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Informing (p,γ) rates using the (d,p) reaction[1]

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Proton capture rates via low-lying proton resonances are of astrophysical interest for understanding galactic chemical evolution, energy generation and production rates of individual radionuclides. These reactions are difficult to measure directly, especially for reactions on radioactive nuclei which dominate the reaction network in explosive scenarios, due to limited beam intensities and the small proton widths. While the (d,n) reaction can be used to constrain these rates indirectly by determining energies, J^π assignments, and spectroscopic factors of proton resonances, practical considerations of neutron measurement for inverse kinematics reactions currently limit the applicability of the technique. Alternatively, the (d,p) reaction can be used to determine these properties for the mirror neutron states in the conjugate nucleus with improved resolution and detection efficiency. Using ORRUBA and GODDESS, we have initiated a campaign of such measurements on astrophysically-interesting self-conjugate (N=Z) nuclei in the sd shell. The technique, results of benchmarking against direct measurements of ^{26}Al(p,γ), and the application of the technique to ^{30}P(p,γ) and ^{38}K(p,γ) will be presented, along with plans for future measurements at FRIB.

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