**Berry Phase**

Say we have an H(x,p,λj), where λj are some set of parameters like V, B, etc. – perhaps the external parameters we might otherwise consider to entire into the thermodynamic description of the system. Let the eigenstates of this system be called |n(λj)>. If we slowly (adiabatically) change these parameters, then the system should remain in whatever eigenstate (or if the eigenstate is part of a degenerate set, then it should remain somewhere in that degenerate space) it was in (unless we get level crossing, in which case we cannot say what state the system will jump into when the levels reseparate). But the phase of the system should also change while this happens. In the special case of a non-degenerate eigenstate, we can compute this phase change with the Schrodinger equation….in the particular case where we begin and end at the same state, this is called the Berry phase. Turns out it is:



So the phase *will* depend on the path taken through parameter space, but shouldn’t depend on the time taken to perform the path (as long as it’s adiabatic enough I guess). We can write this another way. Define the curl of **A** as:



Then,



Not sure what dSij means exactly, but integral extends over the surface bounded by the closed path above. Anyway, it seems to be a general theorem that evaluating this integral over a closed surface yields:



where C is an integer called the Chern #.