SCRUTINY OF THE CORE OF THE GALACTIC CENTER BY H_3^+ AND CO: GCIRS 3 AND GCIRS 1W

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Out of the over two dozen sightlines toward the Central Molecular Zone of the Galactic center so far observed by infrared spectra of H_3^+ and CO, sightlines toward GCIRS 3 [a] and Iota [b] stand out as exceptional since they show cloud components with clear $R(2,2)^l$ absorption indicating that their unstable (J, K) = (2,2) levels are well populated. Those two sightlines toward the Galactic core and Sgr B, respectively, must pass through hot and dense gas. The cloud component at $\sim$ 60 km s^{-1} toward GCIRS 3 is particularly intriguing since GCIRS 1W, which is separated from it only by 5".8 (0.23 pc if the same distance to the Galactic center of 8 k pc is assumed), barely shows the $R(2,2)^l$ absorption. The cloud must be compact and this calls for a high ionization rate.

To further study this problem the sightlines toward GCIRS 3 and GCIRS 1W have been observed by VLT under high spectral resolution. The observed $R(3,3)^l$ absorption is extraordinarily deep and the $R(2,2)^l$ absorption is clearly observable at $\sim$ 60 km s^{-1} for GCIRS 3 indicating unusually high temperature and high density of the cloud. In contrast, toward GCIRS 1W, the $R(3,3)^l$ absorption is of ordinary depth and the $R(2,2)^l$ absorptions is marginal if any indicating the well known warm and diffuse gas observed toward other regions of the Central Molecular Zone. Their analysis and comparison with radio HCN emission observed in the area will be discussed.

[a] M. Goto, T. Usuda, T. Nagata, T. R. Geballe, B. J. McCall, N. Indriolo, H. Suto, Th. Henning, C. P. Morong, and T. Oka, ApJ, 688, 306 (2008).
[b] Goto, Usuda, Geballe, Indriolo, McCall, Henning, Oka, PASJ (2011) in press.