LARGE PICTURE OF THE GALACTIC CENTER STUDIED BY H_3^+: HIGH IONIZATION RATE, PREVAILING WARM AND DIFFUSE GAS, AND NON-ROTATING EXPANDING MOLECULAR RING

TAKESHI OKA, *Department of Astronomy and Astrophysics, Department of Chemistry, the Enrico Fermi Institute, University of Chicago, Chicago, IL 60637*; THOMAS R. GEBALLE, *Gemini Observatory, Hilo, HI 96720*; NICK INDRIOLO, *Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD 21218*.

Following our initial studies of the diffuse interstellar medium in the Central Molecular Zone (CMZ) of the Galactic center (GC) toward two remarkable sightlines—one 140 pc to the West of Sgr A* near Sgr E, and the other 85 pc to the East of Sgr A* near Sgr B[a]—we are in the process of using newly identified bright stars with smooth continua suitable for H_3^+ spectroscopy to both fill the gap between these sightlines and expand coverage to wider regions of the CMZ. So far we have identified 43 qualified stars, of which 24 have been at least partially observed (i.e., in at least one spectral setting). The high ionization rate (on the order of $\zeta \sim 3 \times 10^{-15}$ s^{-1}) and the existence of warm ($T \sim$250 K) and diffuse ($n \leq 100$ cm^{-3}) gas previously reported in the GC[b] have also been observed in some of the new sightlines, indicating these conditions fill a large portion of the CMZ.

The velocity profiles observed in the diffuse clouds, some of which show absorption extending $\sim$ 140 km s^{-1}, allow us to draw a velocity-longitude diagram. The high-velocity fronts of such a diagram reveal the existence of an expanding molecular ring (EMR) with radius of $\sim$ 140 pc and velocity of $\sim$ 140 km s^{-1}. This ring is similar to those previously reported[c de] but is qualitatively different in that it is not rotating, suggesting an expulsion rather than the gravitational potential as causing the EMR. Possible relations between our observations and other high energy events will be discussed.

[a] T. R. Geballe and T. Oka, ApJ, 709, L70 (2010).
[b] T. Oka, T. R. Geballe, M. Goto, T. Usuda, and B. J. McCall ApJ, 632, 882 (2005).
[c] N. Kaifu, T. Kato, and T. Iguchi, Nature, 238, 105 (1972).
[d] N. Z. Scoville, ApJ, 175, L127 (1972).
[e] Y. Sofue, PASJ, 47, 551 (1995).