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Measuring the ${}^{134}Te(d,p\gamma){}^{135}Te$ Reaction with GODDESS to Deduce the Single-Particle Structure of ^{135}Te and Inform Neutron Capture¹ C.C. UMMEL, J.A. CIZEWSKI, Rutgers University, S.D. PAIN, Oak Ridge National Laboratory, A. RATKIEWICZ, Lawrence Livermore National Laboratory, GODDESS COLLABORATION, ORRUBA COLLABORATION, GRETINA COL-LABORATION — ¹³⁴Te ($t_{1/2} = 42$ minutes), a beta-decay precursor to stable ¹³⁴Xe, can be destroyed in an r-process environment by neutron capture. Constraint of the 134 Te $(n,\gamma)^{135}$ Te cross section is key to explaining an overabundance of 134,136 Xe observed in pre-solar grains². Due to its proximity to the Z = 50 and N = 82closed shells, neutron capture on ¹³⁴Te is expected to largely occur via direct capture into low-lying states in ¹³⁵Te (Z = 52, N = 83), which can be constrained via the measurement of level energies, spin-parities, and spectroscopic factors using neutron transfer reactions such as (d, p). Previous studies of ¹³⁵Te revealed a fragmented level structure that cannot be resolved by charged particles alone³. However, level energies can be constrained via the detection of gamma rays emitted by ¹³⁵Te in coincidence with charged ejectiles. The ¹³⁴Te $(d, p\gamma)^{135}$ Te reaction was thus measured with the coupled GODDESS (GRETINA-ORRUBA: Dual Detectors for Experimental Structure Studies) detectors at the ATLAS facility at Argonne National Laboratory. Preliminary results will be presented.

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²U. Ott, Astrophys. J. **463**, 344 (1996).

³J.M. Allmond, et. al., Phys. Rev. C 86, 031307 (2012).

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