Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Collective fields in the functional RG for fermions: Vacuum expectation values and spontaneous symmetry breaking FLORIAN SCHUETZ, PETER KOPIETZ, Institut fuer Theoretische Physik, Universitaet Frankfurt, Max-von-Laue Strasse 1, 60438 Frankfurt — We discuss partial bosonization of interacting electron systems by a Hubbard-Stratonovich transformation and derive the functional renormalization group equations for the one-line-irreducible vertices of the resulting coupled field theory containing fermionic and collective bosonic fields. We analyze different choices of the cutoff in either the fermionic or the bosonic propagator. Recently,we have shown that for the Tomonaga-Luttinger model a purely bosonic cutoff can be combined with Ward identities to solve a whole hierarchy of flow equations and to reproduce the exact solution for the single particle Green's function known from bosonization [1]. Here, we generalize our approach to include the possibility that some bosonic components of the field have a finite vacuum expectation value. The system of flow equations is then modified and supplemented by a flow equation for the vacuum expectation value of the field. For bosonic fields describing fluctuations in the zero-sound channel, the vacuum expectation value of the zero mode is closely related to the fermionic density, which can be exploited to calculate the compressibility. By using a cutoff in the free bosonic propagator, the renormalization group flow can be set up to systematically yield corrections to the self-consistent Hartree approximation. [1] F. Schuetz, L. Bartosch, and P. Kopietz, Phys. Rev. B 72, 035105 (2005)

Florian Schuetz
Institut fuer Theoretische Physik, Universitaet Frankfurt, Max-von-Laue Strasse 1, 60438 Frankfurt

Date submitted: 30 Nov 2005 Electronic form version 1.4