

Massive Stars Near the Galactic Center

August 28 2009



A false-color infrared image of the Central Molecular Zone in our Milky Way galaxy. Astronomers have used infrared spectroscopy to confirm for the first time the presence of very young, massive stars in this unusual region. Credit: NASA/JPL-Caltech

The Central Molecular Zone (CMZ) of our galaxy is a giant complex of molecular gas and dust situated in the innermost 700 light-years of the Milky Way. Although the galaxy is over 100,000 light-years in size, nearly 10% of all of its molecular gas lies in the CMZ. Astronomers know that regions of dense gas and dust tend to produce new stars as the material coalesces and heats up under the influence of gravity.

There should therefore be abundant star formation going on in the CMZ, and indeed the CMZ is the source of about 5%-10% of the galaxy's infrared and [ultraviolet light](#) because of its star formation activity. Evidence has mounting that conditions for star formation in the CMZ are significantly different from those elsewhere -- the gas pressures and temperatures are higher than elsewhere, for example.

Furthermore, the presence of strong magnetic fields, tidal shear, and

turbulence challenges the standard paradigm of slow gravitational collapse of molecular cloud cores. Astronomers piecing together the complex puzzle of star formation look to the CMZ region as a testbed for their understanding of [star formation](#).

There is plenty of indirect evidence for massive stars in the CMZ; the influence can be seen across the spectrum, from the radio to the X-ray. But there is a huge amount of dust between us and the CMZ -- optical light, for example, is extinguished by a factor of about one trillion -- and so it has been hard to identify positively any young, new [massive stars](#) or protostars there. Spectroscopic observations in the infrared offer a key way to do this because they are not as easily confused as methods that rely on stellar colors (evolved stars can appear like young stars in their colors when they are heavily dust attenuated). These young stars are likely to be the ones to reveal the most about any special birth conditions or processes at work there.

SAO astronomer Howard Smith is a member of a team of ten scientists who have used the Spitzer Space Telescope to probe the galactic center, the CMZ, and their stars.

Writing in the latest issue of *The Astrophysical Journal Letters*, the team's latest paper reports the first conclusive spectroscopic evidence for massive young stars in the CMZ. They identify three such objects from the presence of warm molecular gas features in their photospheres (or envelopes), features that are familiar from studies of young stars much closer to earth. While confirming the competing roles of various processes in the CMZ still requires a larger sample of young stars and additional modeling, the new results are a key step in the goal of better understanding the wide range of environments that can give birth to massive young stars.

Provided by Harvard-Smithsonian Center for Astrophysics ([news](#) : [web](#))

Citation: Massive Stars Near the Galactic Center (2009, August 28) retrieved 2 May 2024 from <https://phys.org/news/2009-08-massive-stars-galactic-center.html>

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