

The Study of the $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ at LUNA

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The $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ has an important role in nucleosynthesis of massive stars and AGB stars. As a matter of fact it competes with the $^{22}\text{Ne}(\alpha, n)^{25}\text{Mg}$ which is an efficient source of neutrons for s-process. In addition a recent study shows that the production of all isotopes from ^{26}Mg to ^{31}P is affected by the uncertainty of $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ reaction rate.

The main source of the high uncertainty on the $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ reaction rate is the poorly constrained strength of the 395 keV resonance. Due to the low cross section involved most of the studies of the $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ reaction used indirect methods. As a result a wide range of strengths values ($8.7 \cdot 10^{-15} - 3.1 \cdot 10^{-9}$ [eV]) are attributed to the 395 keV resonance.

The direct measurement performed at LUNA (Laboratory for Underground Nuclear Astrophysics) is fundamental to improve the current state of art of

$^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$. As a matter of fact, thank to the shield of 1400 m of rocks of Gran Sasso, the background in the region of interest is reduced of a factor 1000 at LUNA laboratory. This allowed LUNA to fix the contribute of the 395 keV resonance on the $^{22}\text{Ne}(\alpha,\gamma)^{26}\text{Mg}$ reaction rate.

The experiment was performed at LUNA400keV accelerator, delivering a 400keV alpha beam to ^{22}Ne gas target. In order to investigate such a low cross section a high efficiency 4π BGO summing crystal was used. Details on the setup will be described during the talk.

The first campaign was concluded in July 2016 and new upper limits for the 395keV resonance were found. Results and their impact on the efficiency of the $^{22}\text{Ne}(\alpha, n)^{25}\text{Mg}$ will be shown during the talk. A second campaign is planned in March and will cover three months. During the second phase of the experiment the residual background is further reduced surrounding the detector by a shield. An update on the status of the experiment will be presented during the talk.

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