

## CO(J=2-1) Observations of the Galactic Center Molecular Clouds

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### ABSTRACT

We are making a large scale mapping observation of the Galactic center region in the  $^{12}\text{C}^{16}\text{O}(J=2-1)$  line using the Tokyo-NRO 60cm survey telescope with a 9' beam. Here we present its preliminary results.

The distribution of CO(J=2-1) is more asymmetric than CO(J=1-0) in *l*-V plane, resembles rather that of CS(J=2-1) and NH<sub>3</sub> inversion transition lines. This means that the distribution of dense molecular gas in the Galactic center region is **highly asymmetric**. The CO(J=2-1) distribution also suggests that molecular gas forms a **huge complex of giant clouds** rather than individual unrelated clouds.

In sharp contrast to the asymmetric distribution of the molecular gas, HII regions and OH/IR stars show a much more symmetric pattern in the *l*-V plane. This fact means that star formation have mainly taken place in a roughly rigid rotating disk or a ring like structure since 10<sup>6</sup> years ago.

In order to estimate the physical condition in the Galactic center molecular clouds, we employed a large velocity gradient model(e.g. Goldreich & Kwan 1974) to our analysis.

## QUESTIONS and ANSWERS

Talk Title : CO (J=2-1) Observations of the Galactic Center Molecular Clouds

Speaker : Oka, T.

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Koo, B.-C. : How does the J=2-1 to 1-0 line ratio map look like? Is there any correspondence with the H recombination line map?

Oka, T. : That's a good question. (2-1)/(1-0) ratio of CO is relatively high in the Nuclear Molecular Cloud Complex, exceed 1.0. In negative side ridge that is about 0.75 and in the Expanding Molecular Ring about 0.6 or lower. And there is rough anti-correlation in l-V plane between the high (2-1)/(1-0) ratio region and Hydrogen recombination line. We think that around and inside of the Star Forming Ring optically thin gas generated by strong tidal force and strong UV field is distributed.

Choe, S. U. : I can see the negative features in your P-V diagram. What is it? Is it related to the galactic center structures you mentioned in your talk?

Oka, T. : Previously that feature was considered as a part of the Expanding Molecular Ring. But in fact, I don't think so. Because the other part of EMR shows relatively low CO(2-1)/CO(1-0) intensity ratio typically 0.6, while that negative feature shows high (2-1)/(1-0) ratio excess 1.0. I think that may be related to the Nuclear Molecular Cloud Complex, but its dynamics has not yet been understood. More precise analysis is needed.

Y. C. Mihn : There are many models on the structure of the Galactic Center? How can you put 20 km/s and 40 km/s clouds and other structures in your model from the result of 9' beam observations?

Oka, T. : For the first question, answer is yes. But the unified model explaining the whole observations has not been proposed yet. And for the second one, as you mentioned it is impossible to determine the position of 20 km/s and 40 km/s clouds from the results of 9' beam observation. But we know that the most prominent features in that position and in that velocity range are 20, and 40 km/s clouds. So we can see these clouds as a strong peak in l-V diagram.