

ER=EPR and strange metal from field theory wormhole.

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We give an understanding how strange metals arise from the spatially random Yukawa-SYK model based on the wormhole picture and find a parallelism between the disorder theory and quantum gravity. We start from the observation that the Gaussian average over the spatial random coupling gives a wormhole, defined as a mechanism for long range interaction without causal suppression outside the lightcone. We find that the large-

N

N limit equivalence of the quenched and annealed averages provides a field theory version of the ER=EPR. Since the wormhole establishes momentum exchanges over arbitrary distance without causal suppression, it provides a mechanism of the planckian dissipation. It also tells us why SYK-like models describe strongly interacting systems even in the small coupling case. We classify the disorder samples into two classes: I) spatially random coupling with wormholes and no information loss, II) spatially uniform coupling with decoherence.

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