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Spin asymmetries for electron-thallium scattering calculated with the relativistic convergent close-coupling method

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Synopsis Spin asymmetries for elastic and inelastic scattering of electrons from thallium are presented. Thallium is a heavy target ($Z = 81$) and the spin asymmetries can be caused by relativistic effects (spin-orbit interactions) in addition to exchange effects.

The relativistic convergent close-coupling (RCCC) method has been successfully applied to the calculation of the spin asymmetry for elastic scattering on Cd, Cs, Zn and Hg, and recently indium [1]. The calculation of spin asymmetries for electron-atom collisions provides a sensitive test of the correct implementation of exchange and spin-orbit interactions in scattering theories. Furthermore, the unitarity of the RCCC method has the consequence that inelastic scattering channels affect the elastic channel via the conservation of total scattered flux. Here we apply the RCCC method to the calculation of electron-thallium spin asymmetries. We present $6p\,^2P^o_{1/2} \rightarrow 6p\,^2P^o_{1/2}$ elastic electron scattering spin asymmetries, and also inelastic electron scattering spin asymmetries associated the $6p\,^2P^o_{1/2} \rightarrow 6p\,^2P^o_{3/2}$ and $6p\,^2P^o_{1/2} \rightarrow 7s\,^2S_{1/2}$ transitions.

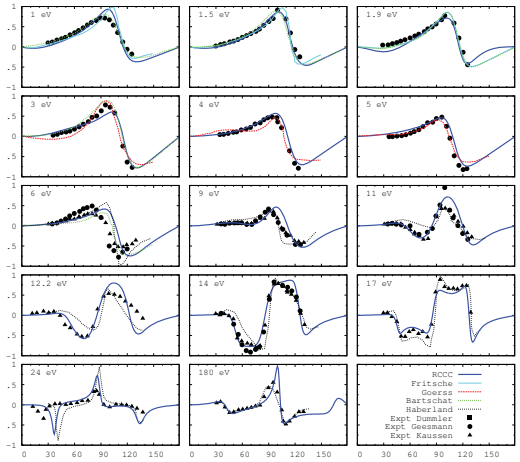

Figure 1. Spin asymmetry function for $6p\,^2P^o_{1/2} \rightarrow 6p\,^2P^o_{1/2}$ elastic electron scattering on thallium. Theory and experiment references are listed in [2].

Many of the RCCC spin asymmetries presented are the first theoretical results provided for comparison with measurements that were made two decades ago. The full details of the RCCC method applied to electron-thallium spin asymmetries are described in [2].

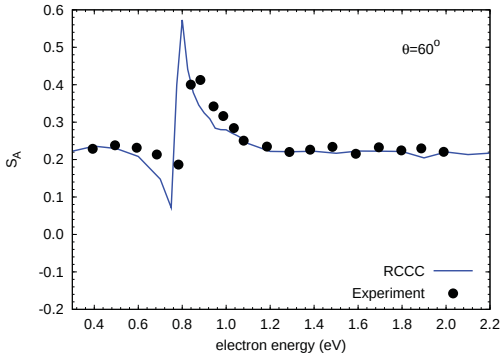

Figure 2. The spin asymmetry parameter as a function of energy for elastic electron scattering on thallium. The detector is located at $\theta = 60°$. Measurements are due to [3].

References

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