Detailed study of nuclear physics parameters via (p,γ)-reaction cross-section measurements

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In order to understand and describe the astrophysical processes that are responsible for the nucleosynthesis of all different kinds of elements a precise knowledge of cross sections and reaction rates is necessary. However, in particular the network of the γ process, which plays an important role in the nucleosynthesis of the majority of the p nuclei [1, 2], includes so many different reactions on - mainly unstable - nuclei, cross-section values are predominantly calculated in the scope of the Hauser-Feshbach statistical model. The calculated values depend heavily on the nuclear physics input-parameters like the nuclear level densities (NLD), the γ-ray strength functions (γ SF) and nucleon+nucleus optical model potentials (OMPs) [3]. Total and partial cross-section measurements can improve the accuracy of the theoretical calculations [4, 5]. To extend the experimental database, the ^{107}Ag(p,γ)^{108}Cd reaction as well as the ^{93}Nb(p,γ)^{94}Mo reaction were studied via the in-beam method at the high-efficiency HPGe γ-ray spectrometer HORUS at the University of Cologne. Proton beams with energies close to the Gamow window were provided by the 10 MV FN-Tandem accelerator. The comparison of the experimental results to Hauser-Feshbach calculations allowed to find adjusted microscopic models for the NLD and γ SF, which nicely reproduce the results of total and partial cross sections.

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