Poster 19

# Fermi-liquid to non-Fermi liquid crossovers in the superconducting Yukawa-SYK model on a lattice

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Strange-metal phases, found in, e.g., heavy fermions, pnictides, and cuprates, host partially coherent superconducting states, born out of incoherent, non-Fermi liquid (NFL) normal-state spectra [1–4]. The Sachdev-Ye-Kitaev (SYK) approach [5–7], based on all-to-all interactions among $N$ fermion species ("flavors") in 0-dimensional dots, is a promising route for building toy models of NFL physics. A superconducting instability emerges by coupling fermions to $M$ bosonic flavors (the Yukawa-SYK model), responsible for Cooper pairing and for normal-state incoherence [8,9]. In this work, we generalize the Yukawa-SYK model to a lattice with random hopping parameters. We exactly solve the model in the spin-singlet large-$N$ limit, at $N = M$ and at particle-hole symmetry, we construct the phase diagram, and we characterize the FL to NFL crossovers in the normal and superconducting states [10,11]. Hopping exponentially decreases the critical temperature in FL regime, which is maximal in the single-dot NFL limit at given coupling. However, the phase stiffness and the condensation energy are maximal precisely at the NFL/FL crossover. Such correlation is reminiscent of an analogous experimental evidence found in superconducting cuprates [11]. We then generalize the theory to 2D dispersive fermions and bosons, and apply this model to DC and AC strange-metal magnetotransport [12].

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