

Stars Forming Just Beyond Black Hole's Grasp at Galactic Center

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This 0.6 by 0.7-degree infrared photograph of the galactic center shows a large population of old, red stars. However, the discovery of two young protostars within a few light-years of the center of the Milky Way shows that stars can form there despite powerful gravitational tides due to the supermassive black hole. Credit: 2MASS/E. Kopan (IPAC/Caltech)

(PhysOrg.com) -- The center of the Milky Way presents astronomers with a paradox: it holds young stars, but no one is sure how those stars got there. The galactic center is wracked with powerful gravitational tides stirred by a 4 million solar-mass black hole. Those tides should rip

apart molecular clouds that act as stellar nurseries, preventing stars from forming in place. Yet the alternative - stars falling inward after forming elsewhere - should be a rare occurrence.

Using the Very Large Array of radio telescopes, astronomers from the Harvard-Smithsonian Center for Astrophysics and the Max Planck Institute for Radio Astronomy have identified two protostars located only a few light-years from the galactic center. Their discovery shows that stars can, in fact, form very close to the Milky Way's central black hole.

"We literally caught these stars in the act of forming," said Smithsonian astronomer Elizabeth Humphreys. She presented the finding today at a meeting of the American Astronomical Society in Long Beach, Calif.

The center of the Milky Way is a mysterious region hidden behind intervening dust and gas, making it hard to study. Visible light doesn't make it out, leaving astronomers no choice but to use other wavelengths like infrared and radio, which can penetrate dust more easily.

Humphreys and her colleagues searched for water masers—radio signals that serve as signposts for protostars still embedded in their birth cocoons. They found two protostars located seven and 10 light-years from the galactic center. Combined with one previously identified protostar, the three examples show that star formation is taking place near the Milky Way's core.

Their finding suggests that molecular gas at the center of our galaxy must be denser than previously believed. A higher density would make it easier for a molecular cloud's self-gravity to overcome tides from the black hole, allowing it to not only hold together but also collapse and form new stars.

The discovery of these protostars corroborates recent [theoretical work](#), in which a supercomputer simulation produced star formation within a few light-years of the Milky Way's central black hole.

"We don't understand the environment at the galactic center very well yet," Humphreys said. "By combining observational studies like ours with theoretical work, we hope to get a better handle on what's happening at our galaxy's core. Then, we can extrapolate to more distant galaxies."

Provided by Harvard-Smithsonian Center for Astrophysics

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