

EECS 217C Nanotechnology

Homework #2

Due Monday, April 26, 2004 at the beginning of class

- 1) Calculate the density of states in a 2 dimensional world.
- 2) Calculate the density of states in a 1 dimensional world.
- 3) Calculate the probability for an electron to tunnel through a 1 nm barrier that is 10 eV high. This is a good approximation for the tunnel junction shown in class.
- 4) Calculate the Fermi energy for a piece of aluminum. Calculate the quantum mechanical wavelength of an electron with energy equal to the Fermi energy. (Hard unless you know quantum mechanics).
- 5) Same as 4 for intrinsic Si, intrinsic GaAs. (Be sure to use the correct value for the effective mass!)
- 6) For a 2 dimensional electron gas in GaAs with a density of 10^{11} cm^{-2} , calculate the Fermi energy and the Fermi wavelength. (This will be important when we discuss quantum dots and quantum point contacts.)
- 7) In figure 4 of Giaver's Phys Rev paper, the I-V curve is not a straight line. Can you think of reasons why?