content) and temperatures by 2050, potentially leading to reduced data quality.

STELLAR SPIRAL

Surveys of the open cluster NGC 346 in the Small Magellanic Cloud — a good proxy for early galaxies — indicate that its periodic episodes of star formation are triggered by an inflow of stars spiraling toward its center.

WHAT A SAVE!

On Oct. 7, mission controllers managed to recover NASA's CAPSTONE spacecraft from a near-month-long uncontrolled spin. Now CAPSTONE can resume its mission: testing the stability of the unconventional lunar orbit that the Orion spacecraft will use on crewed Artemis flights.

LOST MOON

Saturn's rings may be the remains of a moon destroyed 150 million years ago, researchers suggest.

Titan could have perturbed a fellow satellite, causing the latter to stray close to Saturn, where it was torn apart by tidal forces.

COLOSSAL SUN-SCOPE

The 4-meter Daniel K. Inouye Solar Telescope, the world's largest, was inaugurated in a ceremony Aug. 31 near the summit of Haleakalā in Hawaii. It will investigate the physics of the Sun, including solar storms that threaten Earth. —MARK ZASTROW