

An IERM approach to photoionisation with application to H^- , He-like and Be-like ions

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Abstract. Recent experimental advances in the field of attosecond science and X-ray free-electron laser sources [1, 2] necessitate the availability of advanced theoretical models which can provide an accurate treatment of double-electron continua. As a first step towards the development of a multipurpose R-matrix code for multiple-electron ejection, we consider the recently developed intermediate energy R-matrix (IERM) approach to photoionisation [3, 4], to ascertain if such an approach could provide a suitable method of representing double-electron continua within an R-matrix framework. We investigate photodetachment and photo-double-detachment of H^- , and show that results are in excellent agreement with existing data (see Fig.1). In addition, we apply the IERM method for photoionisation to members of the He and Be isoelectronic sequences, studying both single and double ionisation processes. While scaling laws for the photo-double-ionisation cross section of He-like ions have been proposed [5], we seek also to determine a scaling law for the photo-double-ionisation of Be-like ions. Various ions of Ne and Ar are also being studied and the latest results will be presented at the conference.

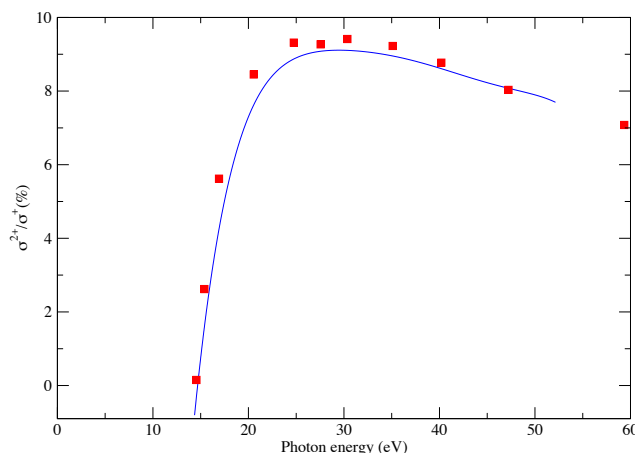


FIGURE 1. Percentage ratio of double-ionisation to single-ionisation in the photodetachment cross section of H^- . Present results (solid line) and Kheifets and Bray [6] (squares).

REFERENCES

1. P. B. Corkum, and F. Krausz, *Nat Phys* **3** (2007).
2. N. Rohringer, D. Ryan, R. A. London, M. Purvis, F. Albert, J. Dunn, J. D. Bozek, C. Bostedt, A. Graf, R. Hill, S. P. Hau-Riege, and J. J. Rocca, *Nature* **481**, 488–491 (2012).
3. A. J. Kinnen, Ph.D. thesis, Queen's University Belfast (2005).
4. M. P. Scott, A. J. Kinnen, and M. W. McIntyre, *submitted Phys. Rev. A.* (2012).
5. M. A. Kornberg, and J. E. Miraglia, *Phys. Rev. A* **49**, 5120–5123 (1994).
6. A. S. Kheifets, and I. Bray, *Phys. Rev. A* **58**, 4501–4511 (1998).