Modelling short-period sdB binaries with MESA

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Short-period subdwarf B stars are short-lived helium-burning cores of red giants that lost their envelopes in a dramatic common envelope event. These binaries form under very specific conditions and, for this reason, they are excellent probes of their red giant progenitors and binary mass transfer. Recently, their long-period sdB counterparts became the first binaries shown to bear the imprint of Galactic chemical evolution. Additionally, these systems are among the most important LISA sources. In this study, we synthesise the first MESA code-based Galactic population of short-periods sdB stars igniting degenerately. We use a neural network-based approach to ignite the cores through the common envelope phase. By comparing the produced population to the observed sample of short-period sdB binaries, we put novel constraints on the conditions for unstable mass transfer in red giant binaries and on the common envelope parameters for red giant main-sequence binaries. Our modelling reproduces the relative lack of post-common envelope short-period horizontal branch stars and the lack of short-period sdB binaries with FGK type companions.