Séminaire commun

A semi-holographic approach to strange metallic behaviour

Hareram Swain

Indian Inst. Tech., Madras

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Résumé

”Strange metals” exhibit an anomalous temperature dependence of the low temperature resistivity and the measurement of their spectral function via ARPES indicates the breakdown of the conventional quasi-particle picture. In my talk, I will explain how we construct a semi-holographic description for such behaviours where we propose an effective theory in which the electron of a two-dimensional band hybridizes with a fermionic operator of a critical holographic sector, while also interacting with other bands that preserve quasiparticle characteristics. Besides the scaling dimension ν of the fermionic operator in the holographic sector, the effective theory has two dimensionless couplings α and γ determining the holographic and Fermi-liquid-type contributions to the self-energy respectively. In the case of DC conductivity that irrespective of the choice of the holographic critical sector, there exists a ratio of the effective couplings for which we obtain linear-in-T resistivity for a wide range of temperatures. This scaling persists to arbitrarily low temperatures when ν approaches unity in which limit we obtain a marginal Fermi liquid with a specific temperature dependence of the self-energy. Interestingly, we explain the origin of the linear-in-T resistivity and strange metallic behavior as a consequence of the emergence of a universal form of the spectral function which is independent of the model parameters when the ratio of the two couplings takes optimal values determined only by the critical exponent. This universal form fits well with photoemission data of copper oxide samples for under/optimal/over-doping with a fixed exponent over a wide range of temperatures. We further obtain a refined Planckian dissipation scenario.