SUPER ASYMPTOTIC GIANT BRANCH STARS: EVOLUTION, NUCLEOSYNTHESIS AND FINAL FATES

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Super Asymptotic Giant Branch (Super-AGB) stars reside in the mass range ~ 6.5-10 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 tens to even thousands of thermal pulses. Super-AGB stars have relatively extreme nucleosynthetic conditions, with temperatures at the base of the convective envelope reaching over 150MK, which results in very efficient hot bottom burning.

We present nucleosynthetic yield calculations for super-AGB stars for a wide range of metallicities from Z=0.02-0.0001 ([Fe/H] ~ 0 to -2.3). We discuss the relative contribution of hot bottom burning and dredge-up events to the surface composition of these stars.

We investigate the impact that uncertainties, such as the mass-loss rate or efficiency of convection, have on element production. We also apply our nucleosynthetic yield results to examine the possible role of super-AGB stars as polluters of the anomolous stars within globular clusters.

The final fate of super-AGB stars is quite uncertain and depends primarily on the competition between the core growth and mass-loss rates. If the stellar envelope is removed prior to the core reaching the Chandrasekhar mass, a O-Ne white dwarf will remain, otherwise the star will undergo an electron-capture supernova leaving behind a neutron star. We describe the selection of factors which influence these different final fate channels, such as the third dredge up efficiency and the Fe-peak opacity instability. Finally, we determine the relative fraction of super-AGB stars that end life as either an O-Ne white dwarf or as a neutron star.