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Studies on neutron-induced reaction with Medley at GANIL

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Neutron induced reactions remain as a subject of great interest for both theory and applications, especially at medium energy range (20 MeV - 40 MeV), where particle emission is mostly described by "pre-equilibrium processes"and nuclear structure effects start to wash out. The current theoretical nuclear models still lack the capability to predict cross sections for any nucleus in an arbitrary energy range with reasonable accuracy for practical applications. These models, implemented within codes like TALYS [1], still rely on experimental data, which are necessary for a correct choice of their free parameters.
In this scope, this project aims at obtaining double differential cross-sections measurements of light charged particles (p, d, t, He, and α) for ^{nat}C, ^{nat}Cr and ^{nat}Fe in neutron-induced reactions. The latter two elements are the primary components of Eurofer steel, which will be extensively explored in fusion technologies, such as in the upcoming DONES facility [2]. Reliable data on radiation damage in structural material are essential for making suitable predictions regarding the longevity and performance of these materials.
In the last few years, three experiments have been conducted at the Neutrons For Science (NFS) facility at GANIL with the Medley setup to study production of light ions in those elements. This setup, designed and assembled in Uppsala [3], comprises eight telescopes, each containing two silicon detectors and one CsI, for detection and identification of light-ions using the ΔE-ΔE-E technique. The first objective of this series of experiments is to measure the NFS neutron spectrum, using neutron-proton elastic scattering in a CH_2 target. Medley has shown to provide good particle identification with enough energy resolution to distinguish between the individual isotopes of H and of He, and the required resolution for time of flight measurements in the whole energy range available at the facility.
In this contribution, we will present the preliminary values of the NFS neutron spectrum, along with the perspectives regarding the analysis of light-ion emission on the aforementioned nuclei.

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[2] Y. Qiu, Fusion Engineering and Design, 201 (2024) 114242
[3] Pomp, S., et al., EPJ Web of Conferences, 8 (2010) 07013

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