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Effective theory of Fermi pockets in fluctuating antiferromagnets[1]

YANG QI, SUBIR SACHDEV, Harvard University — Photo emission, STM, transport and other experiments in cuprate superconductors have revealed Fermi arc and Fermi pocket structures in underdoped regime. Here we present an analytical effective theory for the Fermi pocket structures appeared in electron excitation spectrum. The physics of Fermi pockets in the presence of fluctuating spin density wave order has been described by a U(1) gauge theory with charged fermions and bosonic spin fields, or the "spin-fermion model". We study a theory of bound states of spin and charge excitations in this model, and relate the bound state to physical electron excitations. We present a phenomenological effective Hamiltonian for the bound states, whose form is determined by symmetry and gauge invariance. The coupling constants of the theory will have to be determined by experiments. This effective model is used to calculate electron spectrum function across the entire Brillouin zone, and the result is compared to photo emission experiments.

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