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Nucleon-Nucleus Optical Potentials for Soft Deformed Nuclei

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This work presents the current state of a consistently developing dispersive Lane-consistent coupled channels optical model. The model considers the optical potential of a soft deformed target nucleus as an axially deformed potential with linear corrections corresponding to the softness and non-axiality of a nucleus [1]. A soft rotator model was used to calculate the "effective" deformations –matrix elements of quadrupole and octupole deformation operators –with Hamiltonian parameters derived from the low-lying excitation spectrum of a nucleus [2]. While the soft rotator model describes only even-even nucleus excitations, the suggested approach allows the evaluation of these values for odd-A nuclei for levels in rotational bands that share the same single-particle state [3]. Additional corrections arising from nuclear volume conservation and the immobility of the center of mass are also taken into account.

In this model, levels from 5 rotational bands are coupled for even-even actinides, and up to 3 rotational bands for odd-A nuclides. The softness of a target affects the calculations even when levels from only one rotational band are coupled. New regional potentials are obtained for actinides and the tungsten region. It is shown that the new model provides a lower predicted compound nucleus cross-section in a weakly constrained incident energy region of 100 keV-1 MeV compared to the rigid rotor model.

References:

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