

**THE CO 2–1/1–0 RATIO IN THE DISK AND CENTER
OF THE MILKY WAY GALAXY**

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We are conducting a survey of the CO $J=2-1$ line emission in the southern Milky Way (the Tokyo-Onsala-ESO-Calán Galactic CO survey), using the 60-cm radio telescope (*VST2*) in La Silla, Chile. It is combined with

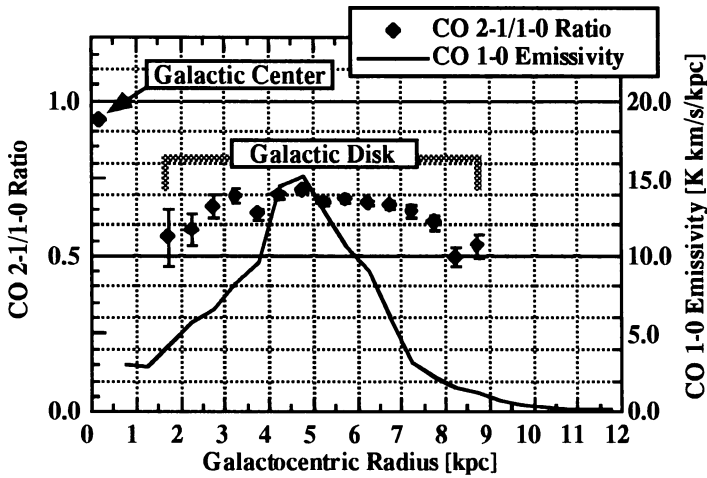


Figure 1. The CO $J=2-1/J=1-0$ intensity ratio as a function of the Galactocentric radius. The Galactic center value is an average over all emission within $|l| \leq 2.5^\circ$ and $|b| \leq 1^\circ$. The disk value is from the data at $|l| = 5^\circ \rightarrow 85^\circ$ sampled and analyzed symmetrically for the 1st and 4th quadrants. A flat rotation at $\Theta_0 = 220 \text{ km s}^{-1}$ was assumed.

the northern survey made with the identical telescope (*VST1*) at Nobeyama (*e.g.*, Sakamoto *et al.* 1995), and is directly comparable with the Columbia survey of the CO $J=1-0$ emission (*e.g.*, Dame *et al.* 1987).

Figure 1 shows the CO $J=2-1/J=1-0$ ratio plotted against the Galactocentric radii. The data are from i) the galactic plane pilot survey that covers $|l| \leq 90^\circ$ sampled at every degree (Hasegawa *et al.*, in preparation), and ii) the new survey of the Galactic center region covering $|l| \leq 6^\circ$ and $|b| \leq 2^\circ$ (Sawada *et al.*, in preparation). The molecular gas in the central 750 pc of the Galaxy exhibit markedly higher $J=2-1/J=1-0$ ratio of 0.93 ± 0.02 , in contrast to the disk gas with the ratio of 0.5-0.7 (total intensity ratio being 0.66 ± 0.01). The Galactic center value in our previous paper (Oka *et al.* 1997) was underestimated.

References

- Dame, T. M., Ungrechts, H., Cohen, R. S., de Geus, E. J., Grenier, I.A., May, J., Murphy, D. C., Nyman, L. Å., & Thaddeus, P. (1987) A composite CO survey of the entire Milky Way, *ApJ*, **322**, pp. 706-720
- Oka, T., Hasegawa, T., Hayashi, M., Handa, T., & Sakamoto, S. (1997) CO ($J=2-1$) line observations of the Galactic center molecular cloud complex. II. Dynamical structure and physical conditions, *ApJ* in press.
- Sakamoto, S., Hasegawa, T., Hayashi, M., Handa, T., & Oka, T. (1995) An out-of-plane CO ($J=2-1$) survey of the Milky Way. I. The data, *ApJS*, **100**, pp. 125-131