The $A^1\Pi_u - X^1\Sigma_g^+$ Electronic Transition System of C_3

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The 4050Å comet group of C_3,[1] which consists of a series of vibronic bands of the $A^1\Pi_u - X^1\Sigma_g^+$electronic transition system, has been of much interest to astronomers. C_3 is the largest molecule identified in the diffuse interstelar medium so far. Spectroscopic characterization of small carbono-containing species like C_2 and C_3 serves as a remote diagnostic of the physical-chemical conditions in translucent interstellar clouds[2], and may help to shed light on the mystery of the diffuse interstelar bands[3]. In this contribution, we present:

a) The high resolution (R=80 000) detection of eight bands of C_3 in the diffuse translucent cloud towards HD 169454.[4,5] Four of these vibronic bands are also found in two additional objects: HD 73882 and HD 154368. Column densities and excitation conditions of C_3 are inferred based on a laboratory re-examination of the eight bands observed towards HD 169454 using cavity ring-down spectroscopy and a supersonic planar plasma expansion. High-quality laboratory data allow to derive accurate spectroscopic parameters of these bands and build the list of lines with a wavelength accuracy of better than 0.01 Å, which is sufficient for the analysis of the observational data. An improved perturbation analysis in the $A^1\Pi_u$ (000) state is given as well.

b) The systematic laboratory investigation on the $A^1\Pi_u - X^1\Sigma_g^+$ (000-000) electronic origin band of ^{13}C-substituted C_3. Rotationally resolved spectra of all five ^{13}C-isotopologues are recorded in a supersonic plasma expansion by discharging $^{13}C_2H_2$ or $^{12}C_2H_2/^{13}C_2H_2$ mixtures diluted in noble gases. The $A^1\Pi_u$ state molecular constants for five isotopologues and ground-state molecular constants for $^{13}C^{12}C^{13}C$ and $^{12}C^{13}C^{13}C$ are experimentally determined for the first time. This work extends the recent mid-infrared work on the ^{13}C-monosubstuted isotopologues of C_3 by Krieg et al.[6].

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