Contribution ID : **155** Type : **not specified**

Hydrodynamics at Causal Boundaries: 3d Example

Tuesday, 3 December 2024 16:20 (30)

We study three-dimensional gravity on a spacetime bounded by a generic two-dimensional causal surface, constructing the solution phase space specified by four generic functions over the causal boundary. We discuss the symplectic form, boundary charges, and their algebra, providing a fluid description at the causal boundary. This description covers an extension of known asymptotic hydrodynamics for 3d AdS or flat space. Additionally, we develop a framework revealing the intrinsic conserved stress tensor and current at the null infinity of 3d asymptotically flat spacetime, conjugate to the degenerate metric and Ehresmann connection of the boundary null geometry. Their conservation reproduces Bondi-mass and angular momentum equations with a specified torsional affine connection. Our results enhance 3d flat holography, showing a flat fluid/gravity correspondence and yielding a Schwarzian action at null infinity, aligning with codimension 2 holography of 3d flat spacetimes.

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Session Classification : Day 4: Parallel session I