

Thermionic emission laser spectroscopy of C_4^- and C_6^-

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The structure of small carbon-containing clusters has attracted a lot of interest after the recent discovery of the anion C_6H^- in interstellar space [1]. For the identification of molecules and the modelling of astrophysical processes, both the optical absorption cross spectrum and the neutralization processes of the ions are of prime interest.

We have measured the visible and near-infrared spectrum of C_4^- and C_6^- in the Tokyo Metropolitan University electrostatic storage ring. Single photon excitation show an enhanced decay with a delayed component, consistent with a thermionic-type electron emission process. The enhanced signal for C_4^- is rapidly decreasing from UV to infrared, interrupted by a broad peak with a centroid at 700 nm. The peak was found to sharpen up only marginally with storage time.

The neutralization yield is strongly influenced by the distributions of internal excitation energy generated in the source. This distribution is determined by a comparison of the enhanced peaks during the first and the second turn in the ring after photo excitation and found to be exponentially decreasing from blue to red. Correction for this effect gives the spectrum shown in Fig.1 [2]

The neutralization spectrum for C_6^- looks qualitatively similar to that of C_4^- with a peak in the NIR but shifted to longer wavelengths. The occurrence of these peaks in both species suggest an interpretation in terms of non-linear isomers.

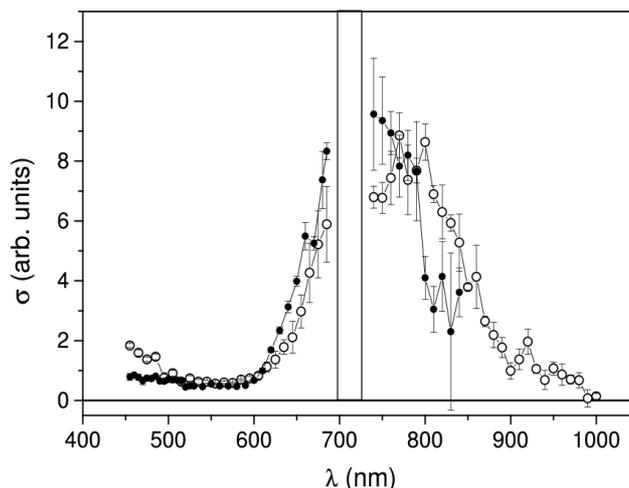


Fig.1. Photo absorption cross section of C_4^- after correction with the source energy distribution. The laser firing times were 5 ms (open circles), 90 ms (filled circles).

References:

[1] M.C. McCarthy et al. *Astrophys. J.*, 652, L141 (2006).

[2] A.E.K. Sundén et al. To be published.