Killing horizons naturally define asymptotic symmetries

and this could hint at modifications of gravity

Asymptotic Symmetries on Conformal Killing Horizons

Níckolas de Aguiar Alves & André G. S. Landulfo • arXiv: 2504.12514 [gr-qc]

Background: Far away from all matter sources, one could hope general relativity recovers the symmetries of special relativity—the Poincaré group. The truth is much more complicated; in fact, the symmetry group is infinite-dimensional. This has been seen as a path to a holographic description of quantum gravity in asymptotically flat spacetimes. Similar symmetries also exist in some cosmological spacetimes. Can we relate them? If so, what does that teach us?

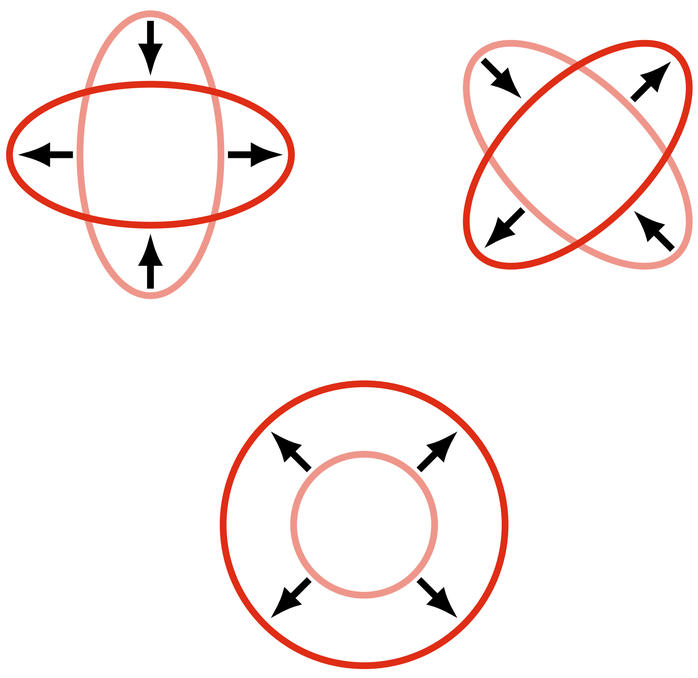
Asymptotic Conformal Killing Horizon (ACKH): null hypersurface with a vector field that satisfies the conformal Killing equation in a limiting sense
Examples: null infinity, cosmological horizons, some black hole horizons

ACKH Group: $\mathrm{SO}^+(3,1) \times C^\infty(\mathbb{S}^2) \times C^\infty(\mathbb{S}^2)$

- $\mathrm{SO}^+(3,1)$: Lorentz transformations
- $C^\infty(\mathbb{S}^2)$: supertranslations
- $C^\infty(\mathbb{S}^2)$: superdilations

Perspectives

- ACKHs unify asymptotic symmetries at null infinity (BMS group) and at cosmological horizons (DMP group)
- formalism does not depend on spacetime dimension or cross-sectional geometry
- superdilations could signal a new memory effect in a modified theory of gravity
- past and future null infinity could be interpreted as a bifurcate ACKH
- could be useful in bootstrapping quantum field states in curved spacetime



UFABC CAPES