Neutron capture cross sections on Zn and Ge isotopes for the weak s process

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Many of the atoms with atomic mass numbers $60 < A < 90$ have their origins in the weak s process occurring in massive stars. The abundances produced in the weak s process are sensitive to individual neutron capture cross sections that can have a broad impact on nucleosynthesis [1]. There is limited neutron capture cross section data especially at energies relevant for shell carbon burning near $kT \approx 90$ keV that extends into the unresolved resonance region. Cross sections are difficult to predict theoretically, and recent calorimetric measurements have shown that contributions from scattered neutrons and small target impurities could impact the reliability of earlier measurements in some cases (e.g. see [2]). We will present recent measurements of neutron capture cross sections on stable isotopes of Zn and Ge using neutron time-of-flight with highly enriched samples and the Detector for Advanced Neutron Capture Experiments (DANCE) at the Manuel Lujan Neutron Science Center at LANSCE. DANCE is a 4π BaF_2 calorimeter that allows neutron capture on different isotopes to be distinguished by the neutron-capture Q-value. Particular care was taken in these measurements to characterize systematic uncertainties and contributions from scattered neutrons and isotopic impurities that can be significant. The experiments, analysis, preliminary results, and implications for nucleosynthesis in the weak s process will be presented.

References

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