Calculation of excitation and ionization processes using relativistic CCC method\(^1\)

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The recently formulated relativistic convergent close-coupling (RCCC) method has been applied to electron scattering from quasi-one electron atoms [1] and also highly charged hydrogenlike ions [2]. In the latter case it has been used to resolve discrepancies between theory and experiment for the polarization of x-rays emitted by hydrogenlike ions (Ti\(^{21+}\), Ar\(^{17+}\), Fe\(^{25+}\)) during electron impact excitation and make predictions for cross sections and radiation polarization for hydrogen-like uranium ion. Here we report on the extension of the RCCC method to accommodate electron scattering from two electron targets and quasi-two electron targets. We apply the theory to electron scattering from mercury which serves as a testing ground for relativistic theories due to its high atomic number, \(Z = 80\). Furthermore, electron-mercury scattering plays an important practical role in the physics of fluorescent and high intensity discharge lamps. In our calculations the mercury atom was modeled as a quasi-two electron atom consisting of two valence electrons above an inert \([Xe]4f^{14}5d^{10}\) frozen core. One- and two-electron polarization potentials have been used to model more accurately the valence-core-electrons correlations. We have calculated cross sections for electron impact excitations of mercury for a large number of transitions. Good agreement was found with our previous nonrelativistic results for the transitions that are not strongly affected by relativistic effects (e.g., \((6s6p)^1P_1\)). For the transitions that are strongly affected by relativistic effects (e.g., \((6s6p)^3P_1\)) we find good agreement with recent DBSR calculations [3] and available experiment.


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