New dissipative non–Markovian model treatment of capture: the need for precise experimental above–barrier cross sections

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In Ref. [1] the problem of the apparently large diffuseness of the Woods–Saxon nucleus-nucleus potential needed to fit a large number of precision capture excitation functions was formulated. We presume that the large diffuseness is an artifact masking some dynamical effects. In order to confirm or disprove this presumption we have developed a dynamical model and analyzed several precision capture excitation functions [2–5] on the reactions involving spherical nuclei.

The model resembles the one of Refs. [6–8]: it is the dissipative trajectory model employing the surface friction. Yet the potential is very much different: this is the double folding potential based on the microscopically well founded M3Y NN–forces with the finite range exchange part and density dependence. We account for the retarding friction and for the non–Markovian noise as well. The modeling is performed for several cases:

(i) the classical dissipative trajectory calculations;

(ii) accounting for the Markovian noise;

(iii) accounting for the retarding friction without fluctuations;

(iv) including the retarding friction and the non–Markovian noise.

The first results look encouraging: it is possible to reproduce the precision capture excitation functions with the double-folding potential possessing the small diffuseness. However, the precise data are available only for near–barrier energies whereas for higher energies some deviations of the calculated cross sections from older data are observed.

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