Study of the alpha-nucleus optical potentials used in the weak r-process nucleosynthesis models by the measurement of the ^{96}Zr(α,n)^{99}Mo and ^{100}Mo(α,n)^{103}Ru reaction cross sections

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In neutrino-driven winds above a nascent neutron star or after the merging of two neutron stars, light r-process elements may be formed at high temperatures in a very short time scale of the order of milliseconds. It was shown by sensitivity studies that this — so-called — weak r-process nucleosynthesis runs close to the valley of stability and stable isotopes between ^{56}Fe and ^{109}Ag can be synthesized via (α,n) and (α,xn) reactions [1–4].

The modelling of the weak r-process requires a large nuclear reaction network calculation, consisting of a few thousand reactions, in which the cross sections of the alpha-induced reactions are taken from the Hauser-Feshbach model using global alpha-nucleus optical model potentials (OMP). However, the use of different OMPs in the calculations can cause up to an order of magnitude discrepancy between the predicted cross sections [3, 4]. There is a lack of precise (α,n) data in the $50 \leq A \leq 100$ mass region, therefore, to improve the reliability of the statistical model calculations, alpha-induced cross section measurements were carried out on two neutron-rich stable isotopes — ^{96}Zr and ^{100}Mo — at Atomki using the activation method. The experimental data as well as the comparison with cross section predictions calculated with OMPs used in the weak r-process network will be presented.

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