ECE 656 Homework (Week 6)

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1) In Lecture 14, we discussed M(E) for a 3D semiconductor with parabolic energy bands. Answer the following two questions about a 3D semiconductor with non-parabolic energy bands.

   a) Assume that the non-parabolicity can be described by

   $$E\left(1+\alpha E\right)=\frac{\hbar^2 k^2}{2m^*\left(0\right)} \ .$$

   Derive an expression for the corresponding $M\left(E\right)$.

   b) Using the following numbers for GaAs

   $m^*\left(0\right)=0.067\,m_0$

   $\alpha=0.64$,

   plot $M\left(E\right)$ from the bottom of the Γ valley to $E=0.3$ eV comparing results from the non-parabolic expression derived in part a) to the parabolic expression quoted in the lecture.