CARBON CHAIN ANIONS OF ASTROPHYSICAL INTEREST: PHOTODETACHMENT SPECTROSCOPY AND THEORETICAL CALCULATIONS

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The recent observation of close coincidences between several of the diffuse interstellar bands and vibronic features of the $A^2\Pi_u \leftarrow X^2\Pi_g$ system of C_7^- in the gas phase has lead to discussion about the possible role of carbon-based anions in the interstellar medium[a]. In this contribution spectra of the anions C_3^-, C_5^- and C_7^-, obtained using photodetachment spectroscopy, are presented and interpreted using the results of *ab initio* calculations. Transitions to both bound electronic states and to states lying above the photodetachment threshold are observed; the latter are assigned as Feshbach resonances on the basis of their calculated electronic structures[b]. Lifetimes for these resonant states are estimated from the observed rotational structure.

The spin-orbit splittings in these anions are calculated theoretically. The results confirm the assigments of the Renner-Teller structure in C_3^-. For C_7^- the calculations have lead to the identification of the $\Omega = \frac{3}{2} - \frac{3}{2}$ components of the $A^2\Pi_u \leftarrow X^2\Pi_g$ 0_0^0 and 1_0^1 bands in the experimental spectrum. The implications for future laboratory and astronomical searches for transitions in these anions are discussed.

[a] M. Tulej, D. A. Kirkwood, M. Pachkov and J. P. Maier *Astrophys. J.* **506**, L69 (1998).

[b] M. Tulej, J. Fulara, A. Sobolewski, M. Jungen and J. P. Maier *J. Chem. Phys.* **112**(8), 3747 (2000).