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Black hole explosions in loop quantum gravity

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Effective models of gravitational collapse in loop quantum gravity for the Lemaître-Tolman-Bondi spacetime predict that collapsing matter reaches a maximum finite density, bounces, and then expands outwards. I explain how in the marginally bound case, shell-crossing singularities commonly occur for inhomogeneous initial profiles of the dust energy density; this is the case in particular for all profiles that are continuous and of compact support, including configurations arbitrarily close to the Oppenheimer-Snyder model. When a shell-crossing singularity occurs, it is necessary to seek weak solutions to the dynamics; I argue that weak solutions typically develop shock waves. I will conclude by showing numerical simulations where shock waves arise in weak solutions of Lemaître-Tolman-Bondi effective equations written in generalized Painlevé-Gullstrand coordinates, both for marginally bound and unbound configurations.

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