THE GALACTIC CENTER REGION FILLED WITH MOLECULAR SHELLS

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1. Introduction

The kinematics and structures of the molecular clouds probably give us key information for activities in the Galactic center region. CS lines are good tracers of dense molecular clouds. In addition, the lines are expected to be nearly free from the strong contamination of disk molecular clouds because of high critical density, $n(\mathrm{H_2}) \simeq 10^4 cm^{-3}$. Thus, we have made survey observations of the Galactic center region in the CS J=1-0 line with the Nobeyama 45-m telescope (Tsuboi, Handa, and Ukita 1997). The beamsize is 34" and the achieved noise was $T_{rms} = 0.25$ K/1.6 km s^{-1} in T_{MB}. Then, we detected the molecular mass of $M(\mathrm{H_2})_{CS,thin} = (3-8) \times 10^7$ M$\odot$ in the Galactic center molecular zone (CMZ), assuming of optically thin, $T_{ex} = 30 - 80$ K (Güsten 1989), and $X(\mathrm{CS}) = 1 \times 10^{-8}$ (Irvine et al. 1987).

2. Expanding Shells in the Galactic Center Region

We found dozens shell-like structures in CMZ. Almost half number of these associate with well-known nonthermal or thermal sources in the Galactic center region, for example, Radio Arc, Sgr B2, and Sgr D. The remain half number of shells do not associate with such continuum sources. The shells are prominent especially in the Sgr B2 complex region. Figure 1-(a) shows a example of the shells. Figure 1-(b) shows the $l - v$ diagram. A shell is located at $l = 0.81°, b = -0.07°$, or on the eastern side of the Sgr B2 region in figure 1. The diameter is D =25 pc. This is also identified as a twin-arc feature, shown by arrows, with large velocity width of v = 60 km s^{-1}. The ratio of $T_{MB}(\mathrm{CS})/T_{MB}(^{13}\mathrm{CO})$ in the shell increases up to twice of those of the surrounding regions. These have been observed by the

Y. Sofue (ed.), The Central Regions of the Galaxy and Galaxies, 169-170.

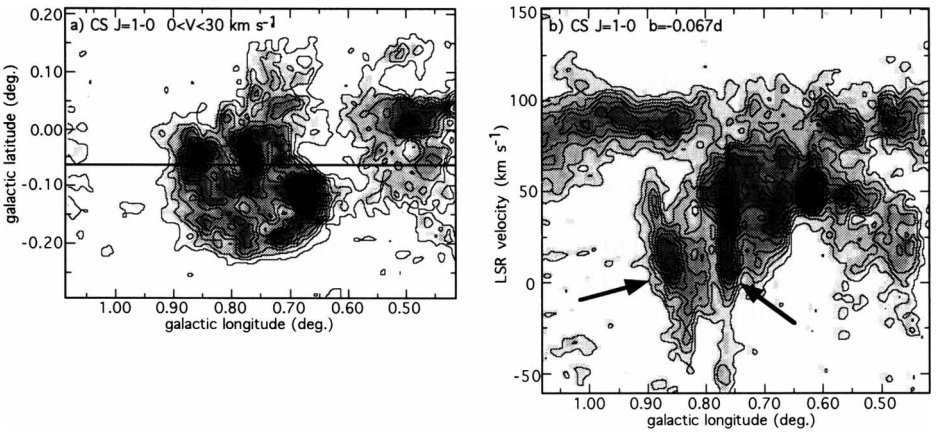

Figure 1. (a) Integrated intensity CS J=1-0 map from 0 to 30 km s^{-1} in the Sgr B2 region. Contour intervals and the first contour level are both 6.3 K km s^{-1} in T_{MB}. (b) The $l - v$ diagram along $b = -0.067°$ shown by a solid line in the left panel. Contour intervals and the first contour level are both 0.25 K in T_{MB}.

interacting region between molecular clouds and the supernova remnants, such as IC443 (White et al. 1987). Thus this is presumably an expanding shell. The mass is $M(\mathrm{H_2})_{CS,thin} = 1.3 \times 10^6$ M$\odot$. The kinetic energy is estimated to be $E_{kin} \simeq 1 \times 10^{52}$ erg. The age of the shell is younger than $t \leq 4 \times 10^5$years.

These shells are expanding with velocity of 20-50 km s^{-1}. Their ages are at the last 10^6 year even if the expansion velocity is constant. The kinetic energy contained in each shell is 10^{51-52} erg. These shells occupy a large part of volume in CMZ. The total kinetic energy is up to 10^{53} erg. The origin of the expanding shells remains ambiguous. If the shells were made by super novae in the Galactic center region, a short-time activation of star formation was occurred in the past time. Thus these structures may be remnants of active star formation in the Galactic center region.

References

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