The ^{59}Cu(p,α)^{56}Ni cross section and heavy element nucleosynthesis in core collapse supernovae

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In the research field of heavy element nucleosynthesis, the origin of p-nuclei has been a longstanding problem. They are thought to be produced in the hot environments such as supernovae via p-capture and γ-disintegration processes. But with these processes, most stellar models fail to reproduce the observed abundances of the lighter p-nuclei ^{92,94}Mo and ^{96,98}Ru [1]. In a study by Fröhlich et al., a new process called the νp-process was suggested as an explanation for the abundances of p-nuclei with A>64 [2]. However, the competition between (p,α) and (p,γ) reactions on ^{59}Cu in an end-point cycle could hinder the reaction flow to the heavier elements by cycling the material back [3]. This competition is temperature sensitive and it is crucial to measure the ^{59}Cu(p,α)^{56}Ni reaction cross section in order to obtain reliable modelling results. Additionally, this reaction is of key importance to the light curve of X-ray bursts and the ashes' composition on the surface of the neutron star [4].

We have carried out the first direct measurement of the ^{59}Cu(p,α)^{56}Ni reaction cross section. The experiment was performed at the recently upgraded HIE-ISOLDE facility at CERN in inverse kinematics bombarding a CH_2 target with a high intensity radioactive ^{59}Cu beam at beam energies between 3.6 - 5.0 MeV/u. I will present the experimental procedure, data analysis and first results.

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