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Transport in Fermi Hubbard models: lessons from weak coupling[1]

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In the absence of phase transitions, all of the strong coupling phenomena in cold atom experiments are continuously connected to physics at weak coupling. I will report on quantum Boltzman equation calculations of resistivity in the Fermi Hubbard model. Here the only mechanism for momentum relaxation is Umklapp scattering – where quantum coherent two-particle scattering deposits momentum into a perfect lattice. At temperatures large compared to the bandwidth the scattering rates are temperature independent but resistivity nonetheless grows linearly with temperature because of band-filling effects. At temperature small compared to the bandwidth the resistivity generically has the Fermi-liquid form, $\rho \propto T^2$. The temperature of the crossover from quadratic to linear behavior depends on the filling, vanishing at half-filling – where the resistivity is approximately linear for all temperatures. I will also report on a simple, yet quantitatively accurate, Gutzwiller Ansatz based calculation of the compressibility.

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