Measurement of the ^{159}Tb(n, γ) Cross Section at the CSNS Back-n Facility

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The stellar (n, γ) cross section data for the mass numbers around A ≈ 160 are of key importance to nucleosynthesis in the main component of the slow neutron capture process, which occurs in the thermally pulsing asymptotic giant branch (TP–AGB). The new measurement of (n, γ) cross sections for ^{159}Tb was performed using the C_6D_6 detector system at the back streaming white neutron beam line (Back-n) of the China spallation neutron source (CSNS) with neutron energies ranging from 1 eV to 1 MeV. Experimental resonance capture kernels are reported up to 1.2 keV neutron energy with this capture measurement. Maxwellian-averaged cross sections (MACS) are derived from the measured ^{159}Tb (n, γ) cross sections at kT = 5 ~100 keV and are in good agreement with the recommended data of KADoNiS-v0.3 and JEFF-3.3, while KADoNiS-v1.0 and ENDF-VIII.0 significantly overestimate the present MACS up to 40% and 20%, respectively. A sensitive test of the s-process nucleosynthesis is also performed with the stellar evolution code MESA. Significant changes in abundances around A ≈ 160 are observed between the ENDF/B-VIII.0 and present measured rate of ^{159}Tb(n, γ)^{160}Tb in the MESA simulation.

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