

Measurement of $^{27}\text{Al}(\alpha, n\gamma)^{30}\text{P}$ reaction yields and angular correlations.

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Reactions induced by alpha particles are important in multiple research areas such as nuclear astrophysics, nuclear technologies, dark matter searches and neutrino physics. Accurate data on neutron yields from the interaction of α -particles with nuclei via (α, n) reactions are of particular interest in this context. Despite the existence of experimental data and libraries, they show large discrepancies and they are not compatible with the declared uncertainties. In addition, such libraries are only available for a few isotopes, and the spectroscopic information available is limited. The need for new measurements with higher precision has been recently recognized [1]. This work is focused on the reaction $^{27}\text{Al}(\alpha, n)^{30}\text{P}$, which served as a benchmark to compare measurements from previous experiments and cross check experimental techniques. The measurements are part of a larger project, the Spanish MANY collaboration (Measurement of Alpha Neutron Yields), whose ultimate goal is the measurement of (α, xn) production yields, reaction cross-sections and neutron energy spectra. Here we focus in particular on the measurement of $^{27}\text{Al}(\alpha, n)$ reaction yields via activation and $^{27}\text{Al}(\alpha, n\gamma)$ production yields. One of the objectives of this work is the commissioning of the new experimental beamline and of the detector systems via a previously measured $^{27}\text{Al}(\alpha, n)^{30}\text{P}$ reaction. The experiment was carried in two independent beam times at the CMAM (Centro de Micro-Análisis de Materiales) laboratory in Madrid [2], Spain using an array of ten $\text{LaBr}_3(\text{Ce})$ FATIMA-type [3] detectors placed at selected angles in the laboratory frame. The gamma spectroscopy measurements allow to determine the total reaction yield from the decay of the activation products and the $(\alpha, n\gamma)$ yield from the de-excitation of the states in the target nuclei. The setup was complemented by a high-resolution HPGe detector to aid gamma-ray identification. The presentation will address the thick-target yields obtained by activation in the 5 to 15 MeV energy range, the gamma yields resulting for the $^{27}\text{Al}(\alpha, n\gamma)$ reaction as a function of energy, and the effect of angular correlations on the experimentally obtained gamma yields.

References.

- [1] S. Westerdale et al., Tech. Report INDC (2022) NDS-0836
- [2] A. Redondo-Cubero et al., Eur. Phys. J. Plus 136 (2021) 175
- [3] V. Vedia et al., Nucl. Instrum. Methods A 857 (2017) 98

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