$HOCO^+$ toward Sgr B2 Complex

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A number of rotational lines of protonated carbon dioxide, $HOCO^+$, have been observed mostly at frequencies above 80 GHz in interstellar clouds. In this conference, we report the identification of the lowest rotational transition 1_{01}-0_{00} of $HOCO^+$ at 21.383 GHz toward Sgr B2, and a detection of emission of the next lowest transition 2_{02}-1_{01} at 42.766 GHz toward GCM0.77-0.06, using the Nobeyama 45m telescope.

Protonated carbon dioxide ($HOCO^+$) has been identified in interstellar clouds since 1981 [1]. Although millimeter-wave thermal lines of this molecule are considerably weak and difficult to detect in general, they are found in a few different environments in the Galaxy, for example, toward the translucent clouds [2], in the Galactic Center [3], and toward a low-mass protostar [4], and moreover, toward the center of the galaxy NGC 253 [5]. This molecular ion can be used as a measure of the abundance of CO_2 which is not observable directly at radio wavelengths.

Several years ago, we have identified the weak thermal line U42.767 seen toward the Galactic Center to the $HOCO^+$ 2_{02}-1_{01} transition, and made a map of this thermal line in the 30' x 30' area of Sgr A* [6]. Because the frequency of this transition is close to the frequency of the SiO v=2 J=1-0 transition (42.821 GHz), so that the observations can simultaneously be made with SiO maser surveys with the Nobeyama 45-m telescope [7,8].

No observation of the lowest rotational transition 1_{01}-0_{00} of $HOCO^+$ has been reported till today, because the line is severely blended with a recombination line H67alpha at 21.386 GHz. We reanalyzed the spectral line data toward Sgr B2 complex at this frequency, which were taken using Nobeyama 45m telescope in 2004 and were archived. Subtracting the averaged line profile of H66alpha and H68alpha from the H67alpha profile, we obtained the difference spectrum, which shows a clear emission of the 1_{01}-0_{00} transition of $HOCO^+$. We also report the detection of unexpectedly strong $HOCO^+$ emission toward the Galactic Center molecular cloud GCM0.77-0.06 at 42.766 GHz.

References

[1] P. Thaddeus, M. Guelin, & R. A. Linke, 1981, ApJ, 246, L41S.
[2] B.E. Turner, R. Terzieva, & E. Herbst, 1999, ApJ, 518, 699
[3] Y. C. Minh, et al. . 2005, New Astronomy, 10, 425
[4] N. Sakai, T. Sakai, Y. Aikawa, & S. Yamamoto 2008, ApJ, 675, L89
[5] S. Martin et al. ApJS, 164, 450
[6] S. Deguchi, A. Miyazaki, & Y.C. Minh, 2006, PASJ, 58, 979
[7] S. Deguchi, et al. PASJ, 56, 261
[8] T. Fujii, et al. 2006, PASJ, 58, 529