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**Gradient Expansion approach to interacting Fermi Liquids**
RYUICHI SHINDOU, LEON BALENTS, Physics Department, University of California, Santa Barbara — Starting from the Keldysh equation for a general multiple band Fermi liquid (FL), we project out fully occupied / empty bands and derive the SU(2) reduced Keldysh equation (RKE), only to discuss the low-energy property of those quasi-particles which are constrained within a single Fermi surface. The RKE thus derived characterizes quasi-particle dynamics in terms of Berry's curvatures defined in the (d+1) dual space. Namely, in addition to the well-studied "k-space magnetic field", our Fermi liquid formulations naturally introduce "k-space electric field", as the Berry's curvature in frequency and momentum space. When solving the derived RKE in favor of spectral functions, we observed that these artificial electromagnetic fields enter into the linear response of the spectral weight against real applied electromagnetic fields. This theoretical observation naturally lets us raise several photoemission experiments as the candidate experimental tool to measure both U(1) and SU(2) artificial fields in a momentum resolved way, which is widely demanded from the (spin) galvanomagnetic community. Restricting ourselves to the U(1) FLs, we further derive the U(1) Boltzmann equation out of this RKE, to find that not only the artificial magnetic field but also the electric fields enters into the effective EOM for quasi-particles as the Lorentz force in k-space.

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