

Abstract Submitted
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A Full-Relativistic B-Spline R-Matrix Method for Electron and Photon Collisions with Atoms and Ions¹ OLEG ZATSARINNY, KLAUS BARTSCHAT, Drake University — We have extended our *B*-spline *R*-matrix (close-coupling) method [1] to fully account for relativistic effects in a Dirac-Coulomb formulation. Our numerical implementation of the close-coupling method enables us to construct term-dependent, non-orthogonal sets of one-electron orbitals for the bound and continuum electrons. This is a critical aspect for complex targets, where individually optimized one-electron orbitals can significantly reduce the size of the multi-configuration expansions needed for an accurate target description. Furthermore, core-valence correlation effects are treated fully *ab initio*, rather than through semi-empirical, and usually local, model potentials. The method will be described in detail and illustrated by comparing our theoretical predictions for e-Cs collisions with benchmark experiments for angle-integrated and angle-differential cross sections [2], various spin-dependent scattering asymmetries [3], and Stokes parameters measured in superelastic collisions with laser-excited atoms [4]. [1] O. Zatsarinny, *Comp. Phys. Commun.* **174**, 273 (2006). [2] W. Gehenn and E. Reichert, *J. Phys. B* **10**, 3105 (1977). [3] G. Baum *et al.*, *Phys. Rev. A* **66**, 022705 (2002) and **70**, 012707 (2004). [4] D.S. Slaughter *et al.*, *Phys. Rev. A* **75**, 062717 (2007).

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