

Measurement of the $^{25}\text{Mg}(\alpha,n)^{28}\text{Si}$ reaction cross section at LNL

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The detection of the 1809 keV emission line associated with the decay of ^{26}Al ($T_{1/2} \sim 7.2 \cdot 10^5$ years) in the interstellar medium provides a direct evidence that nucleosynthesis is ongoing in our galaxy.

^{26}Al is thought to be mainly produced in massive stars, but in order to have a quantitative understanding of the ^{26}Al distribution, the cross section of all the nuclear reactions involved in its production should be accurately known.

A recent sensitivity study [1] demonstrated that the $^{25}\text{Mg}(\alpha,n)^{28}\text{Si}$ is the reaction with the strongest impact on the synthesis of ^{26}Al during explosive Neon and Carbon burning.

In the energy range $E_\alpha = 1 - 6$ MeV, the $^{25}\text{Mg}(\alpha,n)^{28}\text{Si}$ cross section has been reported by many authors ([2] - [6]). Below 3 MeV the literature data are characterized by large uncertainties due to beam - induced background. Moreover the reaction rate reported by NACRE [7] is based on unpublished data. At higher energies the NACRE rate is based on Hauser-Feshbach calculations, disregarding the experimental cross sections.

In order to improve the experimental knowledge of the $^{25}\text{Mg}(\alpha,n)^{28}\text{Si}$ cross section, a new direct measurement has been performed at Legnaro National Laboratories.

A pulsed α beam with energies $E_\alpha = 3-5$ MeV was provided by the CN electrostatic accelerator. The neutrons were detected with 10 liquid scintillators from the RIPEN array, covering the angular range from 0 to 110 degrees in the laboratory frame of reference. $\gamma - n$ discrimination is achieved applying the Pulse Shape Analysis technique. Furthermore, measuring the neutron energy with the Time Of Flight method it is possible to disentangle the contribution to the cross section of different ^{28}Si excited states, and to identify the background neutrons produced by (α,n) reactions with light contaminants in the setup. The experimental setup, the data processing and preliminary results of the data analysis are discussed.

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