First results from the $^{63}Cu(\alpha,\gamma)^{67}Ga$ reaction study for nuclear astrophysics purposes

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The p-process is the nucleosynthetic mechanism responsible for the production in cosmos of a class of proton-rich isotopes, heavier than iron, known as p-nuclei. The observed, in our solar system, abundancies of some of these isotopes cannot be reproduced by p-process nucleosynthesis models. The corresponding abundance calculations require solving a huge reaction network, involving almost 20000 reactions and 2000 nuclei with mass numbers between ≈70-190. For the solution of this network, it is mandatory to insert as input the relevant reaction rates, i.e., the corresponding cross-sections must be known. The huge number of the reactions involved in the network makes the task of measuring every single cross-section almost impossible. Hence, abundance calculations rely strongly on the cross-section predictions of the Hauser-Feshbach (HF) nuclear reaction theory. It is therefore imperative to evaluate the nuclear parameters entering in HF calculations, in order to understand the deviations of the calculated abundancies from the observed ones in the solar system. Details can be found in [1].

The present work reports on preliminary cross-section results of the $^{63}Cu(\alpha,\gamma)^{67}Ga$ reaction, at energies between 6 and 9 MeV. The relevant measurements were conducted at the RUBION Dynamitron Tandem Laboratory [2] of the Ruhr-University Bochum, Germany using the 4π γ-summing method [1], utilizing a 12inch×12inch NaI(Tl) scintillator. The current results complement previous cross-sections measured for the $^{65}Cu(\alpha,\gamma)^{69}Ga$ reaction and are compared with previous measurements as well.

[1] Sotirios V. Harissopulos, Eur. Phys. J. Plus 133, 332 (2018) https://doi.org/10.1140/epjp/i2018-12185-8, and references therein

[2] RUBION Webpage; https://www.rubion.rub.de/en/

[3] Sotirios Harissopulos et al., EPJ Web of Conferences 227, 0100 (2020); https://doi.org/10.1051/epjconf/202022701008