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ABSTRACT

Microscopic optical potentials for direct reactions and the statistical model

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The neutron-nucleus optical potential (OP) is one of the essential ingredients in both direct and compound nuclear reaction calculations. Phenomenological parametrizations based on fits to elastic scattering data are widely used for many applications in astrophysics, basic nuclear science, and nuclear data. However, the explicit connection of the OP with the underlying nuclear structure has always been an active line of research since the seminal papers of Feshbach were published in the 50's. This connection contributes to a better microscopic understanding of nuclear collisions, to a more transparent extraction of structure information from reaction experiments, and to a better controlled extrapolation to scarcely explored regions of the nuclear chart. We will present our recent results in the microscopic derivation of OPs based on a self-consistent solution of the Dyson equation, making use of state-of-the-art shell-model structure calculations. Our results can also be used to draw an explicit connection between level densities, neutron transmission coefficients, and gamma strength functions, all of them essential ingredients of the statistical model of the nucleus.