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SEMINAR ANNOUNCEMENT

"Nucleon scattering on actinides using a dispersive optical model with extended couplings"

by

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Abstract

Modern nuclear applications demand higher precision of nuclear constants for construction and fissile materials. Actinides are of great importance among the last. Nevertheless, for many actinides only scarce experimental data are available. New sophisticated nuclear structure and reaction models can help to overcome this problem. Recently we suggested an extension of the dispersive Lane-consistent coupled–channels (CC) optical model that allows coupling of levels from other than ground state (GS) band for both even-even and odd actinides [1]. The corresponding optical model potential let us describe simultaneously experimental optical data for ^{232}Th, ^{233}U, ^{235}U, ^{238}U, ^{239}Pu (total cross sections, angular distributions of scattered nucleons and angular distributions of neutrons with excitation of isobar-analog states and also very experimentally accurate ^{238}U to ^{232}Th total cross section ratio) up to 200 MeV nucleon incident energies almost within experimental errors. This approach requires the introduction of new parameters – the "effective" deformations that couple levels from different bands. The fitting of these parameters is possible only for well experimentally investigated nuclei. On the other hand, for even-even nuclei the soft-rotator model (SRM) allows calculation of the "effective" deformations using low-lying collective levels energies. The SRM also allows considering additional monopole coupling appeared due to nuclear volume conservation during shape oscillations. It is shown to be significant for accurate predictions of optical observables. The new model let us study the saturation of the coupling scheme for actinides. It appeared that even-even actinides require up to 20 levels in five rotational bands to reach reliable predictions of compound nucleus cross sections, i.e. then it changes by less than a few percent upon addition of any other level. Odd actinides on the contrary demonstrate saturated coupling scheme with only GS band levels. All described features are implemented in the latest version of the OPTMAN code.

[1] E. Sh. Soukhovitskii, R. Capote, J. M. Quesada, S. Chiba, D. S. Martyanov, *Phys. Rev.* **C 94**, 064605 (2016).