What can Barium stars tell us about binarity and nucleosynthesis in AGB stars?

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A rich zoo of peculiar objects forms when stars with extended and loosely bound convective envelopes, such as Asymptotic Giant Branch (AGB) stars, undergo gravitational interaction with a binary companion. The stellar, chemical and orbital properties of these peculiar products of binary interactions with AGB stars are essential to understand the interaction history in such systems and the mechanisms that dominate, in addition to many physical processes that concern their giant progenitors. In the past years, we have obtained new important observational constraints for a family of chemically peculiar stars known as Barium (Ba) stars. These main-sequence and red-giant stars formed when a former AGB companion, which is now a dim white dwarf (WD), polluted them with material enriched with s-process elements. Neither binary evolution models nor nucleosynthesis models fully reproduce the orbital and chemical properties of Ba stars. These problems point to an important gap in our knowledge about AGB stars and their interactions with their companions in binary systems.

I will present the results of several long-term radial-velocity monitoring programmes and an accurate HR diagram of Ba and related stars built thanks to high-quality Gaia distances. Combining these results with astrometric information, we could also determine absolute masses for the dim WD companions of Ba stars, obtaining direct information about their AGB progenitors via initial-final mass relationships. During my talk, I will discuss the orbital parameters of Ba star systems in the context of binary interactions in systems with AGB-star components and the chemical properties of Ba stars and our recently determined WD masses in the context of AGB nucleosynthesis.