Homework 11: Band Structure

Kamil Wcz

1)

1. $\lambda = 460$ nm not absorbed
   $\lambda = 550$ absorbed
   $\lambda = 650$ absorbed

$E_{gap} = \frac{1240}{\lambda}$

Smallest energy you know the gap is 4 to? $\frac{1240}{450} \approx 2.76$ eV

2. Largest energy the gap 2 to?

$\frac{1240}{550} \approx 2.25$ eV

3. Would not conduct well: gaps prevent free movement

2) $v_e = 1$ m/s $E = 1$ V/m

1. Momentum of electron?

$m_e = 9.109 \times 10^{-31}$ kg $p = 9.109 \times 10^{-31}$ kg m/s

2. $F = \frac{dp}{dt}$ $v_e(10^{-5}\text{s}) = ?$

$F = ma$ $-1\frac{V}{m} = -1\frac{N}{C}$ $F = 1.602 \times 10^{-19}$ N $= ma = \frac{dp}{dt}$

$\Delta p = F \cdot t$ $q_e = -1.602 \times 10^{-19}$ C $F \cdot dt = 1.602 \times 10^{-24} \frac{kg m}{s} = mv$

$v \approx 1758700$ m/s

3. We are not using UV light. So, we cannot increase the electron's energy by much, we can't cross the 5 eV gap. The velocity must stay the same: 1 m/s

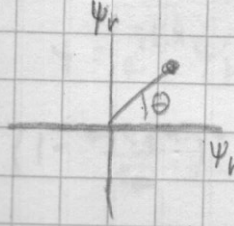
---

Lecture 16: Polarization and spin (internal variables) 9/27/23

Polarization: ψ_h is polarization in the horizontal direction
ψ_v is polarization in the vertical direction
$\psi = a\psi_v + b\psi_h$

Probability of passing through vertical filter: $P(v) = \frac{|a|^2}{|a|^2+|b|^2}$
horiz: $P(h) = \frac{|b|^2}{|a|^2+|b|^2}$

Representing polarization:



Diagonal: $\frac{\psi_v + \psi_h}{\sqrt{2}}$

$\psi_h \cos(\theta) + \psi_v \sin(\theta)$

Polarization:	State:
Vert	ψ_v
Horiz	ψ_h
Diag	$\frac{1}{\sqrt{2}}(\psi_h + \psi_v)$
Circular	$\psi_h + i\psi_v$ (Right)