Molecular Gas, Dust, and Star Formation in Galaxies
Proceedings IAU Symposium No. 292, 2012
T. Wong & J. Ott, eds.

doi:10.1017/S1743921313000744

The Environmental Effect of the CMF in the Galactic Center 50 km s^{-1} Molecular Cloud

Masato Tsuboi[1] **and Atsushi Miyazaki**[2]

[1]Institute of Space and Astronautical Science, 3-1-1 Yoshinodai, Sagamihara, 252-5210, Japan
email: tsuboi@vsop.isas.jaxa.jp

[2]Korean VLBI Network, Korea Astronomy and Space Science Institute,
P.0. Box 89, Yonsei University, 262 Seongsan-ro, Seodaemun-gu, Seoul 120-749, Korea
email: amiya@kasi.re.kr

Abstract. We present the statistical properties of molecular clumps in the Galactic center 50 km s^{-1} molecular cloud based on observations of the CS $J = 1-0$ emission line with the Nobeyama Millimeter Array. The CMF and size spectrum for the whole cloud can be described by power laws of $dN/dM \propto M^{-2.6\pm0.1}$ and $dN/dR \propto R^{-5.9\pm0.3}$, respectively. The CMF observed in the interacting part with the Sgr A East steepens to $dN/dM \propto M^{-4.0\pm0.2}$. On the other hand, the interaction presumably truncates the size spectrum on the larger side of $R \sim 0.4$ pc.

Keywords. ISM: clouds — supernova remnants — stars: formation

1. Results and Discussion

The Galactic center 50 km s^{-1} molecular cloud (GCM-0.02-0.07) is most prominent in the Central Molecular Zone (CMZ). The cloud is interacting with a supernova remnant, Sgr A East. The cloud should be a most promising test bed to study of the star formation mechanism in the CMZ.

We present the clump mass function (CMF) in the cloud based on imaging observations of the CS J=1-0 emission line with the Nobeyama Millimeter Array (Tsuboi *et al.* 2009). In the cloud, we identified 37 molecular clumps with local thermal equilibrium (LTE) masses of $200 - 6000$ M$_\odot$ using CLUMPFIND. The velocity widths of the molecular clumps are about five-fold those of Galactic disk molecular clouds with the same radius. The velocity width-size relation of the clumps is bimodal. The virial-theorem masses are three-fold the LTE masses. The CMF and size spectrum for the whole cloud can be described by power laws of $dN/dM \propto M^{-2.6\pm0.1}$ ($M \gtrsim 900 M_\odot$) and $dN/dR \propto R^{-5.9\pm0.3}$ ($R \gtrsim 0.35$ pc), respectively. The power law index of the CMF, $\gamma = -2.6$, is slightly larger than the indexes previously obtained for the molecular clouds in the CMZ, $\gamma = -2.0 - 2.5$ (e.g. Bally *et al.* 2010).

There is a significant difference between CMFs observed in the interacting part with the Sgr A East and the non-interacting part. The index in the interacting region is steepen up to $\gamma = -4.0 \pm 0.2$. On the other hand, the interaction presumably truncates the size spectrum on the larger side of $R \sim 0.4$ pc. They indicate that over 50 % of the clumps in the region have similar high mass, $M = 1400 \pm 300$M$_\odot$, and similar small size, $R = 0.38 \pm 0.06$ pc. These typical size and mass are nearly equal to the Jeans length ($L_{\rm J} \sim 0.3$ pc) and Jeans mass ($M_{\rm J} \sim 1700$ M$_\odot$) for $n({\rm H_2}) \sim 10^4$ cm^{-3} and $T \sim 50$ K.

References

Tsuboi, M., Miyazaki, A., & Okumura, S. K. 2009, *PASJ*, 61, 29
Bally, J. *et al.* 2010, *ApJ*, 721, 137