ECE 656 Homework (Week 8)

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1) For electrons, the bandstructure is a plot of energy, $E\left(\vec{k}\right)$, vs. wavevector, $\vec{k}$. For phonons, the dispersion is a plot of phonon energy, $\hbar\omega\left(\vec{q}\right)$, vs. phonon wavector, $\vec{q}$. For electrons, we <u>often</u> approximate the bandstructure with simple, parabolic bands,

$$E\left(\vec{k}\right)=\frac{\hbar^2k^2}{2m^*}$$

For phonons, we can <u>sometimes</u> approximate the phonon dispersion with the Debye approximation,

$$\hbar\omega=\hbar\upsilon_D q\,,$$

where υ_D is the Debye velocity (an average of the longitudinal and transverse acoustic velocities.)

1a) Compute the density-of-states, $D_{ph}\left(\hbar\omega\right)$, for phonons in the Debye model.

1b) Compute the distribution of channels, $M_{ph}\left(\hbar\omega\right)$, for phonons in the Debye model.