

Q20c 3D Motions of SiO Maser Stars around Sagittarius A* with ALMA

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Many SiO maser stars have been found in the vicinity of Sagittarius A* (Sgr A*) since the early days of the observation of Sgr A*. They are late-type stars in the Nuclear Star Cluster (NSC). We present 3D motions of these with Atacama Large Millimeter/sub-millimeter Array (ALMA). We used here two archive data including SiO $v = 1, J = 2 - 1$ maser emission ($\nu_0 = 86.24344$ GHz) (2016.1.00940.S, PI Darling, J. and 2019.1.00292.S, PI Paine, J.), which were obtained from ALMA Science Archive. The observation epochs were 19 Sep. 2017 and 19 Aug. 2021, respectively. We asked East Asia ALMA Regional Center to calibrate these data because we cannot perform it by Mac OS version problem. The field of view is $68''$ or 2.7 pc in the NSC. The beam sizes are $0.091'' \times 0.082''$ and $0.150'' \times 0.091''$, respectively. We made channel maps of the SiO maser emission with the velocity range of $V_{\text{LSR}} = -350$ to 350 km s $^{-1}$ and the velocity width of $\Delta V = 10$ km s $^{-1}$. We detected 37 SiO maser stars in the channel maps and derived the positions and LSR velocities of the objects. We derived the proper motions comparing with the positions relative to Sgr A* at the two epochs. The derived proper motions are generally mild as compared with those of the sub-millimeter continuum objects in the NSC (the ASJ 2024 Spring Annual Meeting). This suggests that the SiO maser stars revolve on the orbits with larger radiuses around Sgr A*. We estimated 3D motions from the proper motions and LSR velocities. The 3D motions are consistent with Kepler orbits around Sgr A*, of which mass is assumed to be $4 \times 10 M_{\odot}$.