Poster-2-27

Superconductivity and magnetotransport in non-Fermi lquids: exact results from Yukawa-SYK lattice models

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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]. Such properties can be reproduced in Sachdev-Ye-Kitaev (SYK) approach [5-7], based on all-to-all interactions among N fermion species ("flavors"), where superconductivity 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. The phase stiffness and the condensation energy are maximal precisely at the NFL/FL crossover, analogously to 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]; we study interaction-driven renormalization of the cyclotron resonance, and nonlinear T dependence of the Hall angle.

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