Abstract Submitted
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Nuclear state densities in the static-path plus random-phase approximation[1] PAUL FANTO, YORAM ALHASSID, Yale University — Nuclear state densities are important inputs to the Hauser-Feshbach theory of compound-nucleus reactions. We benchmark the static-path plus random-phase approximation (SPA+RPA) to state densities in a chain of heavy samarium isotopes (^{148,150,152,154}Sm), in which the collectivity changes from vibrational to rotational with increasing neutron number. We use a pairing-plus-quadrupole interaction in the configuration-interaction shell model framework. The SPA+RPA includes large-amplitude static fluctuations and small-amplitude quantal fluctuations around each static fluctuation. We have developed a Monte Carlo method for calculating the SPA+RPA thermal energy and heat capacity, which are necessary for the calculation of the state density. We compare the SPA+RPA with the self-consistent mean-field approximation and exact shell-model Monte Carlo results obtained with the same model space and interaction. The SPA+RPA describes pairing and rotational correlations beyond the mean-field approximation. In particular, the SPA+RPA in deformed nuclei reproduces the enhancement of the state density with respect to the mean-field density due to rotational collectivity. We study the evolution of this rotational enhancement with increasing neutron number.

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