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A Unified Progenitor Picture of SLSNe, lGRBs, SNe Ic-BL, and FBOTs

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Extreme stripped-envelope supernovae (SESNe), including Type Ic superluminous supernovae (SLSNe-I), broad-line Type Ic SNe (SNe Ic-BL), and fast blue optical transients (FBOTs), are widely believed to harbor a newborn fast-spinning highly-magnetized neutron star ("magnetar"), which can lose its rotational energy via spin-down processes to accelerate and heat the ejecta. The progenitor(s) of these magnetar-driven SESNe, and the origin of considerable angular momentum (AM) in the cores of massive stars to finally produce such fast-spinning magnetars upon core-collapse are still under debate. Popular proposed scenarios in the literature cannot simultaneously explain their event rate density, SN and magnetar parameters, and the observed metallicity. In this talk, we perform a detailed binary evolution simulation that demonstrates that tidal spin-up helium stars with efficient AM transport mechanism in close binaries can form fast-spinning magnetars at the end of stars' life to naturally reproduce the universal energy-mass correlation of these magnetar-driven SESNe. Our models are consistent with the event rate densities, host environments, ejecta masses, and energetics of these different kinds of magnetar-driven SESNe, supporting that the isolated common-envelope formation channel could be a major common origin of magnetar-driven SESNe. The remnant compact binary systems of magnetar-driven SESNe are progenitors of some gravitational-wave transients and galactic systems.

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