Microscopic Optical Potential for Elastic Proton-Nucleus Scattering from Chiral Forces

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A microscopic optical potential has been derived [1, 2] from NN chiral potentials at fourth (N^3LO)and fifth (N^4LO) order, with the purpose to check the convergence and to assess the theoretical errors associated with the truncation of the chiral expansion in the construction of an optical potential.

Our optical potential has been derived within a nonrelativistic framework at the first-order term within the spectator expansion of the multiple scattering theory and adopting the impulse approximation and the optimum factorization approximation.

The numerical predictions of our microscopic optical potential have been compared [3] with those of a phenomenological optical potential and with available empirical data for elastic proton scattering on different isotopic chains and for incident proton energies in the range $156 \leq E \leq 333$ MeV. The agreement of our results with empirical data is sometimes worse and sometimes better but overall comparable to the agreement given by the phenomenological optical potential. The microscopic optical potential is able to give reliable predictions for the cross section and the analyzing power of both stable and exotic nuclei even at energies where the reliability of the chiral expansion starts to be questionable.

References

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