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Gravitational Collapse at the Boundary

Holography has successfully been used to study the dynamics of strongly coupled gauge theories as they evolve over time in a fixed spacetime. However, in these cases the metric on the field theory side is taken to be non-dynamical. This implies that the framework is not suitable to be used in dynamical contexts, such as in cosmology or astrophysics, thereby limiting the potential of the correspondence. In this work, we attempt to extend the holographic framework to the most dramatic dynamical scenario possible: a gravitational collapse. We construct a model and present a procedure to simulate a gravitational collapse from an ideal fluid on the boundary in an FLRW background. The fluid/gravity correspondence is then used to approximate the corresponding bulk metric data dual to the simulated collapse. Finally, the bulk causal structure is studied, revealing the dynamical formation of a black funnel as the initial planar black hole is gradually perturbed, eventua lly reaching the boundary and opening up to relax into the characteristic funnel shape. The entropy density at the boundary is identified with that obtained using the area density of the apparent horizon in the bulk.

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