LABORATORY SPECTROSCOPY OF $A^2\Sigma^+$–$X^2\Pi_{3/2}$ ELECTRONIC TRANSITION OF ICN^+ TO ESTIMATE PROFILES OF INTERSTELLAR ABSORPTION LINES BY HALOGEN CYANIDE CATIONS

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Diffuse interstellar bands (DIBs) are optical absorption lines by electronic transitions of interstellar molecules in diffuse clouds. Almost all bands are not identified yet, except for C_{60}^+. As a hint of DIB carriers, the presence of C_{60}^+ infers that molecules in diffuse clouds are ionized. Additionally, the molecules would frequently contain a cyano group and more or less include a halogen atom. Hence, halogen cyanide cations are good carrier candidates. To identify origin molecules of DIBs, laboratory data of band profiles of electronic transitions are essential as well as those of their wavelengths. Generally, a band profile is determined by a structural change of an electronic transition. In this work, the high-resolution spectrum of the $A^2\Sigma^+$–$X^2\Pi_{3/2}$ electronic transition for ICN^+, which is one of the halogen cyanide cations, was observed for the first time by cavity ringdown spectroscopy. The rotational constants were determined to be 0.10700(12) and 0.11002(12) $\mathrm{cm}^{-1}$for the $A^2\Sigma^+$ and $X^2\Pi_{3/2}$ states, respectively. Therefore, the rotational constant ratio $\beta = (B' - B'')/B''$ was derived to be -2.7 %. This small β suggests that the profiles of the absorption bands of the halogen cyanide cations have symmetric structures irrespective of diffuse-cloud temperature. This information allows us to search the halogen cyanide cations in space.