## Boltzmann Description of Non-Interacting Electrons in Weakly Localized Regime

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The transport processes of non-interacting electrons is formulated, in view of the exact transport equation of interacting Fermi systems reported by the present authors in this conference. The formalism eliminates the hidden ultraviolet divergence and makes the correct correspondence to the Boltzmann theory, covering the weakly localized regime, by incorporating the particle-particle and hole-hole pairs.
A number of new aspects emerges from this rather traditional approach. A mass renormalization of purely two-particle nature appears in the transport equation, in distinction from the one-particle dispersion mass representing the group velocity. In the conductivity expression, the latter renormalization is cancelled by the change of the density of states, leading to the Drude formula in terms of the *transport* mass. The transport equation is solved numerically for the 2D-system with short-ranged random scatterers, taking the maximally crossed diagrams for the proper vertex. The conductivity is positive definite, but vanishes in the elastic scattering limit even with infinitesimally small self energy, while the transport mass reduces to the free-electron mass in the same limit due to the diverging back scattering. The description differs from the self-consistent theory by Vollhardt and Wölfle[1], in which the Bethe-Salpeter structure of the scattering vertex is abandoned and, accordingly, the correspondence to the Boltzmann theory is lost.

[1]D. Vollhardt and P. Wölfle, Phys. Rev. Lett. **48**, 699 (1982)