MORPHOLOGY OF GAS IN THE GALACTIC CENTER FROM SPECTROSCOPY OF H_3^+

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Over the last several years our observations of the infrared spectrum of H_3^+ toward the Galactic center (GC) have established a high ionization rate ($\zeta > 2 \times 10^{-15}$ s^{-1}) and the existence of a vast amount of warm ($T \sim 250$ K) and diffuse ($n < 100$ cm^{-3}) gas with a high volume filling factor ($f > 0.3$) in the Central Molecular Zone (CMZ) of the GC, a region of radius ~ 150 pc.[abc] These findings are gradually being assimilated into the astrophysics of the GC.

Determining the morphology of this gas is difficult because the sightlines for study are limited by the uncontrollable locations of background stars suitable for spectroscopy of H_3^+. There are wide longitudinal gaps in the locations of those stars and the precise radial locations of the stars within the CMZ are uncertain. Nevertheless, the velocity profiles of the observed H_3^+ spectra indicate the presence of the Expanding Molecular Ring (EMR), a structure containing mostly diffuse gas expanding from the center with velocities of up to 180 km s^{-1} and bordering the CMZ. On the other hand, the 120 pc Molecular Ring,[d] an inner t ring of cold dust and dense gas with radius ~ 100 pc is not clearly seen in H_3^+. This is possibly because the sightlines that we have observed to date lie close to the Galactic plane and miss the ring, which goes above and below the Galactic plane.[e]

[a] Oka, T., Geballe, T.R., Goto, M., Usuda, T., McCall, B.J. 2005, ApJ, 632, 882
[b] Goto, Usuda, Nagata, Geballe, McCall, Indriolo, Suto, Henning, Morong, and Oka, 2008, ApJ, 688, 306.
[c] Geballe, T.R. and Oka, T. 2010, ApJ, 709, L70
[d] Sofue, Y. 1995, PASJ, 47, 527
[e] Molinari, S. et al. 2011, ApJ, 735, L33.