Precision measurements of the ^{24}Mg(α,$p\gamma$)^{27}Al cross section and ^{27}Al(p,$\alpha\gamma$)^{24}Mg cross sections

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Type I X-ray bursts are important astrophysical events that occur in binary star systems where a H and He are accreted onto the surface of a neutron star. To understand the production of nuclei in these explosive environments and related to this, their energy generation and light curves, there have been a number of model calculations that span the parameter space given nuclear physics uncertainties [1]. A number of reactions were identified as having an impact on the X-ray burst energy generation, one of which is the ^{24}Mg(α,p)^{27}Al reaction. The cross sections for this reaction used in the model calculations were based on the inverse reaction ^{27}Al(p,α)^{24}Mg. The data available for the direct reaction is scarce, especially the cross sections to excited states of ^{27}Al. In order to more precisely determine the role of the ^{24}Mg(α,p)^{27}Al reaction, we performed an experiment to measure both the ^{24}Mg(α,$p\gamma$)^{27}Al and ^{27}Al(p,$\alpha\gamma$)^{24}Mg reactions at the University of Notre Dame using 5U Van de Graaff accelerator and HAGRiD, an array of $LaBr_3$ gamma-ray detectors to detect secondary γ rays from the excited states of ^{24}Mg and ^{27}Al. An R-matrix analysis of the differential cross sections will be presented and the influence of these cross sections on previously calculated resonance strengths will be discussed.

[1] Parikh et al., Astrophysical Journal Suppl. 178, 110 (2008).
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