DETECTION OF NON-EMISSION VIBRONIC BANDS OF THIOPHENOXY RADICAL BY ABSORPTION SPECTROSCOPY

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Diffuse Interstellar Bands (DIBs) are absorption bands detected in diffuse clouds by optical observations. Although $\sim$ 600 DIBs have been found so far, only the five bands were assigned to the fullerene cation and the other bands are not identified yet. Recently, benzonitrile (C_6H_5CN) was detected in interstellar space by radio as the first aromatic compound [1]. Thus, thiophenoxy radical (C_6H_5S) is received much attentions as a candidate of DIBs, because sulfur is a dominant element of interstellar molecules. Fluorescence excitation spectra of the $^2A_2$–X $^2B_1$ electronic transition of C_6H_5S showed the origin band as the strongest peak [2]. However, in our previous work, absorption spectra of phenoxy radical (C_6H_5O) brought out the stronger vibronic bands than the origin band [3]. The fact suggests that intensities of higher vibronic bands of C_6H_5S are lost by radiationless transitions in the fluorescence excitation spectra. Thus, stronger vibronic bands of C_6H_5S are expected because of similarity of the two molecules. We investigated the vibronic bands in the 473–519 nm region by Cavity Ring Down spectroscopy and detected them. The strongest vibronic band at 4850 Åwas assigned to the $6a_0^2$ + $6b_0^1$ transition. This band may appear as DIB if sufficient amount of this radical exists in interstellar medium.

[1] McGuire et al., Science, 359, 202 (2018). [2] Shibuya et al., J. Chem. Phys. 121, 237 (1988). [3] Araki et al., Astronomical J. 150, 113 (2015).