Nuclear ingredients for cross section calculation of exotic nuclei

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The increasing need for cross sections far from the valley of stability, especially for applications such as nuclear astrophysics, poses a challenge for nuclear reaction models. So far, predictions of cross sections have relied on more or less phenomenological approaches, depending on parameters adjusted to available experimental data or deduced from systematic relations. While such predictions are expected to be reliable for nuclei not too far from the experimentally known regions, it is clearly preferable to use more fundamental approaches, based on sound physical bases, when dealing with very exotic nuclei.

Thanks to the high computer power available today, all major ingredients required to model a nuclear reaction can now be (and have been) microscopically (or semi-microscopically) determined starting from the information provided by a nucleon-nucleon effective interaction. We have implemented all these microscopic ingredients in the latest version of the TALYS nuclear reaction code [1], and we are now able to perform fully microscopic cross section calculations.

We will discuss both the quality of these ingredients and the impact of using them instead of the usually adopted phenomenological parameters. We will also discuss the foreseen evolutions of the models and of the ingredients on which they rely.

[1] http://www.talys.eu