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Modified Binary-Encounter-Bethe Model for Electron Impact Ionization Cross Sections of Highly Charged Ions

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Synopsis The modified binary-encounter-Bethe model has been used in the calculation of direct ionization cross sections of ions with several charge states [1], going all the way to hydrogenlike Uranium [2]. In this work we present electron impact cross section values for hidrogenlike Mo, Dy, Au and Bi.

Electron impact ionzation cross sections (EICS) are used in a wide range of scientific and industrial applications, such as astrophysical plasmas, atmospheric science, X-ray lasers, magnetic fusion, radiation physics, accelerator physics and tumor therapy physics. The modified binary-encounter-Bethe (MBEB) model, and its relativistic counterpart (MRBEB) [3, 4], generates direct ionization cross sections for any neutral atom (or molecule), which are reliable in intensity (20%) and shape from the ionization threshold to thousands of keV [3].

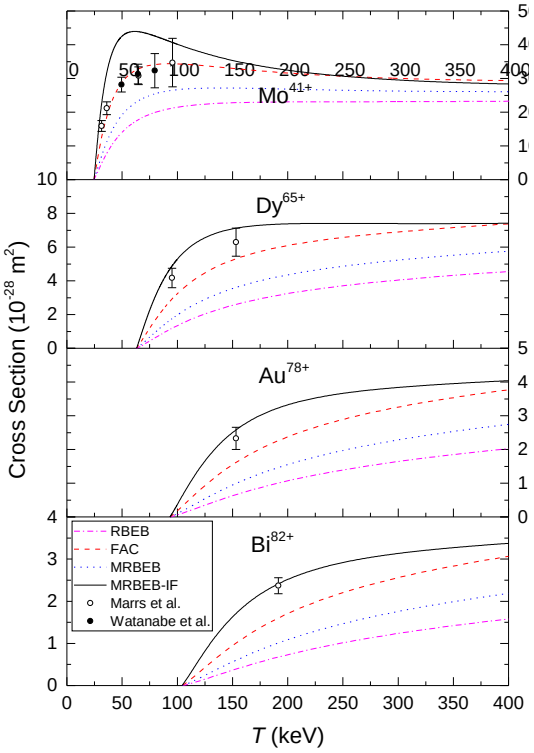

Figure 1. EICS for Mo^{41+}, Dy^{65+}, Au^{78+} and Bi^{82+}. Experimental results are from Marrs *et al.* [5] and Watanabe *et al.* [6]

Highly charged heavy ions have been given considerable attention as a way to investigate relativistic and quantum electrodynamic (QED) effects, as the strong Coulomb field, due to the heavy nucleus and low electron screening, enhances their contributions to the atomic energy levels. The Modified Binary-Encounter-Bethe (MRBEB) model, which rely only on two atomic parameters for EICS evaluation, the binding energy, B, and effective nuclear charge, Z_eff, has been used before to estimate the cross sections for ionization of highly charged Ar, Fe and Kr [1]. However, the influence of the autoionizing channels prevented us from assessing the reliability of the model as it only provides direct cross section values. Very recently, the same model, featuring a correction term called ionic factor (IF), to better describe the Z and incident electron's kinetic energy dependence on the cross section, was used for calculating cross sections for the ionization of U^{91+} to U^{88+} with very good results [2]. Nevertheless, the question about the reliability of the model for such targets remains, as the number of studied targets is scarce. In this work we have calculated EICS for hydrogenlike Mo, Dy, Au and Bi using the MRBEB-IF model, and the results are presented in Fig. 1.

References

[1] M. Guerra *at al* 2013 *Int. J. Mass Spectrom.* **348** 1-8

[2] M. Guerra *at al* 2015 *J. Phys. B* **In Press**

[3] M. Guerra *at al* 2012 *Int. J. Mass Spectrom.* **313** 1-7

[4] M. Guerra *at al* 2009 *J. Phys. Conf. Ser.* **194** 04204

[5] R. E. Marrs *at al* 1997 *Phys. Rev. A* **56** 1338

[6] H. Watanabe *at al* 2002 *J. Phys. B* **35** 5095

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