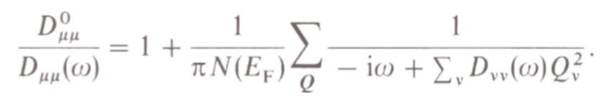
**Quantum Model (Self Consistent Theory)**

We can go beyond first order perturbation theory by working out a self-consistent equation for the diffusion pole. I think this is like is done in the Hartree Fock equation, and is sort of equivalent to a mean field theory? Anyway, in that same Wolfle paper we get:



We can extract the localization length in the limits of weak and large disorder, in terms of the disorder parameter W = 1/kFℓ. He obtains,



Observe how the the localization length diverges with the typical mean field exponent in d = 4. Also note the critical disorder is on the order infinitesimally small for d = 2 + ε. But for 3D, it ~ 1. This could be done for large disorder (small ℓ), but couldn’t it also be done via small kF? And so then is it possible that we could do weak disorder in 3D, or does disorder only enter into these analysis within that ratio, and so it makes no sense to vary separately?