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Feeding the Monster

By Robert Naeye



Astronomers have looked into the galaxy NGC 1097 and watched how gas spirals toward the belly of the beast. *Courtesy ESO.*

January 10, 2006 | An international team has peered deep into the heart of an active galaxy, giving astronomers their best view yet of how streams of gas feed the ravenous monster black holes that lurk in galactic cores.

Kambiz Fathi (Rochester Institute of Technology), working with colleagues in Brazil, Chile, and Italy, combined the Hubble Space Telescope's high-resolution imaging with the spectroscopic power of the 8-meter Gemini South Telescope to probe the central regions of NGC 1097. This large spiral galaxy lies 47 million light-years away in the southern constellation Fornax.

With Hubble, Fathi and his colleagues could trace three spiral arms winding all the way from the outer edge of the galaxy to within 10 light-years of the supermassive black hole at its center. Previous observations could only probe within 100 light-years of an external galaxy's core. While the Hubble

observations suggested that the spiral arms feed gas into the beast, astronomers needed to measure the motions of the gas near the nucleus before they could clinch the case.

Fathi's group used Gemini's Multi-Object Spectrograph to measure the motion of gas at several thousand points inside a 4,500-light-year-wide ring that surrounds the galaxy's center. These exquisite velocity measurements were made all the way to within 30 light-years of the central black hole. The resulting velocity map shows that NGC 1097's spiral arms literally pull gas about 1,000 light-years from the galactic center and funnel it into the core at speeds of 180,000 kilometers per hour (111,000 mph).

"When we extrapolate our last data points, about 30 light-years from the black hole, we find that it would take about 200,000 years for the gas to travel the last leg of its one-way journey to the supermassive black hole," says Fathi, who estimates that a few solar masses flow into the beast's belly each year. NGC 1097's black hole contains about 100 million solar masses, about 25 times the mass of the Milky Way Galaxy's central monster.

"This is a major step forward in our understanding of how fuel can be funneled to a supermassive black hole," said astrophysicist Kimberly Weaver (NASA/Goddard Space Flight Center) at a press conference held at the American Astronomical Society conference in Washington, DC. "We see motions of material streaming inward from spiral arms, but we couldn't look closer in to see how that material gets transferred inward."

Weaver also noted that by watching this galaxy funnel material quickly into its central black hole, astronomers gain powerful insight into how these monsters accumulate enormous amounts of mass. Inwardly moving gas can also trigger powerful bursts of star formation in a galaxy's central regions, frenzied activity that astronomers have observed in many other galaxies.

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