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The ^{140}Ce(n,γ) cross section measured at n_TOF and its astrophysical implications

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The slow (s) and rapid (r) neutron-capture processes are major producers of elements heavier than iron. The main component of the s-process takes place in low-mass AGB stars, through a series of neutron capture reactions and beta decays, resulting in a flow that proceeds along the beta-stability valley. In this context, the neutron-capture cross sections of closed neutron shell nuclei represent bottlenecks for the s-process. Among them, ^{140}Ce is particularly interesting because of a discrepancy between stellar model predictions and observations of stars belonging to the Globular Cluster M22. This discrepancy triggered the n_TOF collaboration to measure the ^{140}Ce neutron capture cross section in a wide neutron energy range at the n_TOF facility, combined with a highly enriched ^{140}Ce sample and an experimental setup based on four low neutron sensitivity liquid scintillations detectors. The high accuracy, high-resolution data of n_TOF have led to a Maxwellian Averaged Cross Sections (MACS) with an uncertainty better than 5%. At low energy, the new value is up to 40% larger than the available library evaluations. This new value, however, did not solve the existing discrepancy, possibly indicating the presence of additional nucleosynthesis processes. I will present the n_TOF measurement and its astrophysical implications.

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