Horizons in flat space holography

A Carrollian Vision

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Three foci in this session

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   BMS, Hilbert space of UIRs, $\mathcal{S}$-matrix construction

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2. **Boundary operators (Shamik Banerjee)**:
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3. **Horizons (this talk)**: What is the holographic imprint of a **dynamical horizon** in asymptotically flat space?

Why focus on horizons in flat space holography?

- Reminder: holography emerged from BH thermodynamics

$$S_{\rm BH} = \frac{A}{4}$$

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- AdS/CFT: understand several aspects of BHs
  - **eternal BH in AdS = thermal equilibrium in CFT**
  - AdS BH formation = thermalization (QGP formation from colliding shockwaves)
  - Hawking–Page phase transition = (de)confinement phase transition
  - AdS BH perturbations = relaxation process in dual plasma ($\frac{\eta}{s} = \frac{1}{4\pi}$)
  - information not lost since dual CFT unitary (at arbitrary finite N)
  - information lost in strict large N limit (large N factorization)
  - AdS BH microstate counting from Cardyology
  - AdS BHs saturate chaos bound
  - AdS BHs are fast scramblers
  - AdS BH interior: entanglement, bulk reconstruction & (no) firewalls
  - AdS BHs suggest ER = EPR
  - Page curve from quantum extremal surfaces (island proposal)
  - AdS BH holographic complexity = computational difficulty in CFT
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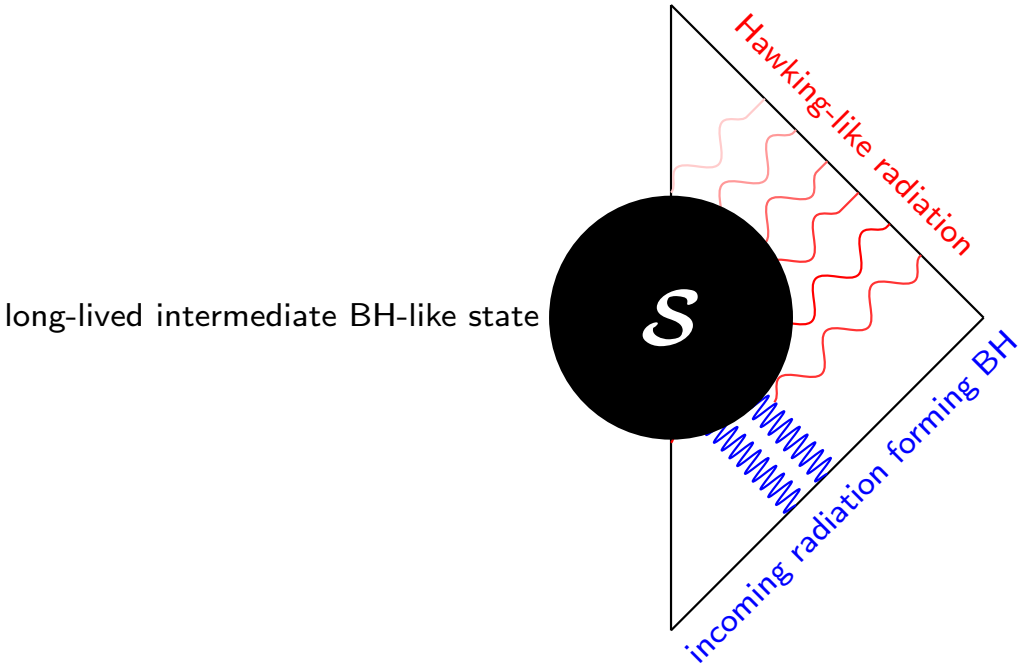

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Focus first on spacetimes with eternal horizons and then on dynamics

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(at least in 2+1)

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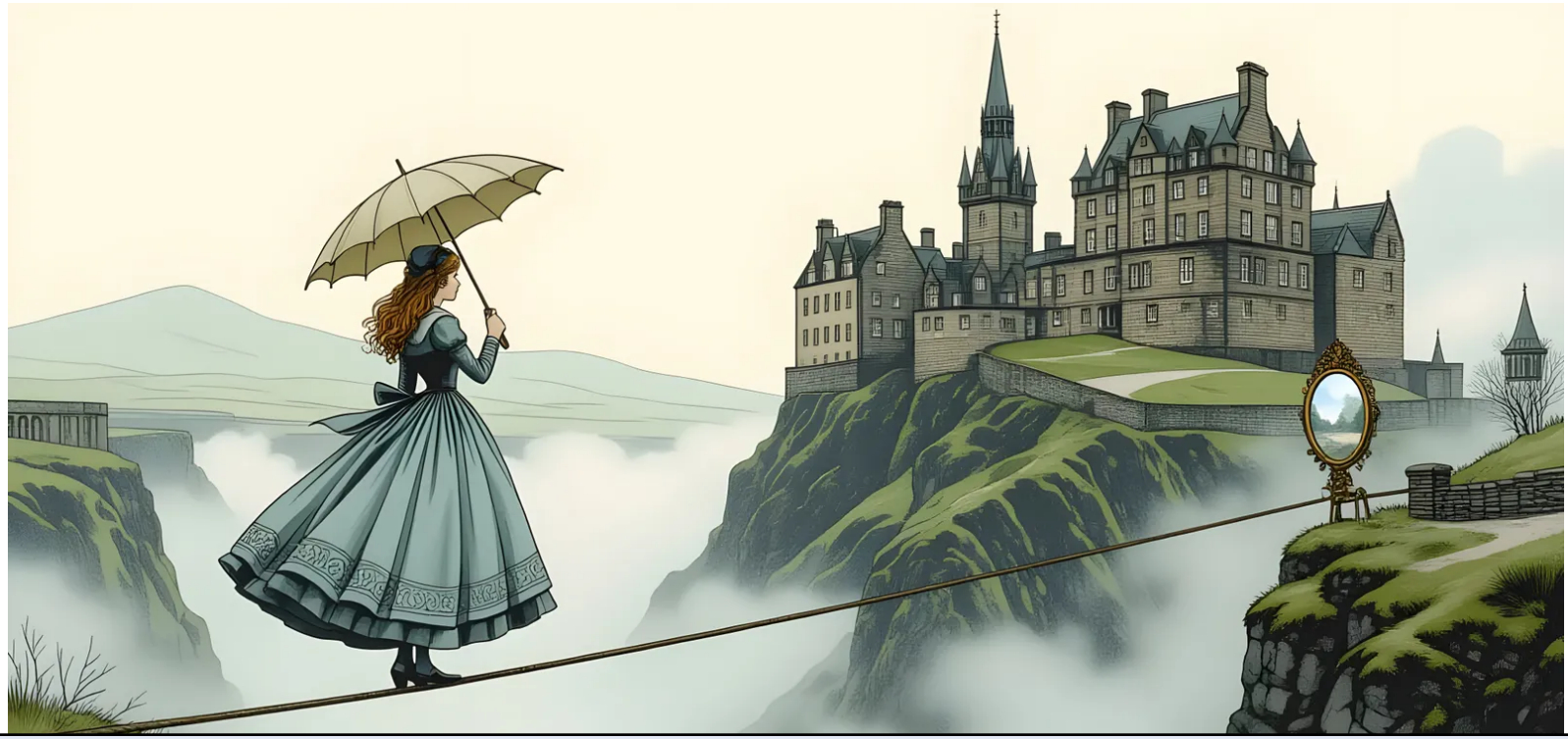

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- my phantasy: RG-flow in Carroll CFT from $\mathscr{I}$ to $\mathscr{H}$ allows isolating horizon degrees of freedom as specific states in Carroll CFT

  electric sector of Carroll CFT: scattering data
  magnetic sector of Carroll CFT: horizon data

Status of flat space holography todo list from horizon perspective

Copy-and-paste AdS list:

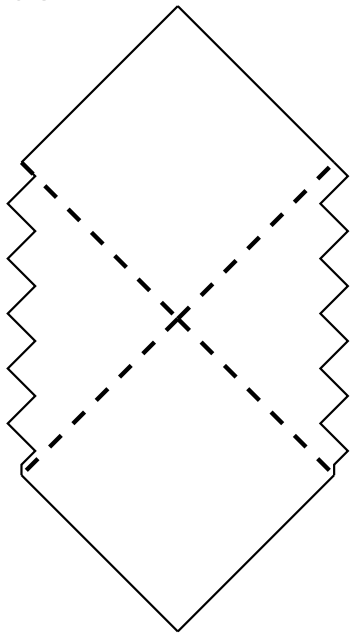
- **eternal BH in AdS = thermal equilibrium in CFT**

  Status in flat space: we do not know

  (in 2+1 this works for flat space cosmologies and Carroll CFT_2)

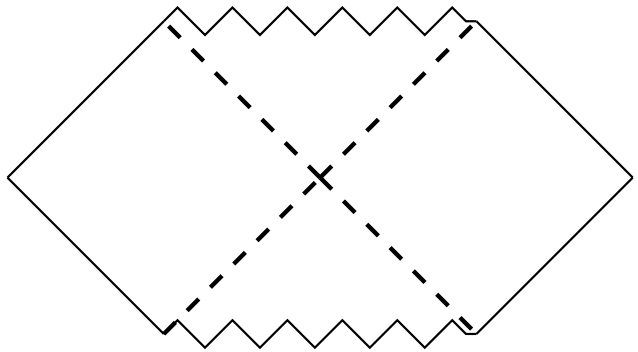
  (in 1+1 this sort of works for CJ/charged SYK)

  Note:



FSC Penrose slice

$\neq$



SBH Penrose slice

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In 2+1: HEE for global flat space and flat space cosmologies and Renyi/entanglement entropy for Carroll CFT_2

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- **Summary: there is a lot we do not know. Let us find out!**


One Vision