Impact of the β decay ground-state feeding of ^{63}Mn on the Urca cooling process

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The Urca cooling process, which emits neutrinos through a cycle of β decays and electron captures, exerts significant influence on the thermal evolution of neutron stars. The neutrino luminosity from a specific Urca pair is predominantly governed by the ground-state to ground-state transition in the corresponding β decay. However, experimental determination of ground-state feeding intensities in β-decay studies remains challenging due to the absence of characteristic γ-rays associated with direct ground-state transitions. Recent advances in total absorption spectroscopy (TAS) have enabled precise determination of true β feeding intensities, including ground-state transitions. In this talk, we elucidate the TAS methodology for measuring ground-state feeding intensities with particular emphasis on its application in astrophysical Urca process studies. Furthermore, we identify the ^{63}Mn - ^{63}Fe pair as a critical candidate in Urca cooling requiring TAS-based measurements to resolve current uncertainties in predicted neutrino luminosities.