Relativistic distortion effects on exclusive $(\vec{p}, 2p)$ analyzing powers at intermediate incident proton energies

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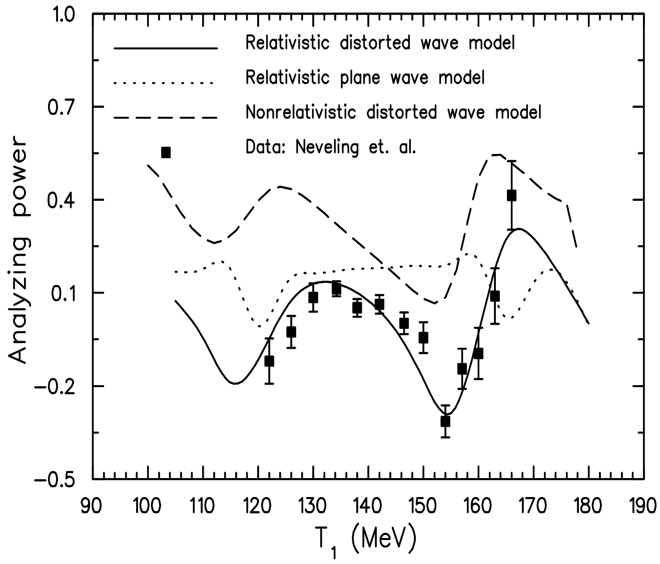
Compared to inclusive proton-induced reactions, exclusive $(\vec{p}, 2p)$ reactions offer a more direct means of studying the sensitivity of observables to distorting potentials, nuclear medium modifications of the NN interaction, as well the preferred reaction dynamics, that is, nonrelativistic Schrödinger- versus relativistic Dirac-equation-based dynamics. In order to systematically address the latter questions, we have developed a relativistic zero-range distorted wave model for the calculation of complete sets of $(\vec{p}, 2p)$ spin observables. Here, we report on the effect of relativistic distorting potentials on analyzing powers and compare model calculations to data measured at intermediate energies. As an example, in the figure below, we compare our relativistic distorted wave- (solid curve) and plane wave (dotted curve) calculations to data measured by the Stellenbosch group at iThemba LABS (Faure, South Africa) [1]. It is rather surprising that distortion effects on the scattering wave functions play such a significant role in determining the shape and magnitude of the analyzing power. For comparison, we also display a recent nonrelativistic distorted wave (dashed curve) prediction [1]. The predictive power of our model is superior compared to the latter. This result indicates a preference of Dirac-based dynamics compared to Schrödinger-based dynamics for the correct description of spin observables.



Relativistic and nonrelativistic predictions of the $^{208}\text{Pb}(\vec{p}, 2p)^{207}\text{Tl}$ analyzing power for knockout of $3s_{1/2}$ protons at an incident laboratory kinetic energy of 200 MeV. The data [1] are plotted as a function of the kinetic energy, T_1, of a proton detected at a laboratory scattering angle of 28.0°, whereas the other scattered proton is detected in coincidence at a scattering angle of 54.6° on the opposite side of the beam. The meaning of the different line-types is explained in the text.

References

[1] R Neveling, *Nuclear medium effects on analyzing power investigated with a proton knockout reaction*, PhD thesis, University of Stellenbosch (2001), unpublished.