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Gamma calorimeters for experimental studies relevant to explosive nucleosynthesis

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A new method employing a large-volume NaI crystal was developed for cross-section measurements of astrophysically relevant capture reactions on medium-mass nuclei. The response function of such a 4 pi calorimeter enables the summing of all capture events. As a result, a single peak, the so-called sum peak, arises in the spectra. Its intensity can be used to obtain very low cross sections of capture reactions with unknown multiplicities. The method enables to first determine these multiplicities, which are then used to derive the corresponding efficiency of the sum peak by means of Monte Carlo simulations. Cross sections are finally obtained from the sum-peak intensity with an average uncertainty of approx.15%. Due to the unique features of the new method, coined 4pi-gamma-summing, a new large NaI detector (12inch x 24inch) was recently purchased with funds of the FP7/LIBRA project. In the present contribution, severe examples of cross section measurements relevant to explosive nucleosynthesis studies will be presented. In addition some interconnections to future arrays like PARIS or AGATA will be discussed.

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