R13a   Astrometry of the Nuclear Star Cluster using ALMA II

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Sgr A* is the nucleus of the nearest barred spiral galaxy, the Milky Way. It harbors a supermassive black hole of $4.2 \times 10^6 M_\odot$, which is called the Galactic Center Black Hole (GCBH). The IR observations in the last three decades have revealed that there are many massive stars (almost WR and O stars) around the GCBH. They are called the Nuclear Star Cluster (NSC). It is important to measure the positions and proper motions of the member stars in the NSC because they are related to their origins. ALMA is capable of determining the positions of the member stars relative to Sgr A* with an accuracy better than 1 milli-arcsecond. We have already reported the first results, such as the streaming motions of star clusters, with ALMA in 2021 (Tsuboi et al. PASJ 2022). However, the results were obtained by comparing between only two observations (ALMA 2017.1.00503.S and ALMA 2018.1.01124.S).

There are more than 10 observations with the angular resolution of $\lesssim 0.1$" in the ALMA Science Archive. We have analyzed these abundant ALMA data to determine the proper motions and accelerations of the NSC member stars . The long-term trajectories of the proper motions are also essential information in the search for intermediate-mass black holes, which are expected to reside in the Galactic Center region. We will present the progress of the astrometry of the NSC using ALMA.