Radio Searches for Interstellar Carbon Chains HC_4OH and H_2CCC

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We have made a sensitive search for the rotational transitions of the interstellar carbon chains HC_4OH and H_2CCC.

The carbon-chain alcohol HC_4OH have searched in the frequency range from 21.2 to 46.7 GHz in the star forming region L1527 in Taurus with rich carbon-chain chemistry [1]. The incentive of this observation was a laboratory detection of HC_4OH by the microwave spectroscopy [2]. Despite achieving an rms of several mK in antenna temperature by the 45m telescope at Nobeyama Radio Observatory, the search for HC_4OH was negative, leading to a 5 sigma upper limit corresponding to the column density of 4×10^{12} cm^{-2} based on the excitation temperature of 12.3 K. The upper limit indicates that the [HC_4-OH]/[HC_4-CN] ratio is less than 1.0. The ratio suggests that the cyanide species with carbon-chain structure is dominant in comparison with the hydroxyl one in L1527, which can be the opposite case of saturated compounds, *e.g.* CH_3OH and CH_3CN, in hot cores and dark clouds.

In order to clarify the authenticity of a recently proposed identification of H_2CCC (*linear*-C_3H_2) as a diffuse interstellar band carrier [3], we searched for the rotational transition of H_2CCC at a frequency of 103 GHz toward HD 183143 using the 45m telescope at Nobeyama Radio Observatory [4]. Although an rms noise level of 32 mK in the antenna temperature, T_A^*, was achieved, detection of H_2CCC was unsuccessful, producing a 3 σ upper limit corresponding to a column density of 2.0×10^{13} cm^{-2}. The upper limit indicates that the contribution of H_2CCC to the diffuse interstellar band at 5450 Å toward the star HD 183143 is less than 1/25; thus, it is unlikely that the laboratory bands of the B^1B_1–X^1A_1 transition of H_2CCC and the diffuse interstellar bands at 5450 Å (and also 4881 Å) toward HD 183143 are related.

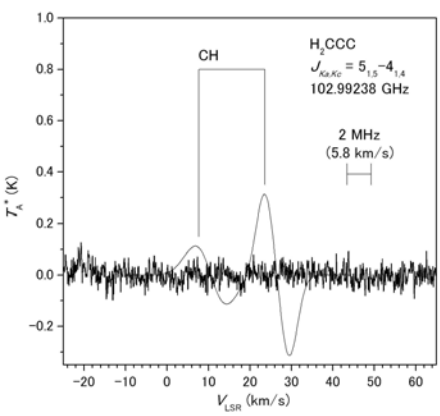

Figure 1: Spectrum at the line position of H_2CCC searched toward HD 183143. Solid vertical lines indicate positions of the two velocity components of CH. Solid curve shows a line profile of H_2CCC simulated in arbitrary intensity.

References

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