C_3: RO-VIBRATIONAL ENERGY LEVELS AND LINE-STRENGTHS FOR THE ELECTRONIC GROUND-STATE

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Although propadienediylidene (tricarbon, C_3) is a major consituent of carbon vapour and therefore a vital molecule for diagnosing the state of astrophysical and terrestial gases containing carbon, available spectroscopic data on hot C_3 are sparse and studies limited as a consequence. As steps towards constructing a full line-list involving states with energies ($\leqslant 4000\,\mathrm{cm}^{-1}$) we have undertaken two tasks. First, levels and corresponding line strengths have been calculated for $^{12}C^{12}C^{12}C$ and its isotopologues ($^{12}C^{13}C^{12}C$ and $^{13}C^{12}C^{12}C$) for $0 \leqslant J \leqslant 20$ and $0 \leqslant K \leqslant 15$. Partition functions and cross-sections have been deduced for temperatures $\leqslant$ 20K and made available for absorption line studies at interstellar conditions. These results can be compared with the astronomical observations of Giessen *et al.* [1] Second, a MARVEL (measured vibration rotation energy levels) study has been completed: transition data covering both the ground ($X\,^1\Sigma_g^+$) and first singlet excited ($A\,^1\Pi_u$) states were extracted from 13 sources giving a set of 4773 transitions from which 1687 energy levels covering both the X and A state were extracted. The recent work of Martin-Drumel et al. [2] provided a particularly useful starting point for this study. Results of both studies will be reported at the conference.

[1] T.F. Giesen et al., Astron. Astrophys., 633, A120 (2020).

[2] M.-A. Martin-Drumel et al., J. Molec. Spectrosc. 391, 111734 (2023).