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58Ni(3He,t)58Cu Measurements to Constrain the Astrophysical Rate of 57Ni(p,γ)58Cu

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The 57Ni(p,γ)58Cu reaction rate significantly impacts nucleosynthesis in a variety of astrophysical sites. In core-collapse supernovae (CCSNe) this reaction impacts the production of 44Ti, a radioiso- tope whose observed gamma-ray emissions offer an important probe into CCSNe, providing a test of nucleosynthesis models. Furthermore, the 57Ni(p,γ)58Cu reaction rate has been shown to significantly impact νp-process nucleosynthesis in multiple astrophysical environments. Despite the importance of 57Ni(p,γ)58Cu, no experimental rates exist for this reaction. To experimentally constrain this rate, structure properties of 58Cu were measured via the 58Ni(3He,t)58Cu reaction using both GODDESS (GRETINA ORRUBA Dual Detectors for Experimental Structure Studies) at Argonne National Lab- oratory's ATLAS facility and the Enge split-pole spectrograph at the University of Notre Dame's Nuclear Science Laboratory. These measurements provide precise determination of 58Cu level en- ergies. This precision is crucial, as the reaction rate depends exponentially on these level energies. The two measurements also provide additional, complimentary structure information that impacts the reaction rate, such as level spin, proton branching ratios, and gamma branching ratios. Experimental procedures and preliminary analysis will be presented.
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