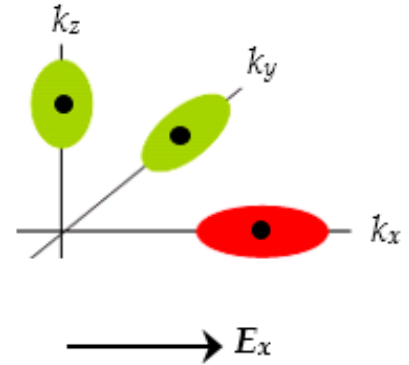


ECE 447/547 (Semiconductor Devices)
Southern Illinois University at Carbondale

Homework 04

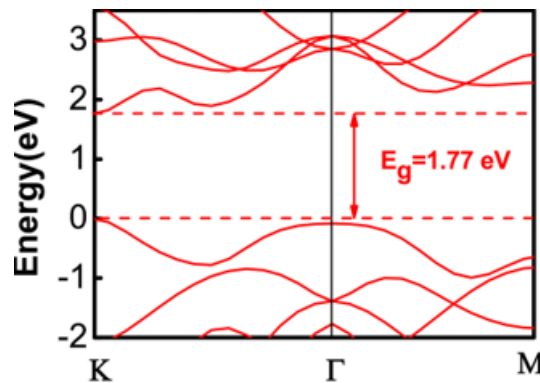
A. Thought experiment: Three orthogonal and degenerate energy valleys in bulk silicon, shown in the figure, have one electron each. The electric field is applied along the y-direction to which all three electrons respond giving rise to a current of I_1 . Now, some amount of tensile strain is applied in the material causing all three electrons located in the *transverse*

valleys and producing a current flow of I_2 . Given that $I \sim \frac{1}{m^*}$ and $m_l^* \sim 4m_t^*$ what will be the ratio of $\frac{I_2}{I_1}$?



B. Explain the origin (from bandstructure point of view) of *negative differential resistance* (NDR) in GaAs or GaN? How could you use this phenomenon in device applications?

C. E - k diagram of a new semiconductor material (possibly MoS₂) is shown in the figure below. Identify (and comment on) a few important parameters/features of this material.



D. Textbook problems: 3.12, 3.13, 3.15, 3.20, 3.22, 3.26