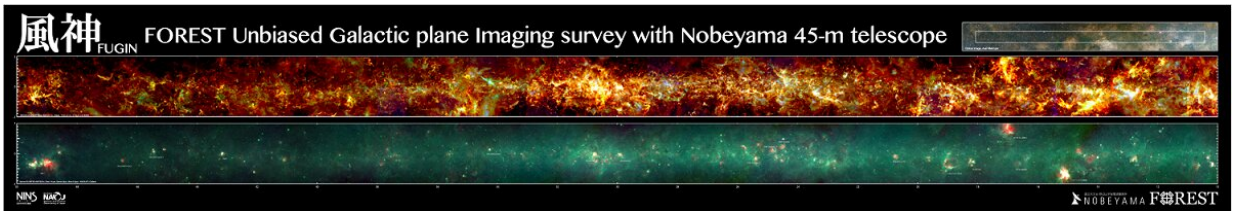
AI draws highly accurate map of star birthplaces in the galaxy

March 1 2023



The upper panel shows the distribution of molecular clouds in the Milky Way Galaxy obtained by the Nobeyama 45-m radio telescope. The lower panel shows infrared observation by the Spitzer Space Telescope. Credit: the National Astronomical Observatory of Japan, Nobeyama Radio Observatory

Stars are formed by molecular gas and dust coalescing in space. These molecular gases are so dilute and cold that they are invisible to the human eye, but they do emit faint radio waves that can be observed by radio telescopes.

Observing from Earth, a lot of matter lies ahead and behind these molecular clouds, and these overlapping features make it difficult to determine their distance and physical properties, such as size and mass. So, even though our galaxy, the Milky Way, is the only galaxy close enough to make detailed observations of molecular clouds in the universe, it has been very difficult to investigate the physical properties of molecular clouds in a cohesive manner from large-scale observations.

A research team led by Dr. Shinji Fujita from the Osaka Metropolitan University Graduate School of Science, identified about 140,000 molecular clouds in the Milky Way galaxy, which are areas of star formation, from large-scale data of carbon monoxide molecules, observed in detail by the Nobeyama 45-m radio telescope. Using artificial intelligence, the research team estimated the distance of each of these molecular clouds, determined their size and mass and successfully mapped their distribution, covering the first quadrant of the Galactic plane, in the most detailed manner to date.

Their findings were published in *Publications of the Astronomical Society of Japan*.

"The results not only give a bird's eye view of the galaxy but will also help in various studies of star formation," explained Dr. Fujita. "In the future, we would like to expand the scope of observations with the Nobeyama 45-m radio telescope and incorporate radio telescope observation data of the sky in the southern hemisphere, which cannot be observed from Japan, for a complete distribution map of the entire Milky Way."

More information: Shinji Fujita et al, Distance determination of molecular clouds in the first quadrant of the Galactic plane using deep learning: I. Method and results, *Publications of the Astronomical Society of Japan* (2023). DOI: 10.1093/pasj/psac104

Provided by Osaka Metropolitan University