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Absolute cross sections and asymmetry parameters for photodetachment of excited $C^-(^2D)$

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Negative ions are of fundamental interest for the understanding of electron correlation and also play an important role in domains such as astrophysics and atmospheric physics. Until recently, the photodetachment of the ground state of the carbon anion C^- (^4S) suffered from long-standing discrepancies between the results of different calculations as well as between theory and experiment. New theoretical and experimental results were reported in [1], which are in very good mutual agreement, as well as a new description of the resonant process occurring for photon energies around 6 eV. Following on from of our previous work, we report here the results obtained for photodetachment of the excited state (^2D) of C^-, in particular over the photon energy range from 0.5 to 2.5 eV where the disagreement between existing calculations are particularly pronounced [2, 3].

A new theoretical description of the photodetachment process is provided, based on an R-matrix approach employing a basis set including polarized pseudostates to reproduce the polarizability of the carbon ^3P ground state. For the first time, absolute experimental cross sections have been obtained over the whole range, by the use of a modified Animated Crossed Beam (ACB) technique allowing for the presence of multiple components in the beam, while proper differential cross sections in the same range have been measured using our Velocity Map Imaging (VMI) spectrometer.

We have also determined a more precise value for the electron affinity (EA) of the excited state, which is slightly higher than the pioneering experimental value of [4] and thus in strong disagreement with theoretical predictions of [5] and [3].

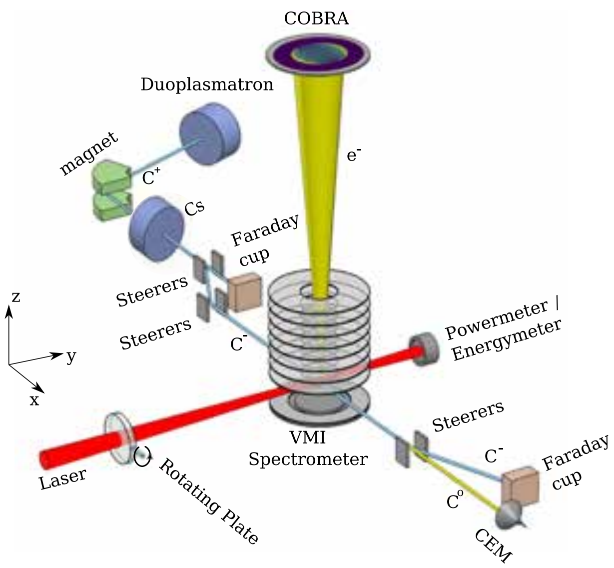

FIG. 1: Experimental setup. The ^{2}D population is generated by double electron capture of C^+ on Cs.

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