

HW #6

Due Nov. 26 (Tuesday) in class

1. Use the parameters in Appendix K of Chuang's book, calculate the conduction, heavy-hole, and light-hole band-edge energies for $\text{In}_{1-x}\text{Ga}_x\text{As}/\text{In}_{0.52}\text{Al}_{0.48}\text{As}$ quantum well structures where the barrier $\text{In}_{0.52}\text{Al}_{0.48}\text{As}$ is lattice-matched to InP substrate, for three Ga mole fractions:
 - a. $x = 0.37$ (compressive strained)
 - b. $x = 0.47$ (lattice matched)
 - c. $x = 0.57$ (tensile strained)
2. Using infinite potential well model, and assume all quantum wells are 10 nm thick, find the electron-heavy hole ($E_{e1} - E_{\text{HH1}}$) and electron-light hole ($E_{e1} - E_{\text{LH1}}$) transition energies for the $\text{In}_{1-x}\text{Ga}_x\text{As}/\text{In}_{0.52}\text{Al}_{0.48}\text{As}$ quantum wells with the three compositions in Problem 1.
3. Find the in-plane effective masses of the heavy hole and light hole for the quantum well in Problem 2 for all three compositions ($x = 0.37, 0.47, 0.57$). Consider the lowest-energy transition only for each composition, which composition has the lowest transparency carrier concentration?