

## THE ‘4050 Å GROUP’ OF THE $\tilde{A}^1\Pi_u - \tilde{X}^1\Sigma_g^+$ TRANSITION SYSTEM OF $C_3$

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The ‘4050 Å group’ of  $C_3$ , which consists of a series of bands of the  $\tilde{A}^1\Pi_u - \tilde{X}^1\Sigma_g^+$  electronic transition system, has been of much interest to astronomers as it serves as a remote diagnostic of the physical-chemical conditions in translucent interstellar clouds. In this contribution, we present:

- a) The high resolution ( $R = 80\,000$ ) detection of eight vibronic bands of  $C_3$  in the diffuse translucent cloud towards HD 169454. Four of these vibronic bands are also detected in two additional objects: HD 73882 and HD 154368. Column densities and excitation conditions of  $C_3$  are inferred.
- b) A laboratory re-examination of the eight vibronic bands observed towards HD 169454 using cavity ring-down spectroscopy and a supersonic plasma jet. High-quality laboratory data build the list of lines with a wavelength accuracy of  $<0.01\text{Å}$ . This is sufficient for the analysis of the observational data. Improved spectroscopic parameters of the corresponding vibronic states are presented. An improved perturbation analysis in the  $\tilde{A}^1\Pi_u(000)$  state is given as well.
- c) The systematic laboratory investigation on the  $\tilde{A}^1\Pi_u - \tilde{X}^1\Sigma_g^+ 000-000$  electronic origin band of  $^{13}\text{C}$ -substituted  $C_3$ . Rotationally resolved spectra of all five  $^{13}\text{C}$ -isotopologues are recorded in a supersonic plasma expansion by discharging  $^{13}\text{C}_2\text{H}_2$  or  $^{12}\text{C}_2\text{H}_2/^{13}\text{C}_2\text{H}_2$  mixtures diluted in noble gas. The  $\tilde{A}^1\Pi_u$  state molecular constants for all five isotopologues and ground-state molecular constants for  $^{13}\text{C}^{12}\text{C}^{13}\text{C}$  and  $^{12}\text{C}^{13}\text{C}^{13}\text{C}$  are experimentally determined for the first time. This work extends the recent mid-infrared work on the  $^{13}\text{C}$ -isotopologues of  $C_3$  by Giesen *et al.*<sup>a</sup>

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<sup>a</sup>T. Giesen, private communication, December 2012.