SOLUZIONE ESERCIZIO LASER

1) Sapendo la distanza tra i livelli energetici, possiamo ricavare la frequenza e la lunghezza d'onda centrale del laser.

$$E = \frac{1{,}2424\ \mu m \cdot eV}{\lambda[\mu m]} \rightarrow \lambda = 0{,}489\ \mu m = 489\ nm$$

2) Per effetto doppler:

$$\Delta\nu_{FWHM} = 2\nu_0 \sqrt{\frac{KT\,2\ln 2}{m_{Ar} c^2}} \qquad T = 3000K$$

$$\nu_0 = \frac{c}{\lambda_0} = 613\ THz$$

$$\Delta\nu_{FWHM} = 3{,}8\ GHz \rightarrow \Delta\lambda = \frac{c}{\nu^2}|\Delta\nu| = 3{,}03\ pm$$

CALCOLIAMO ORA LA DISTANZA TRA I MODI

$$\Delta\nu_{FSR} = \frac{c}{2L} = 832{,}7\ MHz$$

$$\#\,modi = \frac{\Delta\nu_{FWHM}}{\Delta\nu_{FSR}} = 4{,}56 \rightarrow 4\ modi$$

3) SAPPIAMO CHE:

$$g_{th} = \frac{1}{2L} \ln\left(\frac{1}{R_1 R_2}\right) + \alpha_s = 0{,}6\,m^{-1}$$

POSSIAMO RICAVARCI R_2

$$R_2 = \frac{1}{R_1} e^{-g_{th} \cdot 2L} e^{\alpha_s \cdot 2L} = 0{,}9095$$

SOLUZIONE ESERCIZIO LED

1)

$$E_{GAP}(T) = E_{GAP}(0K) - \frac{AT^2}{T+B} \rightarrow E_{GAP}(300K) = 0{,}76eV$$

$$\lambda_0[\mu m] \simeq \frac{1{,}24}{E_{GAP}[eV]} \simeq 1{,}68\,\mu m$$

$$\Delta\lambda_{1/2} = \frac{\lambda_0^2}{hc}\Delta E \sim \frac{\lambda_0^2}{hc} 3kT = 176\,nm$$

2)

$$\eta_{PCE} = \frac{P_{O,LED}}{I_F \cdot V_F}$$

$$\eta_{EQE} = \frac{P_{O,LED}}{I_F} \cdot \frac{q}{h\nu} = \eta_{PCE} \cdot \frac{V_F \cdot q}{h\nu}$$

$$\rightarrow \eta_{PCE} = \frac{\eta_{EQE}\, h\nu}{qV_F} = \frac{\eta_{EQE}\, hc}{q\lambda_0 V_F} = 0{,}08$$

3)

$$P_{OLED} = \eta_{PCE} \cdot I_F \cdot V_F = 5{,}28\,mW$$

$$P_{OFIBRA} = N_A^2 \cdot P_{OLED} = 63{,}8\,\mu W$$

SOLUZIONE ESERCIZIO PN

1) $\eta = \eta_{EXT} \cdot \eta_{INT} = (1-R) \cdot e^{-\alpha x_n^+} \cdot (1-e^{-\alpha W})$

$$R = \left(\frac{n_{Si} - n_{aria}}{n_{Si} + n_{aria}} \right)^2 = 0,3$$

$\sqrt{\varepsilon_{Si}} = \sqrt{11,7}$

$\eta = 0,59$

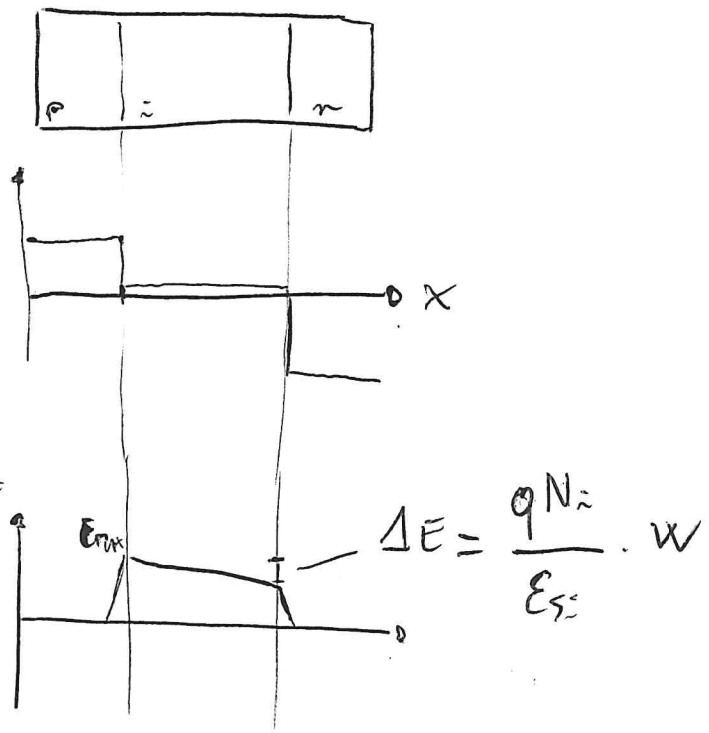
2) $I_{PH} = R \cdot P_0$

↑ RESPONSIVITÀ

$$R = \frac{q \cdot \eta \cdot \lambda}{h_C} = 0,237 \frac{A}{W}$$

$I_{PH} = 59\,nA$

3)



$$\Delta E = \frac{q N_i}{\varepsilon_{Si}} \cdot W$$