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Study of the 20Ne(p,)21Na reaction at LUNA

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The synthesis of Ne, Na, Mg, and Al isotopes is connected to the NeNa-MgAl cycles of stellar burning. The entire cycle speed is controlled by the $^{20}\mathrm{Ne}(\mathrm{p},\gamma)^{21}\mathrm{Na}$ ($Q = 2431.68$ keV) reaction, which is the first and slowest reaction of the whole NeNa cycle. At the state of the art, the uncertainty on the $^{20}\mathrm{Ne}(\mathrm{p},\gamma)^{21}\mathrm{Na}$ reaction rate affects the production of the elements in the NeNa cycle.
In the temperature range from 0.1 GK to 1 GK, the rate is mainly dominated by the 366 keV resonance, corresponding to the excited state of E_X = 2797.5 keV, and by the direct capture component. The present study focuses on the 366 keV resonance and on the direct capture below 400 keV. At LUNA (Laboratory for Underground Nuclear Astrophysics) the $^{20}\mathrm{Ne}(\mathrm{p},\gamma)^{21}\mathrm{Na}$ reaction has been measured using the intense proton beam delivered by the LUNA 400 kV accelerator and a windowless differential-pumping gas target. Two high-purity germanium detectors allow the detection of the products of the reaction.
The experimental details and preliminary results of the campaign will be shown, together with their possible impact on the $^{20}\mathrm{Ne}(\mathrm{p},\gamma)^{21}\mathrm{Na}$ reaction rate.

Session

Experimental Nuclear Astrophysics

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