**Excitations**

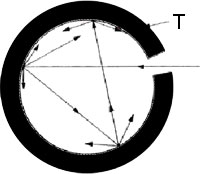
We have from before, that [Natural Gaussian units]:



where ωks = k (and ℏkc in SI units), and the vector potential is given by:



s gives the polarization. So we basically have the excitation spectrum right here, and it is continuous in all three dimensions. If we have a photon gas inside a cavity,



then the spectrum changes a bit – it has to conform to the boundary conditions. To work out the possible ωks we need to solve Maxwell’s equation inside the cavity:



And a plane wave solution exp(i**k**·**r**-iωt), (where ω = k), which vanishes at the boundaries, presumed cubic for simplicity would require:



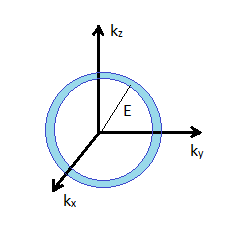
So the new excitations are ωks = k, where k = |**k**|. Unlike for phonons, where we’re restricted to 3N modes for each branch, we have no such restriction here, and the nx,y,z can extend to ∞. A general excited state of the system would be specified by stating how many photons occupy each allowed wave. So,



where qj is the number of photons occupying the kjth mode.

**Density of States/Excitations**

The density of states would follow like it did from the phonon calculation, though this time exactly since we used ωks = k,



And we find, for a given branch…



and we’d multiply by 2 to include both branches (polarizations). Again, this is more like a density of excitations than of states, per seʹ.