

N27a First VLBI Imaging of SiO $v = 0$, $J = 1 \rightarrow 0$ Masers in VY Canis Majoris

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We achieved the first VLBI detections of the ground vibrational state ^{28}SiO and ^{29}SiO masers of the $J = 1 \rightarrow 0$ rotational transitions, towards the $25 M_{\odot}$ red supergiant (RSG) star, VY Canis Majoris (VY CMa), taking advantage of high sensitivity of the VLBI Exploration of Radio Astrometry (VERA) telescopes coordinating with the Nobeyama 45 m telescope. In addition, we succeeded in detecting the $J = 1 \rightarrow 0$ transition in the $v = 3$ state towards VY CMa for the first time with VLBI. The SiO $J = 1 \rightarrow 0$ maser spot in the $v = 0$ state was detected in the cross-power spectra taken with the baselines involving the Nobeyama 45 m telescope, which enabled us to perform self-calibration imaging to derive its location with respect to the brightest $v = 1$ maser spots, at an absolute positional accuracy of ~ 100 milliarcseconds (mas). This observational study demonstrates that the brightest SiO maser spot in the $v = 0$ state is compact (3 mas), yielding the extremely high brightness of 10^7 K. It indicates that the SiO $v = 0$ maser action may originate from strong shocks in the stellar wind emanating from this extreme RSG.