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Detailed study of nuclear physics parameters via (p,gamma-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 gamma-process, which plays an important role in the nucleosynthesis of the majority of the p nuclei, 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 gamma-ray strength functions (gamma SF) and nucleon+nucleus optical model potentials (OMPs). Total and partial cross-section measurements can improve the accuracy of the theoretical calculations. To extend the experimental database, the 107Ag(p,gamma)108Cd reaction as well as the 93Nb(p,gamma)94Mo reaction were studied via the in-beam method at the high-efficiency HPGe gamma-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 gamma SF, which nicely reproduce the results of total and partial cross sections. Supported by the DFG (ZI 510/8-1) and the “ULDETIS” project within the UoC Excellence Initiative institutional strategy.

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