OBSERVATIONS OF THE 3.4-mm HCO^+ LINE TOWARD THE GALACTIC CENTER

Yasuo Fukui, Norio Kaifu, Masaki Morimoto, and Takeshi Miyaji
Tokyo Astronomical Observatory, Mitaka, Tokyo, Japan

3.4-mm line of HCO^+ has been mapped toward the galactic center. The telescope used was the 6-m mm-wave telescope at the Tokyo Astronomical Observatory, equipped with a GaAs Schottky barrier diode mixer and a 256-ch filter bank of 1-MHz resolution. Fig. 1 shows the observed positions on the antenna temperature contour map of HCN(Fukui et al. 1977). Intensive observations were made of the line SR where the HCN emission is strongest. Fig. 2 shows the HCO^+ profile as well as the HCN profile, both of which are averages along SR($0\overset{\circ}{.}0 \lesssim \ell \lesssim 0\overset{\circ}{.}2$).

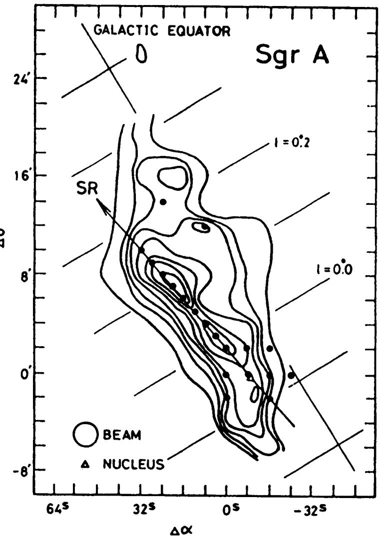

Fig. 1: Observed positions in the 3.4-mm line of HCO^+ are shown on the HCN map(Fukui et al. 1977). The origin is R.A. =17h42m40s and Decl.=-28°59' (1950).

The main results can be summarized as follows;

1. As shown in Fig. 2, the HCO^+ profile is very broad and asymmetric. The emission ranges at least from -50 km s^{-1} to 110 km s^{-1}.
2. The HCO^+ profile has a sharp dip at 0 km s^{-1}. Similar dips were found in CO(Liszt et al. 1975) and HCN(Fukui et al. 1977).
3. The line core of HCO^+ resembles well that of HCN, while the line wing found in HCO^+ is not recognisable in the HCN profile. The decrease in HCN brightness at the edge of the line core is remarkable.

Fig. 3 shows the correlation of the HCO^+ and HCN line shapes. It shows that HCO^+ emission is still significant where little HCN emission is detected, which suggests that HCO^+ becomes significantly more abundant in the less dense region. This tendency is consistent with theoretical prediction based on the ion-molecule reaction scheme (e.g. Suzuki et al. 1976), and can be interpreted as mainly caused by the increase in the degree of ionization with the decrease of density.

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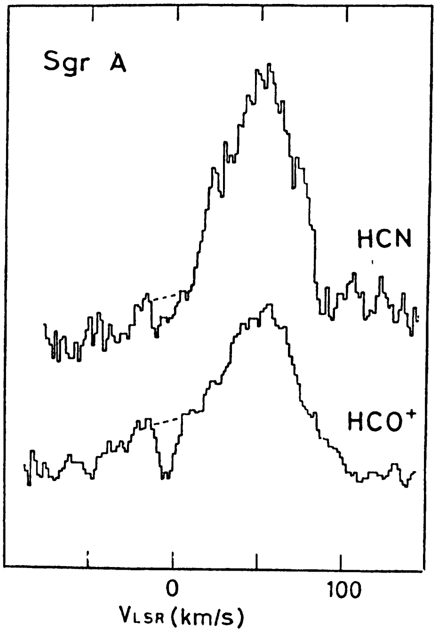

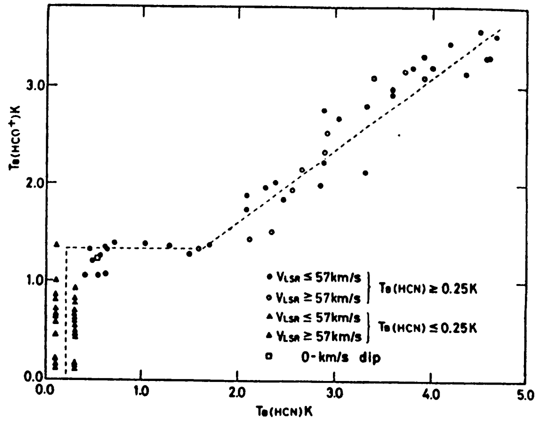

Fig. 2 (left): averaged profiles of HCO^+ and HCN.
Fig. 3 (above): the correlation between HCO^+ and HCN. The profiles in Fig. 2 are sampled at 2 km s^{-1} intervals to provide the data.

Table 1. Molecular abundance in the 0-km s^{-1} cloud

Molecule	Transition(λ mm)	Column density(cm^{-2})	Reference
$H^{12}CN$	J=1-0(3.4)	$\gtrsim 3 \times 10^{13}$	present work
$H^{12}CO^+$	J=1-0(3.4)	$\gtrsim 3 \times 10^{13}$	present work
^{13}CO	J=1-0(2.7)	$\gtrsim 2 \times 10^{16}$	Liszt et al.(1975)
$2H_2$		$3\text{-}10 \times 10^{22}$*	Scoville and Solomon(1975)

* Estimated from the data of the 2.6-mm ^{12}CO emission.

The 0-km s^{-1} dip is ascribed to self-absorption due to a foreground cold cloud. Table 1 summarizes column densities of HCO^+ and HCN in the 0-km s^{-1} cloud. It is noteworthy that these tri-atomic molecules are still abundant in a diffuse cloud where these lines are not appreciably excited.

This paper is a summary of part of the Doctoral thesis of one of the authors (Y.F.).

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