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23Na(p,g)24Mg Cross Section Measurements

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The reaction 23Na(p,γ)24Mg links the NeNa and MgAl cycles in stellar hydrogen burning. For temperatures up to 100MK, typical for RGB and low and intermediate mass AGB stars, the rate of this reaction is predominantly determined by the non-resonant component of the cross section and possibly by a narrow resonance at E(c.m.)=138keV. An upper limit for the strength of this resonance has been established in [1]. The non-resonant cross section of 23Na(p,γ)24Mg has not been observed in a direct experiment yet (cf. [2]). The uncertainty of these two contributions to the cross section yields large uncertainties in the reaction rate at these temperatures.

A combined effort at the Laboratory for underground Nuclear Astrophysics (LUNA) and the University of Notre Dame aims at a cross section determination for this reaction, to constrain the astrophysical reaction rate by improving the knowledge of the resonance strengths and the non-resonant component. Experiments at LUNA benefit from the underground location at the Gran Sasso National Laboratory which allows for the measurement of resonances at low energies with high sensitivity. Measurements at the University of Notre Dame are used to pursue a determination of the non-resonant cross section at higher energies.

The experiments performed at both sites will be presented, together with the status of the analysis and first results.

[1] Cesaratto et al., Phys. Rev. C 88, 065806 (2013)
[2] Hale et al., Phys. Rev. C 70, 045802 (2004)

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