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Measurement of the ^{26}Al(d,p) reaction to constrain the ^{26}Al(p,gamma) rate at stellar temperatures

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The long-lived radioactive nuclide ^{26}Al is a predominant target for γ-ray astronomy, including the first all-sky survey of an individual γ-ray line. Massive stars have been highlighted as a dominant source of ongoing synthesis of ^{26}Al [1]. At these stellar temperatures, the ^{26}Al(p,γ)27Si reaction is expected to be the main reaction destroying ^{26}Al, thus impacting the net ^{26}Al production [2]. However, the strengths of low-lying resonances in ^{27}Si wihch determine this rate are not well-constrained experimentally, and are the subject of recently renewed interest [3].

In order to determine spectroscopic information for the mirror states to astrophysically-important resonances in ^{27}Si, and thereby constrain the reaction rate via these resonances, the ^{26}Al(d,p)^{27}Al reaction has been measured [4]. The experiment was performed at the Holifield Radioactive Ion Beam Facility at Oak Ridge National Laboratory, using a beam of ~5 million ^{26}Al per second. The SIDAR and ORRUBA silicon detector arrays were used to measure proton ejectiles backwards of 90 degrees in the laboratory. Spectroscopic information was determined for mirrors to the astrophysically-relevant resonances, which were found to differ significantly from previously adpoted values. Details of the astrophysical motivation, experiment, and results will be presented.

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