Nucleosynthesis of $^{60}$Fe and constraints on the nuclear level density and $\gamma$-ray strength function

D. Richman$^a$, A. Spyrou$^b$ and A. Couture$^c$

$^a$Michigan State University, NSCL, $^b$NSCL, MSU, $^c$Los Alamos National Laboratory

$^{60}$Fe is created by neutron capture in massive stars prior to core collapse supernova. This isotope is one of only a handful whose gamma-rays from $\beta$-decay indicate ongoing nucleosynthesis in the Galaxy. For this reason the reactions involved for the creation and destruction of $^{60}$Fe in this environment must be well understood. Due to the short half-life of $^{59}$Fe it is challenging to perform a direct capture reaction experiment to determine the cross section of $^{59}(n,\gamma)^{60}$Fe. Instead we used the $\beta$-decay of $^{60}$Mn to populate states at all energies in the $^{60}$Fe nucleus. The resulting $\gamma$-rays were collected using a $4\pi$ total-absorption spectrometer, SuN (Summing NaI(Tl) detector), at the NSCL. With this data the $\beta$-Oslo method can be applied to extract the nuclear level density and gamma-strength function needed for statistical models to calculate the reaction rate using experimentally constrained nuclear structure parameters. Preliminary results from the ongoing analysis will be presented.