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SPH simulations of the Induced Gravitational Collapse

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The Induced Gravitational Collapse (IGC) paradigm points to a binary origin for the long-duration gamma-ray burst (GRBs) associated with supernovae (SN). In this one, a carbon-oxygen core (COcore) explodes in a Type Ib/c SN in presence of a close neutron star (NS) companion. The SN triggers a hypercritical accretion into the NS and depending on the initial binary parameters, two outcomes are possible given place to two families of long GRBs: binary-driven hypernova (BdHNe), where the NS reaches its critical mass, and collapses to a black hole (BH), emitting a GRB; and x-ray flashes (XRFs) where the hypercritical accretion onto the NS is not sufficient to induce its gravitational collapse. We perform three-dimensional (3D) numerical simulations of the IGC paradigm with the smoothed particle hydrodynamics (SPH) technique. We determine whether the star gravitational collapse is possible and assess if the binary holds gravitationally bound or it becomes unbound by the SN explosion.

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