

Astrometry of Galactic Star-Forming Region G48.61+0.02 with VERA

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We performed the astrometry of H₂O masers in the Galactic star-forming region G48.61+0.02 with the VLBI Exploration of Radio Astrometry (VERA). We derived a trigonometric parallax of $199 \pm 7 \mu\text{as}$, which corresponds to a distance of $5.03 \pm 0.19 \text{ kpc}$. The distance to G48.61+0.02 is about a half of its far kinematic distance, which was often assumed previously. This distance places G48.61+0.02 in the Sagittarius-Carina arm and near the active star forming region and the supernova remnant W51. The obtained distance is very close to the parallactic distance of W51 Main/South, which is measured to be $5.41^{+0.31}_{-0.28} \text{ kpc}$ by the H₂O maser astrometric observations with VLBA [1].

We also obtained the three dimensional motion of G48.61+0.02, and found that it has a large peculiar motion of $40 \pm 5 \text{ km s}^{-1}$. The kinetic energy of the peculiar motion is estimated to be $(2 \pm 1) \times 10^{51} \text{ erg}$. What is the origin of this peculiar motion? This peculiar motion would be originated with the multiple supernovae explosions in W51, or the streaming motion across the Sagittarius-Carina arm. W51 C is the nearest SN remnant from G48.61+0.02. Figure 1(a) shows the position of G48.61+0.02 superimposed on *Fermi* LAT counts map in 2–10 GeV around W51 C [2]. The separation between G48.61+0.02 and the center of W51 C is 0.70 deg (62 pc). Figure 1(b) and (c) show the integrated intensity and the position velocity maps in the ¹³CO *J*=1–0 line around W51 C [3]. The explosion kinetic energy of W51 C is estimated to be $\sim 5 \times 10^{51} \text{ erg}$ [2]. Considering the energetics, the SN explosion is the possible origin. G48.61+0.02 appears to be located on the Sagittarius-Carina arm. Therefore, the streaming motion across the spiral arm is one possible origin for the large peculiar motion of G48.61+0.02.

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References

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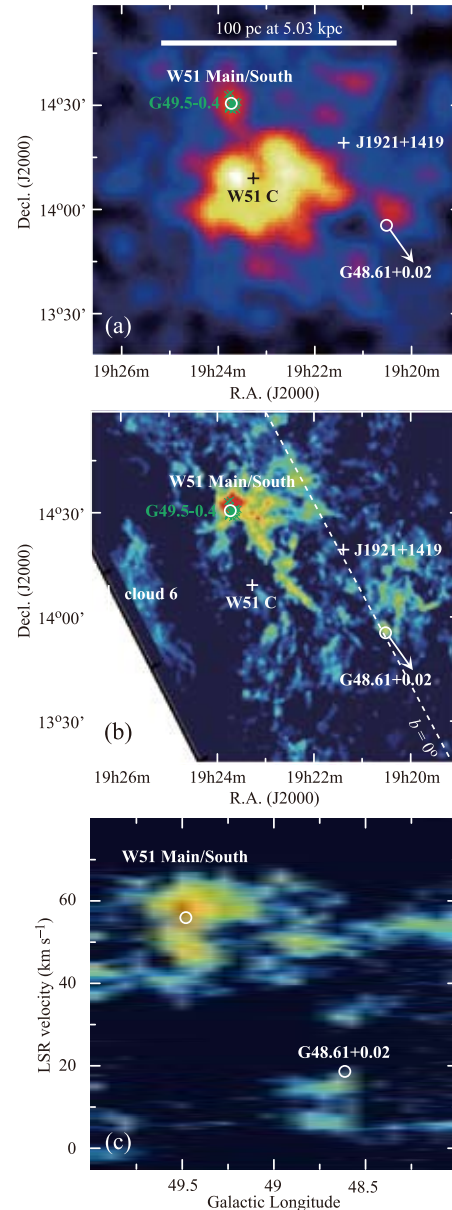


Figure 1: (a): Positions of G48.61+0.02, W51 Main/South (white circle), and OB stars in G49.5–0.4 (green cross) superimposed on *Fermi* LAT counts map in 2.10 GeV around W51 C [2]. The crosses show the center of W51 C and the position of J1921+1419. The arrow shows the motion of G48.61+0.02 relative to W51 Main/South which is obtained to be $-0.12 \pm 0.16 \text{ mas yr}^{-1}$ ($-2.9 \pm 3.9 \text{ km s}^{-1}$) in right ascension and $-0.17 \pm 0.19 \text{ mas yr}^{-1}$ ($-4.1 \pm 4.6 \text{ km s}^{-1}$) in declination. (b): same as (a), but the background shows the integrated intensity map in the ¹³CO *J*=1–0 line [3]. (c): Longitude-velocity map in the ¹³CO *J*=1–0 line [3].