Abstract Submitted
for the DNP13 Meeting of
The American Physical Society

Capture reaction measurements for the astrophysical p-process[1]
S.J. QUINN, A. SIMON, A. SPYROU, A.C. DOMBOS, NSCL, Michigan State University, SUN COLLABORATION — An accurate description of the nucleosynthesis of the group of stable, neutron deficient isotopes heavier than iron remains one of the main open questions in the field of nuclear astrophysics. These isotopes, known as the p-nuclei, are shielded from production by the s- and r- neutron capture processes by the valley of β-stability and therefore must originate from some other astrophysical scenario or scenarios. The most heavily studied scenario to date, the p-process or γ-process, involves photodisintegration reactions, their inverse capture reactions, and β^+ decays on existing seed nuclei in the shock front of Type II SNe. The complete description of the p-process involves reaction networks of over ten-thousand reactions, including many reactions on unstable isotopes. Since only limited experimental data exists, nearly all p-process reaction rates are calculated by the statistical Hauser-Feshbach model, which rely on accurate optical model potentials, level densities, and γ-widths. In an effort to improve the input parameters to the statistical model, particularly the troublesome α- optical model potential, a series of (α,γ) reactions were carried out at the FN Tandem Accelerator at the University of Notre Dame in combination with the NSCL SuN detector. Cross section results and their comparison to theoretical calculations will be presented. Also discussed will be the results of the first ever (p,γ) measurements using the summing technique in inverse kinematics, a significant experimental development towards measuring p-process reaction cross sections with unstable isotopes.

[1]This work was supported by the National Science Foundation, Grants No. PHY 102511, PHY 08-22648, and PHY 0969058.

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Date submitted: 28 Jun 2013 Electronic form version 1.4