Fundamental Structure of the Galaxy Determined with VERA

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We have determined fundamental structure of the Milky Way Galaxy based on the results of highly-accurate astrometry carried out by VERA and other VLBI arrays. VERA (VLBI Exploration or Radio Astrometry), being operated by NAOJ in collaboration with Kagoshima University, has been conducting astrometry of Galactic maser sources with an aim to reveal the three-dimensional structure of the Milky Way Galaxy based phase-referencing VLBI technique, and similar projects are also on-going using VLBA, EVN and so on.

In the present study, we have compiled astrometric results (distances and 3-d motions) of 52 star-forming regions obtained by VERA and other arrays, and used them to determine the fundamental structure of the Milky Way Galaxy. Figure 1 shows the distribution of the 52 sources in the Galaxy, with vectors showing their motions in the Galactic plane. Clearly Galactic rotation can be seen, and from their motions even the position of the rotation center can be estimated. In the present study, we have utilized MCMC (Markov-chain Monte Carlo) method to obtain the best model to reproduce the positions and motions of the maser sources, with model parameters such as the Galactic center distance, R_0, and Galactic rotation velocity at the Sun, Θ_0.

The Galaxy center distance is obtained to be $R_0 = 8.05 \pm 0.45$ kpc. This is consistent with the recent results and the IAU standard (R_0 of 8~8.5 kpc). On the other hand, the Galactic rotation velocity is determined as $\Theta_0 = 238 \pm 14$ km s^{-1}, which is roughly 10 % larger than the IAU standard of 220 km s^{-1}. This result indicates that the mass of the Galaxy is higher than previously expected, which impacts not only on the Galactic structure but also on dark mater search in the Galaxy.

Reference

[1] Honma, M., et al.: 2012, *PASJ*, **64**, 136.

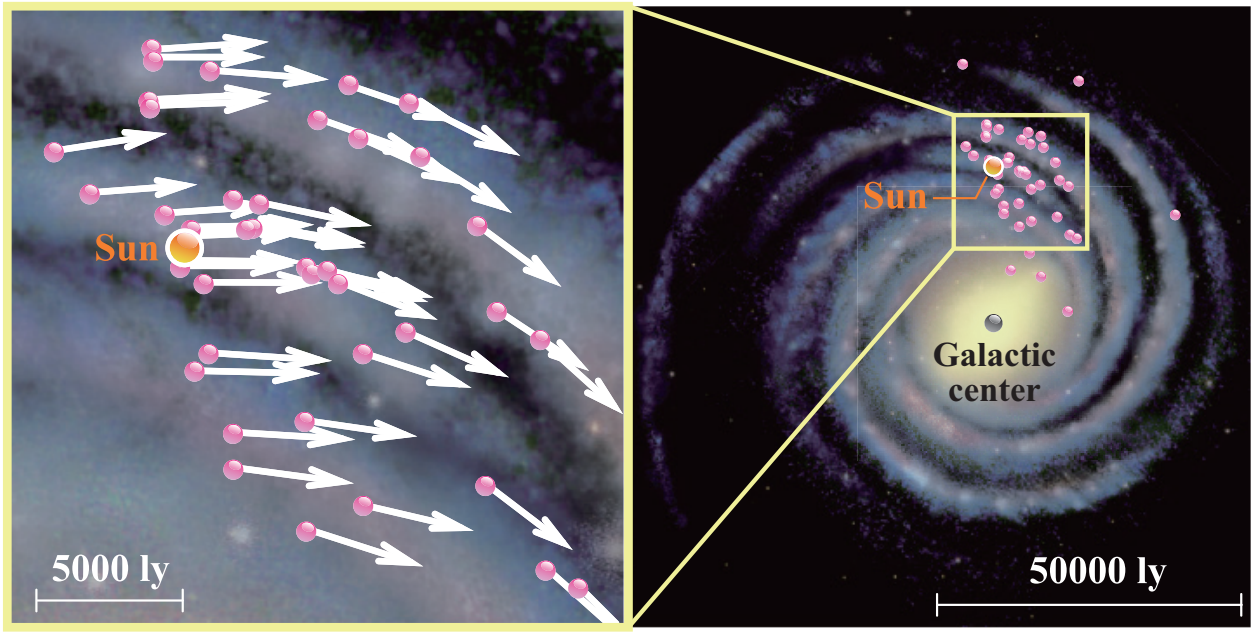

Figure 1: Galaxy-scale distribution and motion of the 52 star-forming regions, for which accurate astrometric results have been obtained.