Investigation of radiative proton-capture reactions using high-resolution $\gamma$-ray spectroscopy

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Reaction cross sections are one of the main nuclear physics ingredients for nucleosynthesis processes in stellar environments. For isotopes heavier than iron, cross sections are often calculated using the Hauser-Feshbach statistical model. The accuracy of these calculations strongly depends on the uncertainties of three nuclear physics input-parameters: nuclear level densities, $\gamma$-strength functions, and particle+nucleus optical-model potentials.

Precision measurements of cross sections and systematic investigations help to improve these models. This talk will present recent radiative proton-capture experiments performed at the Cologne 10 MV FN-Tandem accelerator and the high-efficiency $\gamma$-ray spectrometer HORUS [1]. Besides total and partial cross sections, a method will be presented which allows the determination of primary $\gamma$-ray intensities via the technique of two-step $\gamma$-ray cascades [2]. Moreover, it will be shown how information on the $\gamma$-strength in the reaction product can be extracted in a model-independent way via the ratios of primary $\gamma$-rays.

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