Off-stability nuclear reaction theory predictions for actinides *

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Applications in nuclear energy, especially research efforts to develop a new type of advanced reactor that produces less radioactive waste (GNEP – Global Nuclear Energy Partnership), require a better understanding of cross sections on minor actinides, many of which are unstable. We will describe research work in the US that applies nuclear reaction theory and models, together with use of recently-measured experimental data, to evaluated reaction cross sections on Americium, Neptunium, Uranium, and Plutonium isotopes. We will describe motivations for this work that come from GNEP , including the highest priority needs to address increased confidence in reactor simulations of criticality and transmutation rates.

The nuclear reaction theory work makes use of the systematical properties of nuclei across an isotope chain – e.g. fission barriers, level densities, optical potentials, etc – and allows us to interpolate and extrapolate from known measured regimes to unknown regimes. We assess how well these kind of methods allow us to predict cross sections such as fission, (n,2n), and radiative capture. A specific example is given for ^{241}Am(n,2n), where theory predictions were made in the threshold region (8-12 MeV) prior to recent measurements made by the Athens group and the U.S. LANL-LLNL-TUNL group. Another example is shown for Americum capture cross sections, where new data for unstable radioactive targets have been measured using the DANCE detector at Los Alamos. We will also compare our predictions with recent assessments of some of these actinide cross sections using the surrogate methods, as applied by the Livermore group and the Bordeaux-CEA group.