Coordinate-Space Method for Calculation of Ps-formation Matrix Elements and its Application to Positron Scattering on Hydrogen Negative Ion

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Positron has been a subject of many studies due to it being an antimatter particle and having various practical applications. One of the main challenges for theoretical studies of positron collisions is calculation of rearrangement (Ps-formation) matrix elements that are computationally expensive. Previous state of the art methods [1, 2] applied to the positron scattering problem were based on momentum-space transformations and involved the Coulomb singularity that required special numerical techniques. As a result, application of the momentum-space based method to more complex and/or charged targets was quite challenging [3].

We have recently developed a new method [4] of calculating Ps-formation matrix elements within the convergent close-coupling (CCC) approach. In this report, we present details of the method, test against previous benchmark calculations and then apply to e^+-H^- scattering to obtain electron-loss, Ps-formation and electron-detachment cross sections. The CCC method has been applied to this scattering problem within the single- and two-center approaches. Figure 1 presents electron-loss (sum of Ps formation and electron detachment) cross section calculated within the single- and two-center methods. Agreement of the two results above the electron-detachment threshold confirms internal consistency of the method.

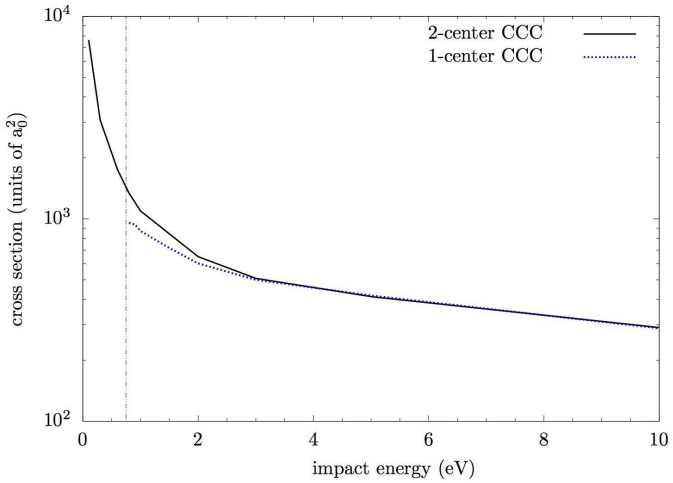

Figure 1. Comparison of single- and two-center results for electron-loss cross sections. The vertical line is the electron-detachment threshold of the H−.

References

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