Is Behavior Expected?

Spectral function features in Lifshitz

- At large ω,
$$\mathrm{Im}(\mathcal{G}) \sim \omega^{2\nu}$$
- For small ω,
$$\mathrm{Im}(\mathcal{G}) \neq 0$$
but is exponentially supressed.
- At $\omega = 0$ there is an essential singularity.

Are these features universal? Are they expected from field theory?

Universality and Field Theory

‘Higher Curvature’ terms

- Scalar with higher curvature action in WKB approx
- Lifshitz scaling fixes large ω behavior, but not conformal; $\mathcal{G}$ not entirely universal
- higher curvature terms in scalar action provide one way to generate new behavior
- nonzero but exponentially suppressed region in Im$(\mathcal{G})$ *is* universal
- essential singularity can be moved or removed

Field Theory model (K. Sun)

- Quadratic band crossing model, appropriate for e.g. bilayer graphene
- Lifshitz scaling fixes large ω behavior
- Perturbative calculation gives Im$(\mathcal{G}) = 0$ for small ω
- nonperturbative resumming gives nonzero but exponentially suppressed region!
- no essential singularity, but expansion untrustworthy near $\omega = 0$.

Further Work

Questions

- Consider probe limit:
    1. Change spacetime in IR by high transverse momentum wiggle
    2. probe spacetime boundary by scalar profile
    3. Can the effect of the high-p wiggle be seen before the probe limit is exceeded?
- How do entanglement wedges, causal holographic information, etc work here?
- We work in Poincare-like coordinates (Lifshitz has no global coords), so we shouldn't see an entanglement shadow. Yet we otherwise have similar reconstruction difficulties to Freivogel et. al.– how can this be understood?

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If these applications are successful, great!

If they fail somehow, then we still learn about the nature of holography and dualities in general.

Thank you!

(and for all of us leaving this weekend, thanks to the organizers for a great workshop so far!)