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Exploring nucleosynthetic processes in a large sample of Barium stars

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Barium (Ba) stars belong to binary systems where a former asymptotic giant branch (AGB, now a white dwarf) star polluted the less evolved companion, which became enriched with material produced through the slow neutron capture process (s process). The currently observed Ba star preserves the abundance pattern of the AGB, allowing us to test the imprints of the s process. Comparing different AGB nucleosynthetic models and Ba star abundances based on high-resolution spectra, we are able to constrain, for example, the effect of the initial rotation velocity and the nature of the neutron source. When comparing AGB models to the extended list of heavy element abundances available for a large homogeneous observational sample of 169 Ba stars, we could confirm that the polluting AGBs are of low mass ($< 4M_{\odot}$). To identify the best fitting AGB models we used machine learning techniques and we showed that some of the stars have anomalous abundance patterns, mainly at the first s-process peak (with higher Nb, Mo and/or Ru than the models), along with high W. Additional measurements could reveal the cause for these overabundances and can help to identify the underlying processes (e.g. the i process).

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