Measurement of the $^{15}\mathbf{N}(\alpha,\gamma)^{19}\mathbf{F}$ reaction at the Felsenkeller laboratory

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Helium burning is a crucial phase in stellar evolution, playing a key role in the synthesis of the elements. Precise measurements of nuclear reactions at the burning energies are important to constrain stellar models and nucleosynthesis pathways. We report on the ^{15}N(α, γ)^{19}F reaction which is one of the main contributors to the ^{19}F production in stars, still yet not understood. At temperatures relevant in the stellar environment the reaction can proceed trough several resonances in the energy range $E_\alpha^{\mathrm{CM}} = 364 - 1497$ keV. This contribution focus on the investigation of the $E_\alpha^{\mathrm{CM}} = 1323$ keV resonance for which available literature data on its energy and alpha width is showing considerable discrepancies [1, 2].
The ^{15}N(α, γ)^{19}F measurement was performed at Felsenkeller shallow-underground laboratory (Dresden, Germany). The experiment was carried out using the well collimated α beam provided by the 5 MV Pelletron accelerator into solid Ta^{15}N targets. The γ ray emitted from the reaction were measured with an array of 21 High-Purity Germanium (HPGe) detectors arranged around the target. The experimental campaign focused on the study of the high-energy resonances and for the first time angular distribution measurements.
Details on experimental setup, data taking and preliminary results on the $E_\alpha^{\mathrm{CM}} = 1323$ keV resonance, as well as future plans will be presented.

[1] A. Di Leva *et al.*, Physical Review C 95.4 (2017): 045803.
[2] R. Fang *et al.*, Physical Review C 110.2 (2024): 025806.