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General-relativistic Simulations of Three-dimensional Core-collapse Supernovae

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Despite decades of effort, the explosion mechanism of core-collapse supernovae is still not well understood. Spherically-symmetric models fail to explode, suggesting that multi-dimensional effects are of crucial importance. Studies in axisymmetry (2D) reveal that the standing accretion shock instability (SASI) and neutrino-driven convection are pivotal ingredients for successful explosions. Axisymmetry, however, is a rather poor approximation of this scenario. 3D studies, on the other hand, are still in their infancy and often employ crude approximations. As a result, the exact role of the SASI and convection is still not well established. In this talk, I will present our 3D general-relativistic simulations of a 27 solar-mass star. We investigate the postbounce hydrodynamics with particular attention to the development and properties of neutrino-driven convection and SASI as well as their role in facilitating explosion.

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