Scaled ionization cross section of biological molecules

A. M. P. Mendez, C. C. Montanari, J. E. Miraglia
Instituto de Astronomía y Física del Espacio (CONICET–UBA), Buenos Aires, Argentina.

In the present work, we investigate the implementation of two known scaling for the cross section and impact energy of multicharged ions on molecules of biological interest in intermediate to high energy range. The cross sections are obtained from distorted–wave calculations (CDW) of thirty–six atom–ion collisional systems and the simple stoichiometric model (SSM). We examine the scaling of seventeen molecules: hydrocarbons, DNA and RNA bases, DNA backbone, tetrahydrofuran (THF), and pyrimidines compounds.

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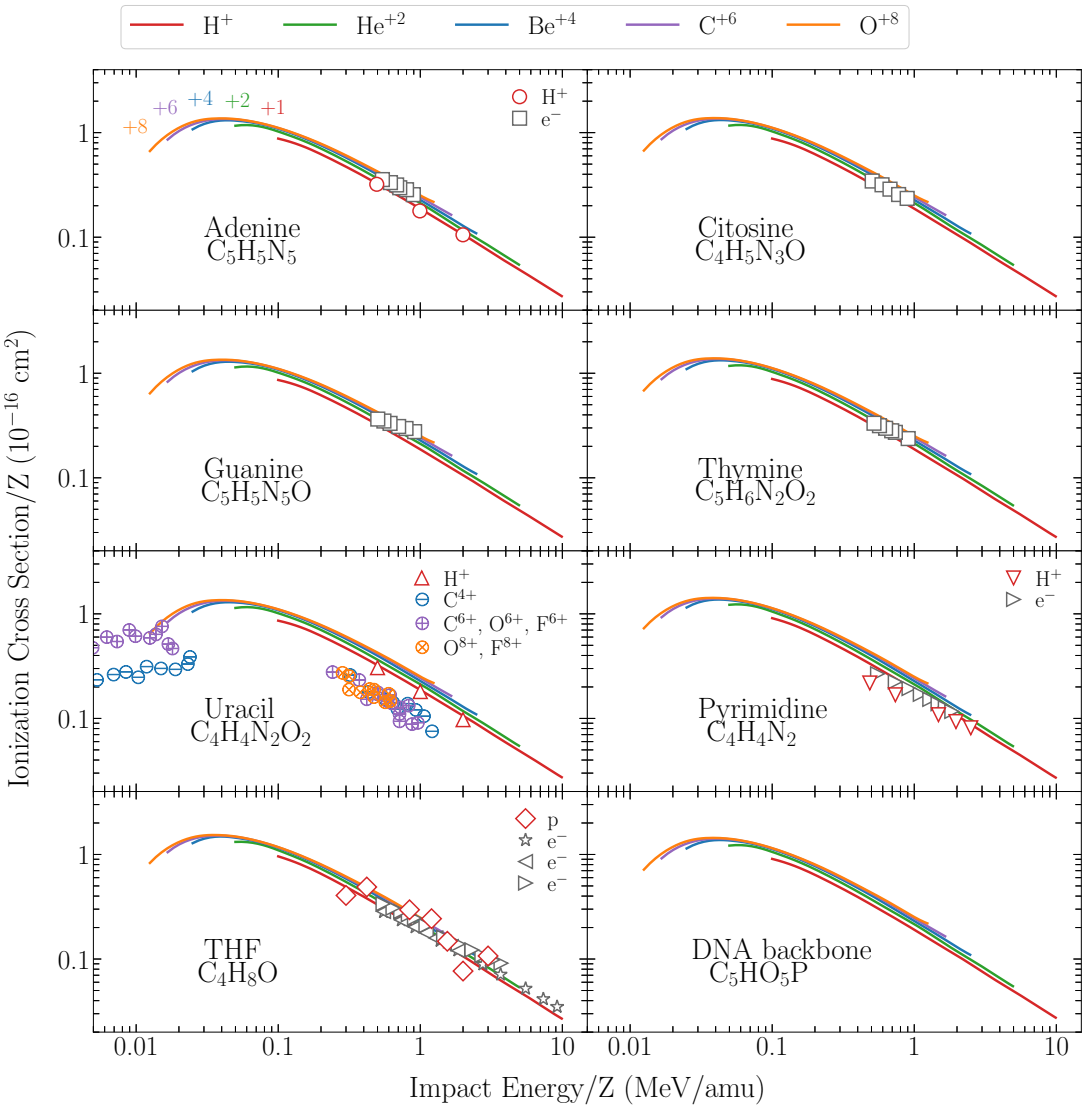

FIG. 1: Reduced CDW ionization cross section σ_M/Z as a function of ion impact energy E/Z. Experiments: proton impact on ○ adenine [1], △ uracil [5], ▽ pyrimidine [9] and ◇ THF [11]. Impact of ⊖ C^{4+}, ⊕ C^{6+}, O^{6+}, F^{6+}, and ⊗ O^{8+}, F^{8+} on uracil [6, 7]. Symbols □ [2], ▷ [10], ◁ [12], and ☆ [13] for electron impact with equivelocity conversion.

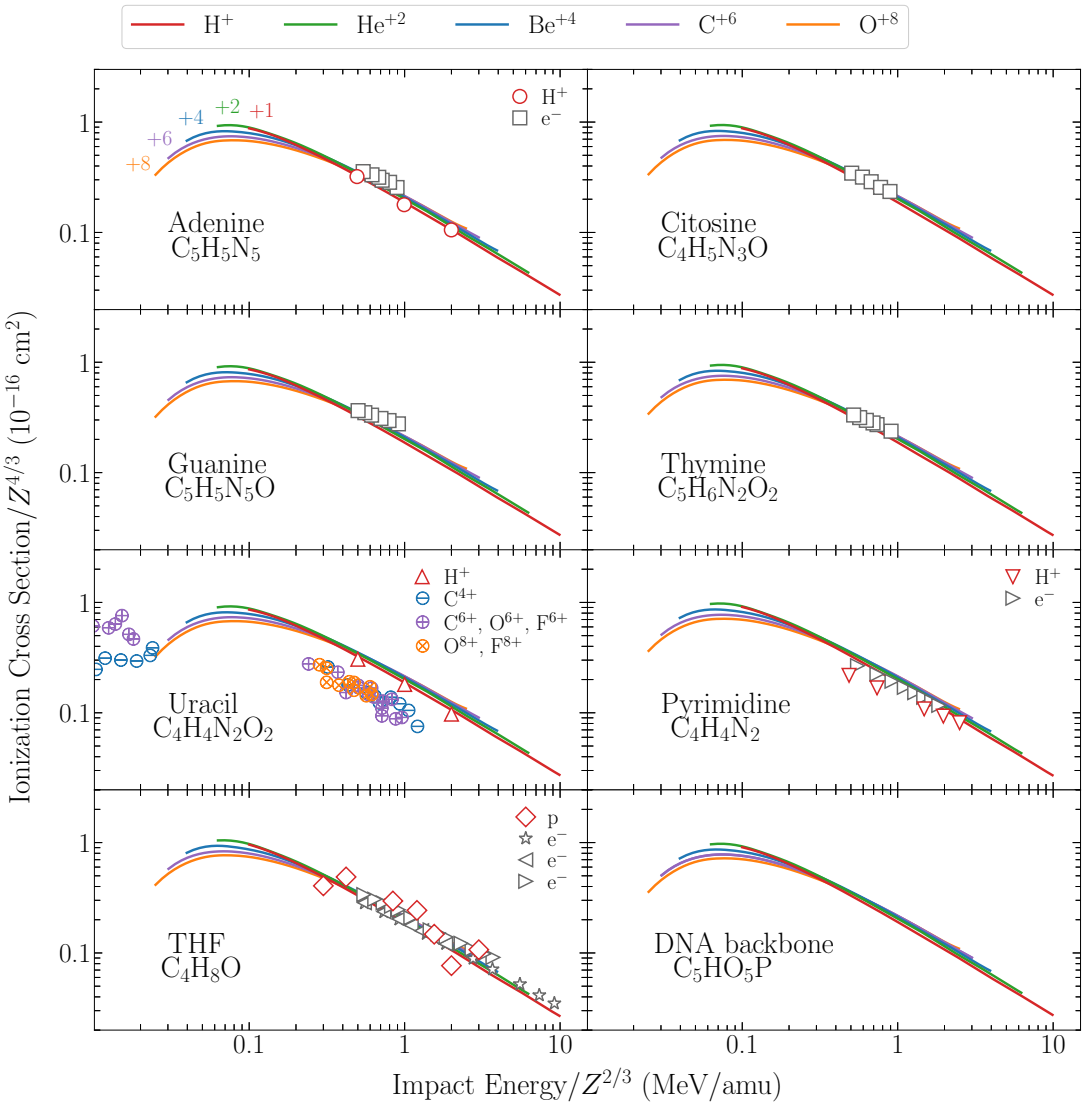

FIG. 2: Reduced CDW ionization cross section $\sigma_M/Z^{4/3}$ as a function of ion impact energy $E/Z^{2/3}$. Experiments: proton impact on ○ adenine [1], △ uracil [5], ▽ pyrimidine [9] and ◇ THF [11]. Impact of ⊖ C^{4+}, ⊕ C^{6+}, O^{6+}, F^{6+}, and ⊗ O^{8+}, F^{8+} on uracil [6, 7]. Symbols □ [2], ▷ [10], ◁ [12], and ☆ [13] for electron impact with equivelocity conversion.

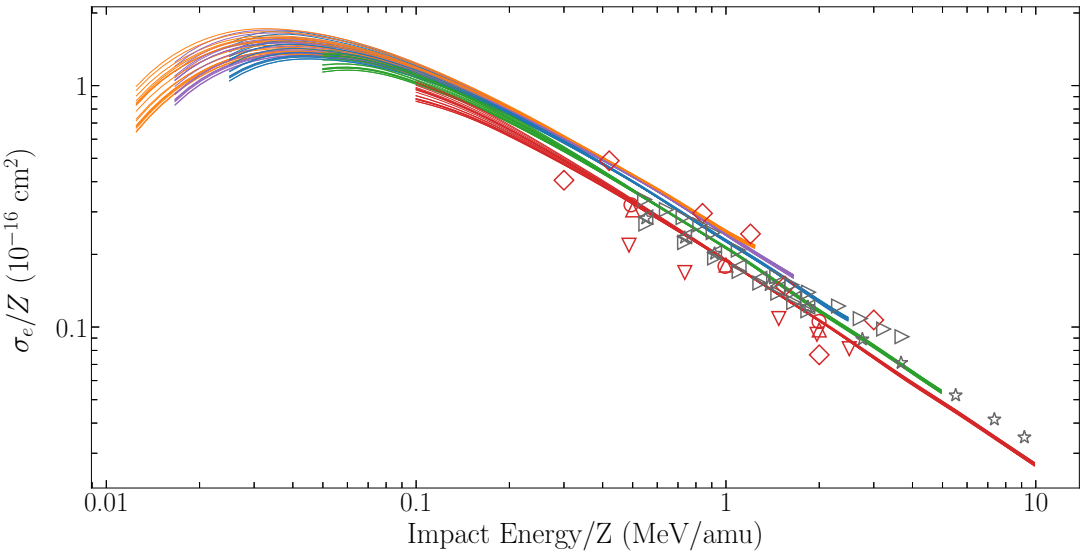

FIG. 3: Scaled and reduced ionization cross section per weakly bound electron σ_e/Z using CDW-based numbers $\nu_\alpha^{\rm CDW}$ for molecules listed in Table 1. Experiments: proton impact on ○ adenine [1], △ uracil [5], ▽ pyrimidine [9] and ◇ THF [11]; electron impact on ▷ pyrimidine [10], and ◁, ☆ [12, 13] THF.

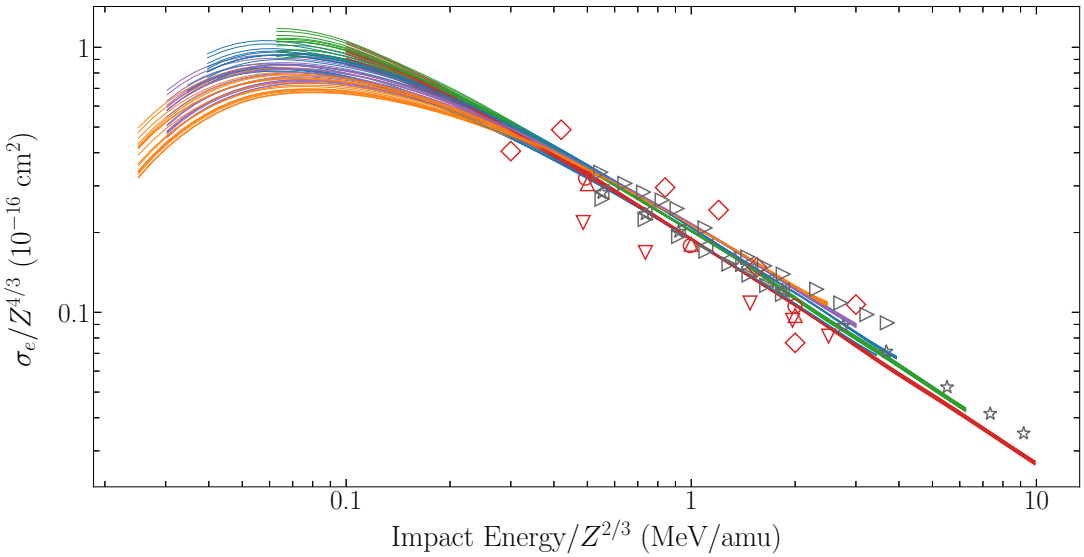

FIG. 4: Scaled and reduced ionization cross section per weakly bound electron $\sigma_e/Z^{4/3}$ using CDW-based numbers $\nu_\alpha^{\rm CDW}$ for molecules listed in Table 1. Experiments: proton impact on ○ adenine [1], △ uracil [5], ▽ pyrimidine [9] and ◇ THF [11]; electron impact on ▷ pyrimidine [10], and ◁, ☆ [12, 13] THF.