# High Resolution Spectroscopy of the $^2A_2 - \widetilde{X}\,^2B_1$ Electronic Transition of Phenoxy Radical as a Candidate of Diffuse Interstellar Bands Carrier

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Diffuse Interstellar Bands (DIBs) still haven't been identified, although several hundreds of bands have been detected [1]. To identify DIBs, we observed the laboratory absorption spectra of the $^2A_2 - \widetilde{X}\,^2B_1$ electronic transition of the phenoxy radical $C_6H_5O$ by cavity ring down spectroscopy. The radical was produced by pulsed discharge with a hollow cathode (inside diameter: 2 cm) using a gas mixture of anisole $C_6H_5OCH_3$ (0.1 Torr) and herium (0.4 Torr) in a cell. The optical cavity in the cell was formed with two high-reflectivity mirrors ($R$ > 99.99 %). Laser pulses transmiting the cavity were detected with a photomultiplier tube and ring down curves were acquired with an oscilloscope. The three absorption bands having the large intervals about 500 $cm^{-1}$ were measured in the 5700－6200 Å region and were assigned to the $^2A_2 - \widetilde{X}\,^2B_1$ electronic transition as shown in Figure 1 because the origin band of the electronic transition was reported at around 6200 Å in matrix [2] and the measured three bands were assigned to the 1-0, 2-0, and 3-0 bands of the $\nu_{11}$ mode by comparing with the frequencies obtained by a quantum chemical calculation (B3LYP/cc-pVTZ). The three bands include the two shoulder peaks at the lower-wavenumber side as shown in Figure 2. The shoulder peaks can not be assigned to the hot bands of the $\nu_{11}$ mode due to the large intervals from the main band ($\nu_{11}$ = 2-0). The relative intensity of the shoulder peaks were tested in a dry-ice temperature. Decreasing of the relative intensity suggested that the peaks are attributed to the hot bands of the lowest vibrational mode ($\nu_{20}$).

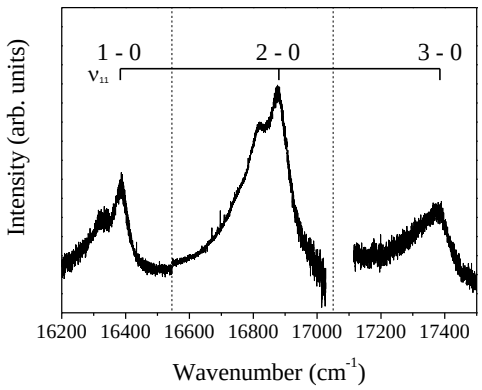


Figure 1: Absorption spectra of the phenoxy radical

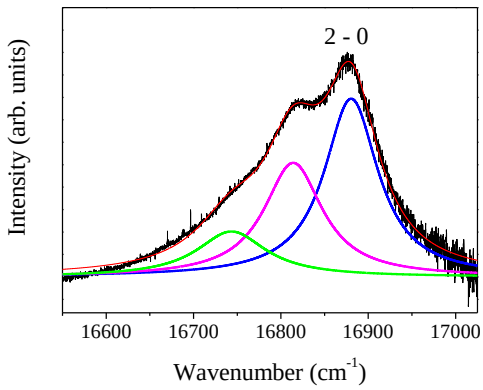


Figure 2: The 2-0 band and the shoulder peaks of the $^2A_2 - \widetilde{X}\,^2B_1$ electronic transition of the phenoxy radical

References

[1] Heger M. L., *Lick Obs. Bull.* **10**, 141 (1922)

[2] Radziszewski *et al*., *J. Chem. Phys*. **115**, 9733 (2001)