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Nucleosynthesis of ^{60}Fe via indirect neutron-capture reaction studies

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Active nucleosynthesis in our galaxy can be observed directly through the detection of long-lived radioactivities. Isotopes such as ^{26}Al, and ^{60}Fe have been observed either in solar system samples or through γ-ray observations within the galaxy. Both isotopes are predominantly produced in massive stars and ejected into the interstellar medium either via stellar winds or through the supernova explosion. Instead of only looking at absolute observational values for each isotope, the ratio of ^{60}Fe/^{26}Al can be used as a more sensitive probe of massive star evolution since many of the observational uncertainties cancel out. A long standing puzzle is that most theoretical models over-predict this ratio compared to observations. The discrepancy has been attributed to uncertainties in the nuclear reactions, and in particular the ones related to the production/destruction of ^{60}Fe. Here we report on the main reaction producing ^{60}Fe, namely the $^{59}\mathrm{Fe}(n,\gamma)^{60}\mathrm{Fe}$ reaction. We will present the results of a β-Oslo measurement that provides an indirect experimental constraint for this reaction. The impact of this result on the evolution and explosion of massive stars will be presented.

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