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R Marion[1]*, K M Dunseath[2], M Terao-Dunseath[2] and X Urbain[1]

[1]Institute of Condensed Matter and Nanosciences, Université catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium
[2]Univ Rennes, CNRS, IPR (Institut de Physique de Rennes)-UMR 6251, F-35000 Rennes, France

Synopsis Absolute total cross sections and asymmetry parameters for photodetachment of $C^-(^4S^o)$ have been measured using animated-crossed-beam and velocity map imaging techniques, for photon energies from threshold up to 6 eV. The cross sections are 15% to 25% larger than earlier experimental results above 2.2 eV. They are in very good agreement with those from a new R-matrix calculation using polarized pseudostates.

Negative ions, in particular those of carbon and oxygen, are of fundamental interest for the understanding of electron correlation and also play an important role in domains such as astrophysics and atmospheric physics. In the case of O^-, there was a long-standing discrepancy between theory and experiment, which was recently resolved by new measurements using an animated-crossed-beam technique to determine absolute total cross sections [1]. The new experimental cross sections are about 20% larger than the earlier values, and are in very good agreement with new theoretical results presented in the same publication. For C^-, the only experimental values near the photodetachment threshold date back more than 40 years [2, 3]. The measurements however were not absolute, and were normalized using the older O^- cross sections. Since the latter have now been superseded, it appears necessary to revise the experimental values for C^- by measuring them directly.

Here we report results for the photodetachment of C^-, determined using the same experimental techniques as in [1]. These are in good agreement with results of a new R-matrix calculation, which employs a basis set with polarized pseudostates to reproduce the polarizability of the carbon ground state. These give a polarizability of 11.58 a_0^3, which compares well with the value of 11.67 a_0^3 from an extensive coupled cluster calculation [4]. The electron affinity of the ground state is 1.258 eV, very close to the experimental value of 1.262 eV [5].

As shown in Figure 1, the agreement between the new theoretical and absolute experimental cross sections is very good. There is no sign of the small bump just above threshold (dashed line) present in the results of a previous R-matrix calculation [6]. Below 2.2 eV, the results are similar to those of earlier experiments but differences of the order of 15% to 25% appear at higher energies.

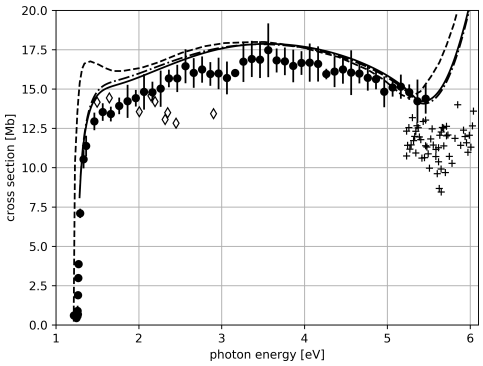

Figure 1. Experimental (circle: present work, diamonds: [2], crosses: [7]) and theoretical (solid: length form, dash-dot: velocity form) total cross sections for photodetachment of $C^-(^4S^o)$.

Results for the asymmetry parameter will also be presented at the conference. This work was supported by the Fonds de la Recherche Scientifique-FNRS through IISN grant No. 4.4504.10.

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*E-mail: raphael.marion@uclouvain.be