A NEW LOOK ON AN OLD PROBLEM: MASS ENHANCEMENT IN FERMI LIQUIDS

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In this work, we explore the relationship between the mass enhancement and specific heat in Fermi liquids by bridging the gap between the microscopic theory of interacting electrons and the phenomenological framework of Landau's Fermi liquid theory. This is done by studying the role of electron self-energy in renormalising quasiparticle effective mass.There exist two distinct mechanisms for mass enhancement: the frequency-dependent quasiparticle weight reduction (ω- mass) and momentum-dependent self-energy effects (k-mass). These two contributions affect the density of states and specific heat differently, leading to discrepancies with traditional Landau theory. However, we demonstrate that these differences can be compensated by the temperature dependence of the self-energy, restoring consistency with Landau's predictions under certain conditions. This gives rise to a new sum rule connecting the Sommerfeld specific heat coefficient to a functional of energy density, verified through numerical simulations on the Bethe and triangular lattice Hubbard model using Dynamical Mean Field Theory (DMFT).