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

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The visible and NIR spectra of the carbon anions, C_4^- and C_6^-, have been measured in the Tokyo Metropolitan University electrostatic storage ring. The anions were produced in a Cs sputter source (C_4^-) and a laser ablation source (C_6^-), both expected to produce hot anions, and stored in the ring for up to 100 ms. Irradiation of the ions with laser light at single photon absorption intensities gave a strongly enhanced neutralization signal for both species. A delayed enhanced signal was observed, as expected from a thermionic type electron emission process, boh for C_4^- and C_6^-.

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 quantitative interpretation of this peak in terms of photo absorption cross sections is influenced significantly by the distributions of internal excitation energy generated in the source. This distribution is determined by a comparison of the enhanced peaks of the first and the second turn after the laser pulse, and is found to be exponentially decreasing from blue to red, similar to the neutralization yield. Correction for this effect gives the spectrum shown in Fig.1.

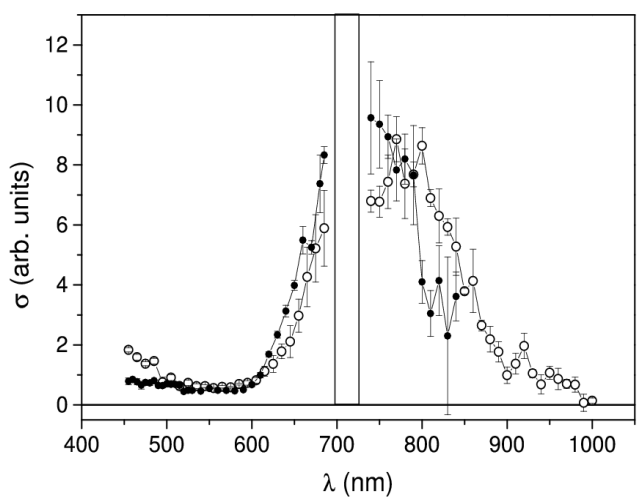

Figure 1. Photo absorption cross section of C_4^- after correction with the source energy distribution. The laser firing times were 5 ms (open circles) and 90 ms (filled circles). The vertical bar is an experimentally inaccessible region.

The neutralization spectrum for C_6^- looks qualitatively similar to that of C_4^- with a peak in the NIR, although the correction from the internal energy distributions could not be performed. The presence of these peaks in both species suggest that non-linear isomers are present in the beam.

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