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Pairing of critical Fermi-surface states MAX METLITSKI, KITP, DAVID MROSS, MIT, SUBIR SACHDEV, Harvard University, TODADRI SENTHIL, MIT — States of matter with a sharp Fermi-surface but no well-defined Landau quasiparticles are expected to arise in a number of physical systems. Examples include i) quantum critical points associated with the onset of order in metals, ii) the spinon Fermi-surface (U(1) spin-liquid) state of a Mott insulator and iii) the Halperin-Lee-Read composite fermion charge liquid state of a half-filled Landau level. In this work, we use renormalization group techniques to investigate possible instabilities of such non-Fermi-liquids to pairing. We show that for a large class of phase transitions in metals, the attractive interaction mediated by order parameter fluctuations always leads to a superconducting instability, which preempts the non-Fermi-liquid effects. On the other hand, the spinon Fermi-surface and the Halperin-Lee-Read states are stable against pairing for a sufficiently weak attractive short-range interaction. However, once the strength of attraction exceeds a critical value, pairing sets in. We describe the ensuing quantum phase transition between i) the U(1) and the Z_2 spin-liquid states, and ii) the Halperin-Lee-Read and Moore-Read states.

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