The i-process in super asymptotic giant branch stars

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Super asymptotic giant branch (super-AGB) stars reside in the mass range ≈ 6-12 Msun and bridge the divide between low/intermediate-mass and massive stars. They are characterised by off-centre carbon ignition prior to a thermally pulsing phase which can consist of many 10-1000s of thermal pulses. Super-AGB stars undergo a variety of nucleosynthetic processes including proton-capture reactions at the base of the convective envelope and heavy element (s-process) production during the thermal pulses. The most massive super-AGB stars can also undergo a dredge-out event, whereby a convective helium burning region merges with an inward moving convective envelope. When these zones meet, hydrogen is mixed down to very high temperature regions where a ^{13}C rich region forms, leading to subsequent neutron release and heavy element (i-process) production. Here we present the first detailed heavy element nucleosynthesis for dredge-out events and discuss how these results could lead to a refining of the mass boundary between high-mass and low-mass stars which has important implications for both the chemical enrichment and energetics of galaxies.

References