First radiative proton capture cross-section measurements on $^{107,109}$Ag and $^{112}$Cd relevant to the $p$-process

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One of the important, but still unsettled topics in Nuclear Astrophysics is the production of the $p$-nuclei [1, 2]. The $p$-process relies on an extended reaction network, which can be described theoretically by the Hauser–Feshbach statistical model, which in turn relies strongly on experimental data. To provide reliable data for $p$-nuclei, an experimental campaign at the Tandem Accelerator Laboratory of NCSR “Demokritos”, focusing on measurements of cross-sections in the $^{107,109}$Ag$(p, \gamma)^{108,110}$Cd [3] and $^{112}$Cd $(p, \gamma)^{113}$In [4] reactions was carried out. Both reactions were studied using a set of four HPGe detectors via the in-beam $\gamma$-ray spectroscopy, while for the latter the activation method was additionally employed to account for the population of a low-lying isomeric state. Total cross sections for proton beam energies lying inside the Gamow window for energies relevant to $p$-process nucleosynthesis were obtained for the first time. Experimental results are compared to Hauser–Feshbach calculations performed with the latest version of the TALYS code (v1.9) [5]. An overall good agreement has been achieved. These results provide important new input for the theoretical description of the $p$-process, but additionally for the origin of the cross-point $p$-nucleus $^{113}$In.

References