Recent experimental results on level densities for compound reaction calculations

A.V. Voinov

Department of Physics and Astronomy, Ohio University, Athens OH 45701, USA

There is a problem related to the choice of the level density input for Hauser-Feshbach model calculations. Modern computer codes have several options to choose from but it is not clear which of them has to be used in some particular cases. Availability of many options helps to describe existing experimental data but it creates problems when it comes to predictions. Traditionally, different level density systematics are based on experimental data from neutron resonance spacing which are available for a limited spin interval and one parity only. On the other hand reaction cross section calculations use the total level density. This can create large uncertainties when converting the neutron resonance spacing to the total level density that results in sizable uncertainties in cross section calculations.

It is clear now that total level densities need to be studied experimentally in a systematic manner. Such information can be obtained only from spectra of compound nuclear reactions. The question is does level densities obtained from compound nuclear reactions keep the same regularities as level densities obtained from neutron resonances? Are they consistent?

We measured level densities of $^{59\text{-}64}$Ni isotopes from proton evaporation spectra of ^{6,7}Li induced reactions. Experimental data are presented. Conclusions of how level density depends on the neutron number and on the degree of proximity to the closed shell (^{56}Ni) are drawn. The level density parameters have been compared with parameters obtained from the analysis of neutron resonances and from model predictions.