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Mixing and Nuclear Uncertainties in Low-Metallicity AGB Stars: The Impact on Stellar Structure and Nucleosynthesis

The slow neutron-capture process(s-process) is one of the two main processes forming elements heavier than iron in stars. Its efficiency critically depends on key (α,n) reactions, which represent the main sources of neutrons to trigger the neutron-capture chain producing all elements up to bismuth, and on the modeling of convective boundaries. I present the evolution and s-process nucleosynthesis of low-mass AGB stars at low metallicities using the MESA stellar evolution code. The combined data set includes models with initial masses M_{ini}/M_{sun} = 2 and 3 for initial metallicities around one tenth that of the Sun. The nucleosynthesis was calculated for all relevant isotopes by post-processing with the NuGrid mppnp code. Theoretical predictions are compared with observed surface abundances on low-metallicity stars, finding that mixing processes at the interface between the He-intershell and the CO-core play a critical role in the s-process at low metallicities, and that models with a 13C-pocket size of at least $\sim 3 \times 10^{-4}$ M_{sun} are strongly favored in reproducing observations. Additionally, these results indicate that recent re-evaluation incorporating indirect measurements of the 22Ne(α,n)25Mg reaction rate strongly impact our stellar nucleosynthesis calculations, bringing them into much better agreement with key observables.

Serdecznie zapraszam,
Agnieszka Majczyna