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Coupled-Channel Computation of Direct Neutron Capture on Non-Spherical Nuclei[1] GORAN ARBANAS, ORNL, IAN THOMPSON, JUTTA ESCHER, LLNL, FILOMENA NUNES, MSU, CHARLOTTE ELSTER, OU, SHI-SHENG ZHANG, ORNL, TORUS COLLABORATION[2] — Models of direct neutron capture of neutrons have so far accounted for the effects of non-spherical nuclei either in the incoming wave functions (via non-spherical optical model potentials), *or* in the final bound states (via non-spherical real potential wells), but not in both. Since it is known that spherical optical potentials do not give a good reproduction of low energy neutron-scattering observables of deformed nuclei, we have performed calculations in which the initial and final states are both treated in a self-consistent, non-spherical-nucleus picture. We have done this in the coupled-channels model of nuclear reactions implemented in the FRESCO code [1] by using the same deformation-length for the couplings to the rotational-band states in the incoming *and* the final state configurations. We compute direct capture using this method for even-mass calcium isotopes ^{40,42,44,46,48}Ca to study the effect across the two closed neutron shells, for neutron-rich even-mass tin isotopes relevant to models of astrophysical nucleosynthesis, and for ^{56}Fe that is an important structural material used in nuclear applications.

[1] I. J. Thompson, Coupled reaction channels calculations in nuclear physics, Computer Physics Reports, 7 (1988), pp. 167 - 212.

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[2]Theory of Reactions for Unstable iSotopes

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