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

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We report the results obtained for photodetachment of the excited state (2D) of C^{-} using our Velocity Map Imaging (VMI) spectrometer and the animated crossed beam technique. A new theoretical description of the photodetachment process is provided.

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.

Following on from 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. 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. The 2D state is obtained by double electron capture of C^{+} in a Cs vapor cell.

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 in strong disagreement with theoretical predictions of [5] and [3]. Similar measurements are in preparation for the weakly bound He^{-} , Ca^{-} and Si^{-} anions.

References

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