Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Fermionic propagators for 2D systems with singular interactions
TIGRAN SEDRAKYAN, ANDREY CHUBUKOV, Department of Physics, University of Wisconsin-Madison — We analyze the form of the fermionic propagator for 2D fermions interacting with massless overdamped bosons. Examples include a nematic and Ising ferromagnetic quantum-critical points, and fermions at a half-filled Landau level. Fermi liquid behavior in these systems is broken at criticality by a singular self-energy, but the Fermi surface remains well defined. These are strong-coupling problems with no expansion parameter other than the number of fermionic species, N. The two known limits, $N >> 1$ and $N = 0$ show qualitatively different behavior of the fermionic propagator $G(\epsilon_k, \omega)$. In the first limit, $G(\epsilon_k, \omega)$ has a pole at some ϵ_k, in the other it is analytic. We analyze the crossover between the two limits. We show that the pole survives for all N, with residue $Z = O(1)$, however at small N it only exists in a range $O(N^2)$. At $N = 0$, the range collapses and the behavior of $G(\epsilon_k, \omega)$ becomes analytic.

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Date submitted: 21 Nov 2008 Electronic form version 1.4