Production sites of stars are rare

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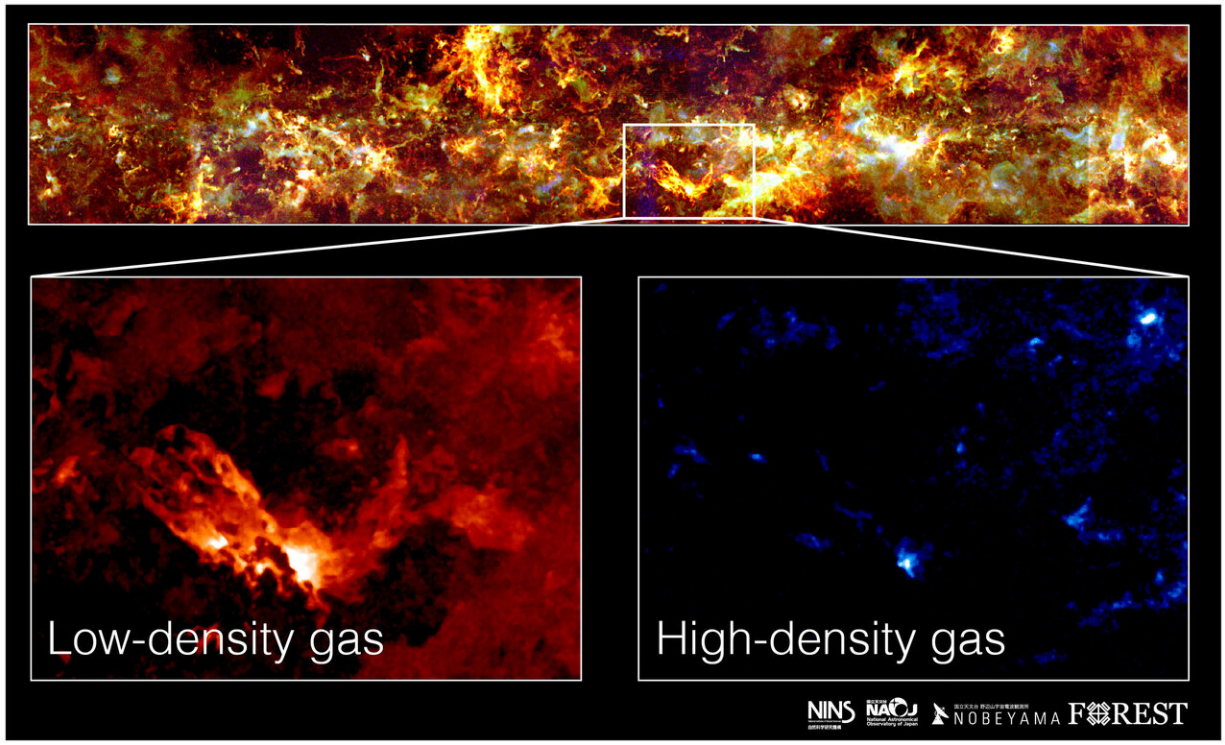

Distribution of gas clouds obtained from the FUGIN project. The high-density gas (right) is detected only in small parts of the low-density gas (left). Credit: NAOJ

Astronomers using the Nobeyama Radio Obeservatory (NRO) 45-meter telescope found that high-density gas, the material for stars, accounts for only 3 percent of the total mass of gas distributed in the Milky Way. This result provides key information for understanding the unexpectedly

low production rate of stars.

Stars are born in gas clouds. The high-density gas pockets form in the extended, low-density gas clouds, and stars form in the very dense gas cores which evolve within the high-density gas. However, observations of distant galaxies detected 1000 times fewer stars than the production value expected from the total amount of low-density gas. To interpret the discrepancy, observations which detect both of the high-density and low-density gas with high-spatial resolution and wide area coverage were needed. However, such observations are difficult, because the high-density gas structures are dozens of times smaller than the low-density gas structures.

The Milky Way survey project FUGIN conducted using the NRO 45-meter telescope and the multi-beam receiver FOREST overcame these difficulties. Kazufumi Torii, a project assistant professor at NAOJ, and his team analyzed the big data obtained in the FUGIN project, and measured the accurate masses of the low-density and high-density gas for a large span of 20,000 light-years along the Milky Way. They revealed for the first time that the high-density gas accounts for only 3 percent of the total gas.

These results imply the production rate of high-density gas in the low-density gas clouds is small, creating only a small number of opportunities to form stars. The researcher team will continue working on the FUGIN data to investigate the cause of inefficient formation of the high-density gas.

These study, "FOREST Unbiased Galactic plane Imaging survey with the Nobeyama 45 m telescope (FUGIN). V. Dense gas mass fraction of molecular gas in the Galactic plane," is published in *Publications of the Astronomical Society of Japan*.

More information: Kazufumi Torii et al. FOREST Unbiased Galactic plane Imaging survey with the Nobeyama 45 m telescope (FUGIN). V. Dense gas mass fraction of molecular gas in the Galactic plane, *Publications of the Astronomical Society of Japan* (2019). DOI: 10.1093/pasj/psz033

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