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Alpha induced reactions on ^{124}Xe for the astrophysical p-process

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Majority of the heavy chemical elements are formed via neutron capture reactions. However, there are a few proton rich nuclei (p-isotopes) which cannot be created these ways.In a high temperature environment pre-existing nuclei can photodissociate, and through (γ, n) reactions the p-isotopes can be created. Subsequent (γ, n) reactions increase the neutron separation energy, and charged particle release in (γ, α) and (γ, p) reactions become favourable, diverting the reaction flow towards lower masses.

Reaction network calculations using astrophysical and nuclear input parameters often fail to reproduce the abundances of naturally occurring p-isotopes. The input reaction rates are usually derived from the Hauser-Feshbach statistical model with considerable uncertainty. Benchmarking the model calculation is crucial for accurate predictions. Experimentally the cross section of the radiative capture is determined, and the photodisintegration rate is derived employing the detailed balance.

In this study, the cross section of $^{124}\mathrm{Xe}(\alpha,\gamma)^{128}\mathrm{Ba}$ and $^{124}\mathrm{Xe}(\alpha,\mathrm{n})^{127}\mathrm{Ba}$ was measured by the activation technique using Atomki's cyclotron accelerator. The experiments were performed using a thin-window gas cell in the astrophysically relevant energy range $E_\alpha = 10 - 15\,\mathrm{MeV}$. The γ-photons following the decay of the reaction products were detected with a high purity germanium detector.

Details of the experiment and preliminary results will be presented.

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