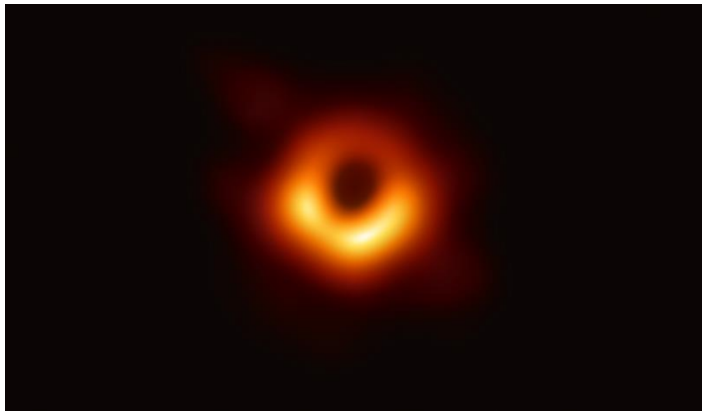
Hidden Symmetries in Black Holes

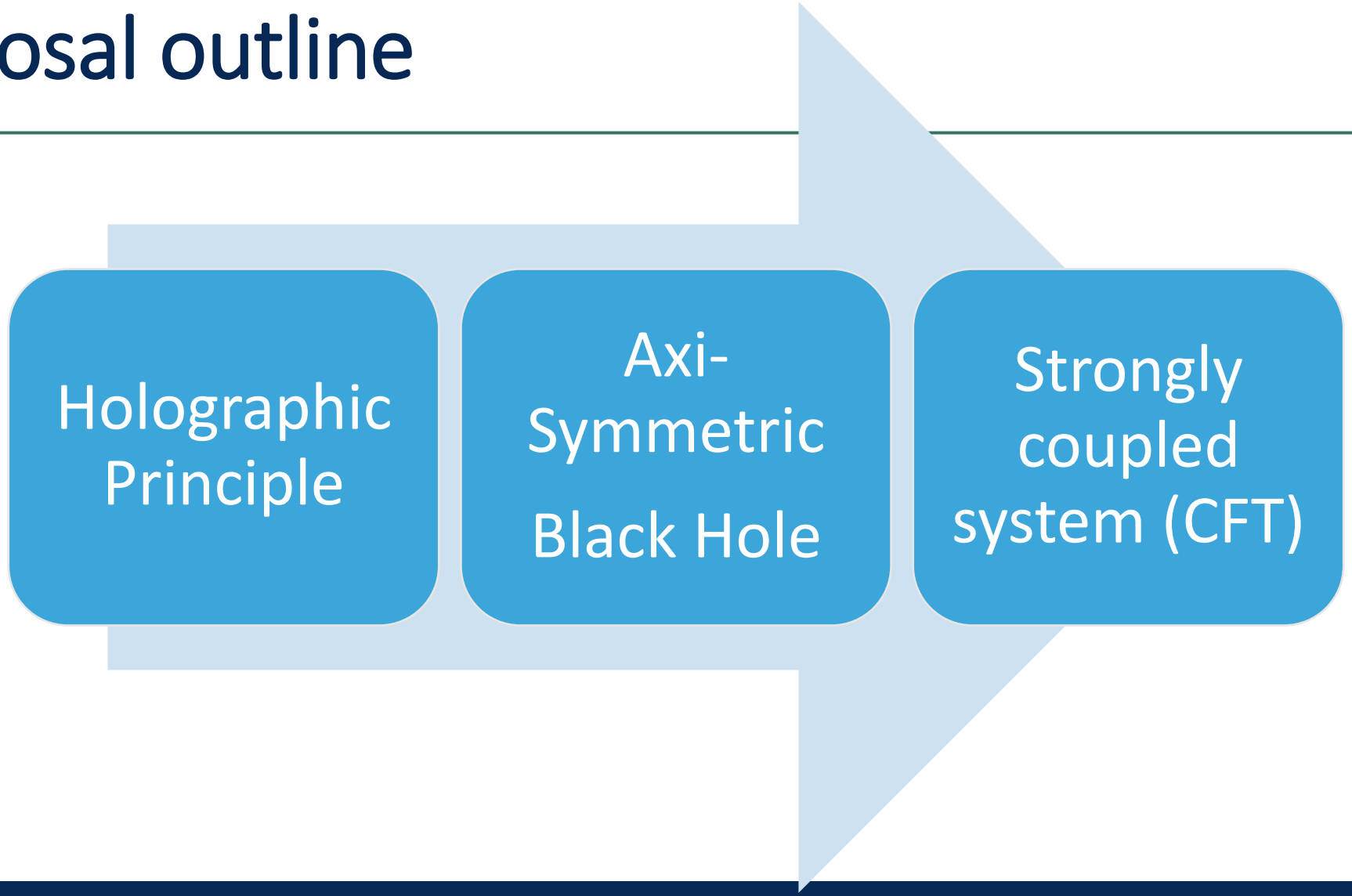
Luis Fernando Temoche// Utah State University
Alex Chanson// Utah State University
Dr. Maria J. Rodriguez// Utah State University
Dr. Victoria Martin// University of Iceland

Black Holes (BH) and Strongly Coupled Systems

- What is a symmetry in physics?
- Can BH solutions can describe strongly coupled systems?



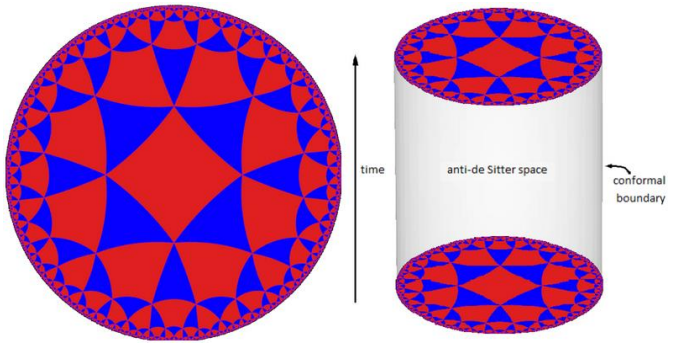
Proposal outline



Geometrical analysis of the BH

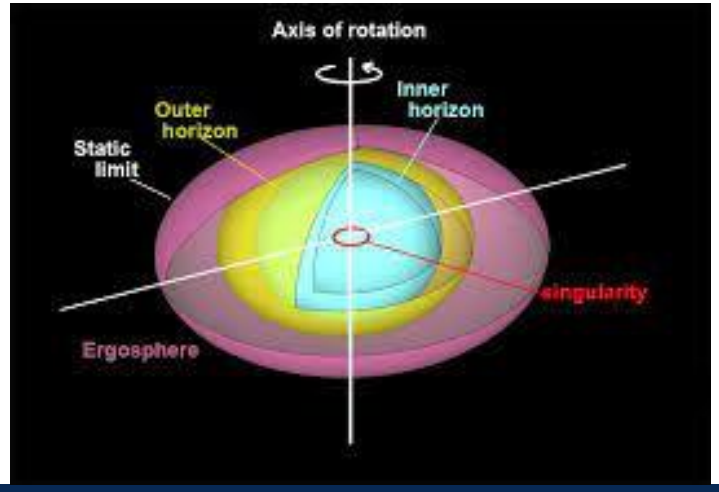
- Use a proper set of lenses: conformal coordinate transformation
- Apply constraints: Taylor expansion on the metric at leading orde
- Recover an AdS_3 like factor.

$$ds^2 = \frac{4\rho_+^2}{y^2} dw^+ dw^- + \frac{16J^2 \sin\theta^2}{y^2\rho_+^2} dy^2 + \rho_+^2 d\theta^2 + O(1)$$



Dynamical analysis for scalar fields

- Extract the radial factor of the KG eq.
- Determine its singularities.
- Calculate CFT dual thermodynamics: effective temperature from singularities.



$$T_{L,R} = \frac{r_+ \pm r_-}{4\pi a}$$

Results beyond Kerr BH

Case : 5D Myers-Perry BH

$$ds^2 = \frac{4\rho_+^2}{y^2} dw^+ dw^- + \frac{k^2 \sin\theta^2}{y^2 \rho_+^2} dy^2 + \rho_+^2 d\theta^2 + r_+^2 \cos\theta^2 d\psi^2 + O(2)$$

$$T_{L,R,\psi} = \frac{r_+ \pm r_-}{2\pi a}$$

$$T_{L,R,\phi} = \frac{r_+ \pm r_-}{2\pi b}$$

Conclusions (so far…)

- Axi-symmetric BH solutions of GR both in 4 and 5D exhibit AdS_3 factors in the near horizon limit.
- Scalar field dynamics propagating in Axi-symmetric BH backgrounds exhibit conformal invariance in the near horizon limit.

Contact Info

Luis Fernando Temoche
Utah State University
l.f.temoche@usu.edu

Dr. Maria J. Rodriguez
Utah State University
maria.rodriguez@usu.edu

USU Gravitational Theory Group

-usuTPT seminars:

https://lfth93.wixsite.com/website

-USU Gravitational Theory Group Journal Club