**Interacting electrons in a B field**

Basically just going to copy what we had for the nearly free model. And just add a magnetic field. So to start, this is our H for interacting electrons within an ionic backgound, and a magnetic field.



where the electron number density is:



where i is the ith electron’s position (operator). We’ll go back to the approximation that the ions are immobile. Then we’d just have:



We’ll treat the e-ion interaction and ion-ion interaction in the continuum approximation, presuming all the interactions are the same, and taking ni(r) = ne(r).



Reviewing our work in the Electrons/Impurities/Conductivity file, the first part of our H can be written as:



where,



as we’d expect. And we know from the analysis done in the e-e Interaction/ Nearly Free folder that the interaction part, comprising the last two terms, comes to:



So all total, our Hamiltonian H = H0 + V comes to,



From the same e-e Interaction/Nearly Free/Interaction file, we know the Fourier transforms of V(r) in 3D, or 2D, are:



(presuming q is slightly imaginary to aid convergence) If we use faux Gaussian units, then we’d do ε0 → 1/4π.