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Low energy measurement of the ^{96}Zr(α,n)^{99}Mo, ^{100}Mo(α,n)^{103}Ru and ^{86}Kr(α,n)^{89}Sr reactions for studying the weak r-process nucleosynthesis

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The light ($30 < Z < 45$) neutron-rich isotopes are thought to be synthesized in the neutrino-driven ejecta of core-collapse supernova via the weak r-process [1]. Recent nucleosynthesis studies have shown that (α, n) reactions play an important role in their production. The rates of these reactions have been calculated using statistical models, and their main uncertainty at the energies relevant to the weak r-process comes from the $\alpha + \mathrm{nucleus}$ optical potential. Several sets of parameters are available for the calculation of the $\alpha + \mathrm{nucleus}$ optical potential, leading to large deviations of reaction rates, exceeding even one order of magnitude.

To constrain the parameters of the $\alpha + \mathrm{nucleus}$ optical potential and to provide high precision reaction rates for astrophysical simulations, recently the cross sections of the $^{96}\mathrm{Zr}(\alpha, \mathrm{n})^{99}\mathrm{Mo}$, $^{100}\mathrm{Mo}(\alpha, \mathrm{n})^{103}\mathrm{Ru}$ and $^{86}\mathrm{Kr}(\alpha, \mathrm{n})^{89}\mathrm{Sr}$ reactions were measured at the Gamow-window for the first time [2,3]. Details on the experimental approach, on the new ATOMKI-V2 potential [4] will be presented and an outlook into the astrophysical application of the data will be provided.

[1] A. Arcones and F. Montes, Astrophys. J. 731 5 (2011).
[2] G.G. Kiss et al., Astrophys. J. 908 202 (2021).
[3] T.N. Szegedi et al., PRC 104 035804 (2021).
[4] P. Mohr et al., PRL 124 252701 (2020).

Primary author: KOVÁCS, Sándor (HUN-REN Institute for Nuclear Research)

Co-authors: KISS, Gábor Gyula (HUN-REN Institute for Nuclear Research); SZEGEDI, Tibor Norbert (INFN-LNS); MOHR, Peter (HUN-REN Institute for Nuclear Research); GYÜRKY, György (HUN-REN Institute for Nuclear Research); MONTES, Fernando (Michigan State University); ARCONES, Almudena (TU Darmstadt, GSI, MPIK)

Presenter: KOVÁCS, Sándor (HUN-REN Institute for Nuclear Research)

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