**Conduction with Impurities**

**Conductivity via Kubo Formula, kind of**

An even sketchier sketch. So we start with our electron – impurity – phonon Hamiltonian,



and add an electromagnetic field to get, ultimately:



The last term we’ll call VEM. And note definitions:



(ρ is charge density) Our steady state non-equilibrium distribution function is:



where Ueq includes all terms in H sans VEM. Now we calculate the expectation of the current. Going through the same machinations as before we get:



And so ultimately,



where we have done the disorder average now, and,



Taking the Fourier transform, we have that the conductivity tensor is:



and specializing to DC,



and expecting a real σDC, we have:



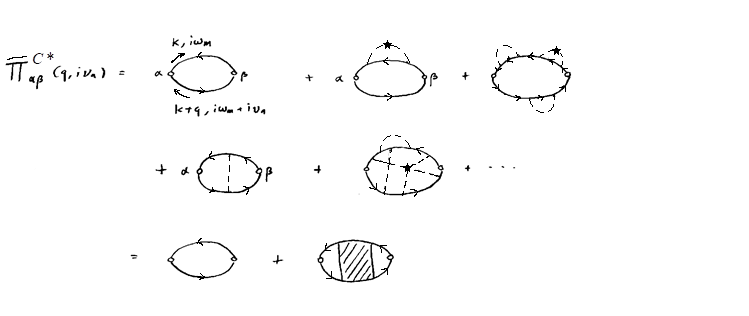
Presuming isotropy, then even more simply,



The current-current correlation function would be given by, as before,



which amounts to, diagrammatically, a structure very similar to what we had before.



Basically just include all impurity and phonon vertices. The Feynman rules are as expected I’d say. I don’t know what the salient results of this approach are per se´.