Holographic massive gravity

David Vegh

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- add charged matter density
- turn on temperature

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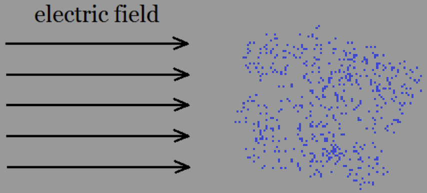
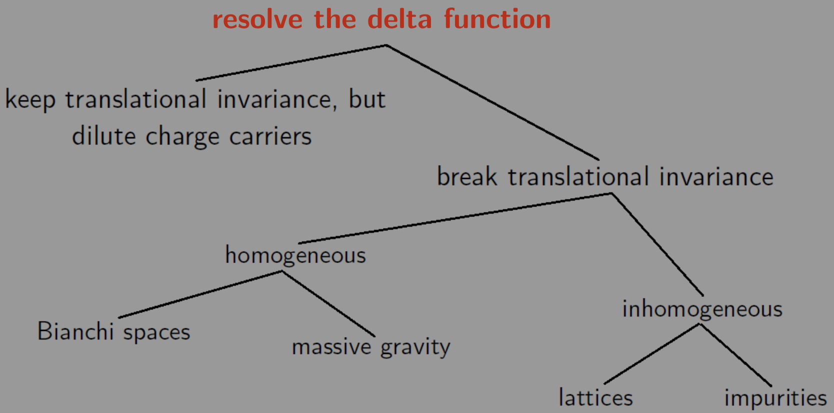


Answer: $\partial_\mu T^{\mu\nu} = 0 \quad \Rightarrow \quad \lim_{\omega\to 0} \sigma(\omega) \sim \frac{\mu}{i\omega} + \delta(\omega)$

Resolving $\sigma_{DC} = \infty$

$$\sigma(\omega) \sim \frac{\mu}{i\omega} + \delta(\omega)$$



So far generic QFTs . . .

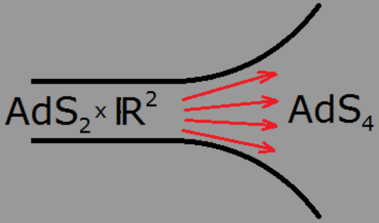
. . . now turn to holographic theories!

Study QFTs with holographic duals

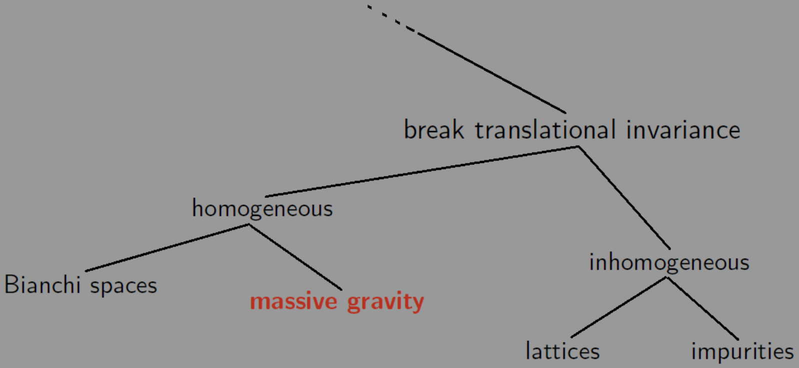
Relativistic CFT_3 with gravity dual + conserved $U(1)$ global symmetry

$$S = \frac{1}{2\kappa^2}\int d^4x\sqrt{-g}\left(\mathcal{R} + \frac{6}{L^2} - \frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \ldots\right)$$

Charged black hole solution



Break translational symmetry



- **We know:** bulk diffeomorphisms $\Rightarrow \partial_\mu T^{\mu\nu} = 0 \Rightarrow \sigma_{DC} = \infty$

  Idea: $\partial_\mu T^{\mu\nu} \neq 0 \Rightarrow$ no bulk diff's $\Rightarrow$ massive gravity

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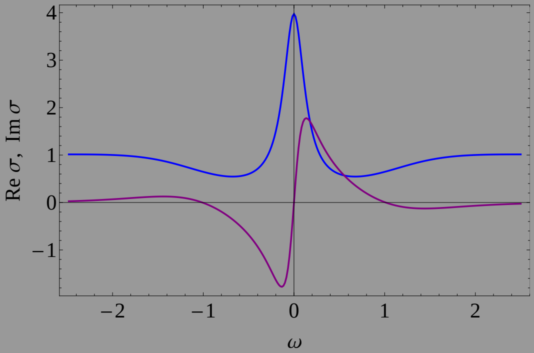
- [de Rham-Gabadadze-Tolley] (and many others)

  $$S = \frac{-1}{2\kappa^2} \int d^4x \sqrt{-g} \left[\mathcal{R} + \Lambda - \frac{L^2}{4} F^2 + m^2 (c_1 \mathcal{U}_1 + c_2 \mathcal{U}_2 + c_3 \mathcal{U}_3 + c_4 \mathcal{U}_4) \right]$$

- the construction eliminates the Boulware-Deser ghost

Conductivity with graviton mass

- perturb a_x, g_{tx} and g_{rx}



Result: $\sigma_{DC} = 1 + \frac{\mu^2}{M^2(r_h)}$