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The MANY project: measurement of neutron yields and spectra from (α,n) reactions in Spain

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Neutron production through α-induced nuclear reactions is relevant in several fields. Specifically, (α,n) reactions are interesting in nuclear astrophysics as a source of neutrons for the slow neutron capture nucleosynthesis (the s-process) [TAI16] and in the α-particle capture process (the so-called α-process) [WOO92, BLI17]. Other fields of interest include the neutron-induced background in underground laboratories [BET10], which is a crucial issue in low counting rate experiments, and in nuclear facilities such as nuclear reactors and particle accelerators [MUR02]. The data available in the EXFOR database [EXFOR] show large discrepancies with respect to the reported uncertainties. On the other hand, the single existing evaluated nuclear data library JENDL/AN-2005 [MUR06] contains information only for 17 isotopes. The general purpose and model driven TENDL [KON12] library provides data for a much larger set of isotopes, but it differs significantly from the JENDL/AN-2005 evaluation and the experimental data in several cases.
The MANY (Measurement of Alpha Neutron Yields and spectra) collaboration is a coordinated effort by Spanish research groups with the aim to carry out measurements of (α,xn) reactions. The MANY project relies on the use of α-beams produced by the two accelerator facilities CMAM [RED21] and CNA HiSPANoS [GOM21], and the scientific exploitation of complementary neutron detection systems: a 4π neutron counter with nearly flat response up to 10 MeV, based on 3He proportional counters moderated in a modular high-density polyethylene matrix, miniBELEN [MON20], and a second detector based on BC501/EJ301 liquid scintillator modules, MONSTER [GAR12, MAR14], which can operate as a time of flight spectrometer. Both systems are also complemented by γ-spectroscopy measurements for (α,nγ) reactions using an array of fast LaBr3(Ce) scintillator detectors of the FATIMA type [VED17] with angular resolution capabilities. All instruments are coupled to high performance digital electronics. The commissioning of the beam-lines with well-know (α,n) reactions is currently on-going. In this contribution an overview of the MANY project will be presented. The status of the commissioning and preliminary results will also be discussed.

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