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S-Process Nucleosynthesis in and from AGB Stars

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The nucleosynthetic slow neutron capture process (s-process) in AGB stars between ~ 1 – 6 M⊙ is responsible for creating about half of the heavy elements in the universe. The s-process can be traced directly through AGBs, or indirectly through their binary companions (CEMP-s stars, Ba stars, CH stars), as thermally pulsing AGBs will dredge s-process material from the inter-shell to the surface. We present and study 10 AGB (intrinsic) stars and 10 (extrinsic) companions where mass transfer is important. Using high-resolution spectra, we derive atmospheric parameters and compute 1D LTE surface abundances, focusing on heavy elements created during the thermally pulsing AGB phase (C, N, Y, Zr, Nb, Mo, Ba, La, Ce, Nd, Pb), and the r-process element Eu. We compare our results to the FRUITY yields to constrain the masses of our AGB stars and their companions, and investigate correlations in abundance space using Gaussian mixture modelling. Through detailed stellar modelling, we constrain possible binary companion masses and other system parameters. This can help determine efficiencies of AGB wind mass transfer, and has implications for galactic chemical evolution as AGB stars deposit their material back into the ISM to seed further stellar generations.

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