The First Very Long Baseline Interferometry Image of a 44 GHz Methanol Maser with the KVN and VERA Array (KaVA)

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We obtained a first VLBI image of a 44 GHz class I methanol maser with KaVA (KVN and VERA Array), which is a newly combined array of KVN (Korean VLBI Network) and VERA (VLBI Exploration of Radio Astrometry) (Figure 1) [1].

The imaged 44 GHz methanol maser is associated with a millimeter core MM2 in a massive star-forming region IRAS 18151–1208. The distance of this source is estimated to be 3 kpc [2]. This 44 GHz methanol maser source was newly detected in the course of KVN single-dish survey as one of the brightest source with a total flux density of about 500 Jy [3].

The absolute positions of the maser component with $v_{\rm LSR}$ = 29.4 km s^{-1} is derived to be $\alpha_{J2000.0}$ = $18^h17^m49.^s95$, $\delta_{J2000.0}$ = −12°08′06.5″ with the error of ~ 20″ from a fringe-rate mapping in our VLBI data [1]. This result suggest that the maser components detected in our observation are associated with a region around the younger millimeter core MM2 than MM1 [5] which is pre-UC HII region [4].

The compact maser components were detected with the synthesized beam size of 2.7 milliarcseconds × 1.5 milliarcseconds (mas) [1]. Minimum size in the maser components is ~ 5 mas × 2 mas, corresponding to the linear size of ~ 15 AU × 6 AU at the distance of 3 kpc. Brightness temperature of the maser components ranges ~ $3.5 \times 10^8 - 1.0 \times 10^{10}$ K. These values are higher than a lower limit of 10^8 K estimated with the previous highest spacial resolution image with ~ 50 mas observed with Very Large Array (VLA).

This VLBI observation for 44 GHz methanol maser would be expected to be powerful tool to obtain accurate positions and proper motions to identify maser pumping sources.

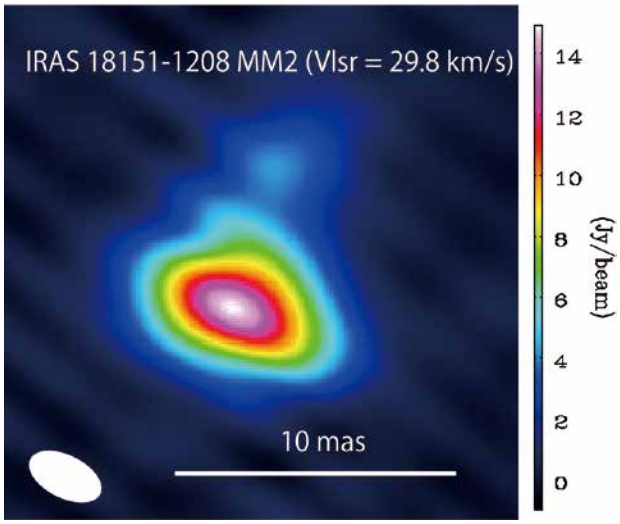

Figure 1: An intensity map of a 44 GHz methanol-maser component of $v_{\rm LSR}$ = 29.8 km s^{-1} associated with IRAS 18151–1208 MM2. Synthesized beam is shown in the bottom-left corner.

References

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[3] Kim, K. T. in prep.
[4] Marseille, M., et al.: 2008, *A&A*, **488**, 579
[5] Sakai, T., Sakai, N., Hirota, T., Yamamoto, S.: 2010, *ApJ*, **714**, 1658.