

Absorption Spectrum

With the optics features of **nextnano++**, the optical absorption spectrum can be calculated for various polarization directions.

Physics Model

The absorption rate in a semiconductor can be written as

$$R_{ba} = \frac{2}{V} \sum_{\mathbf{k}_a} \sum_{\mathbf{k}_b} \frac{2\pi}{\hbar} |H_{ba}|^2 \delta(E_b - E_a - \hbar\omega)(1-f_a) \cdot f_b,$$

where the matrix element $|H_{ba}|$ depends on the polarization of light and the $\mathbf{k}$ vector.

Input File

Results

Transition Matrix Element

The transition matrix element $H_{ab}(\mathbf{k})$ is plotted as a function of $\mathbf{k}=(k_x, k_y)$ for a quantum well structure (1D simulation) in figure 1

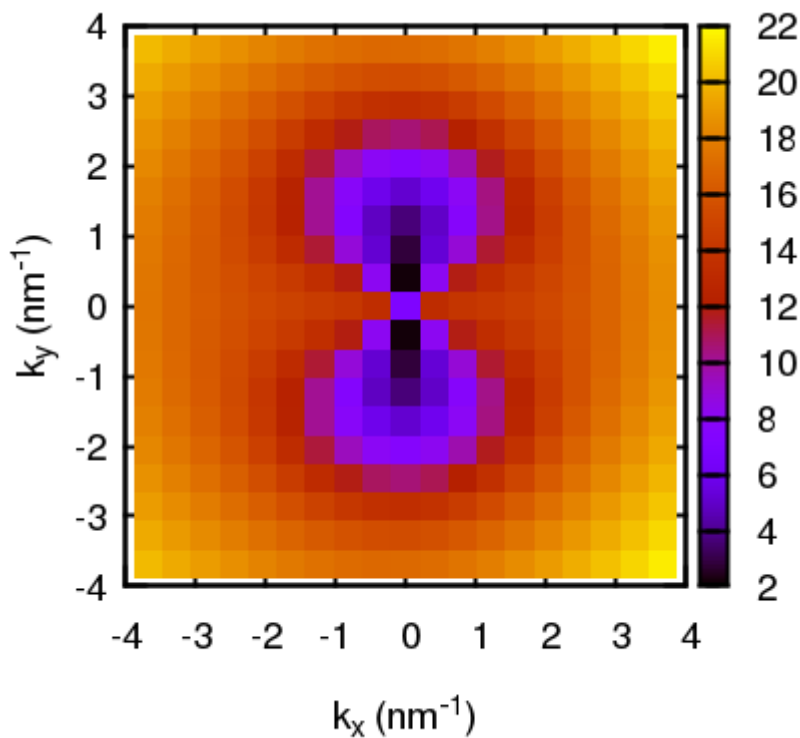


Figure 1: Transition matrix element in $\mathbf{k}$ space

Eigenvalues

The dispersion of the ground state energy is plotted with respect to $\mathbf{k}$ space in figure 2 for electrons, and in figure 3 for holes, respectively.

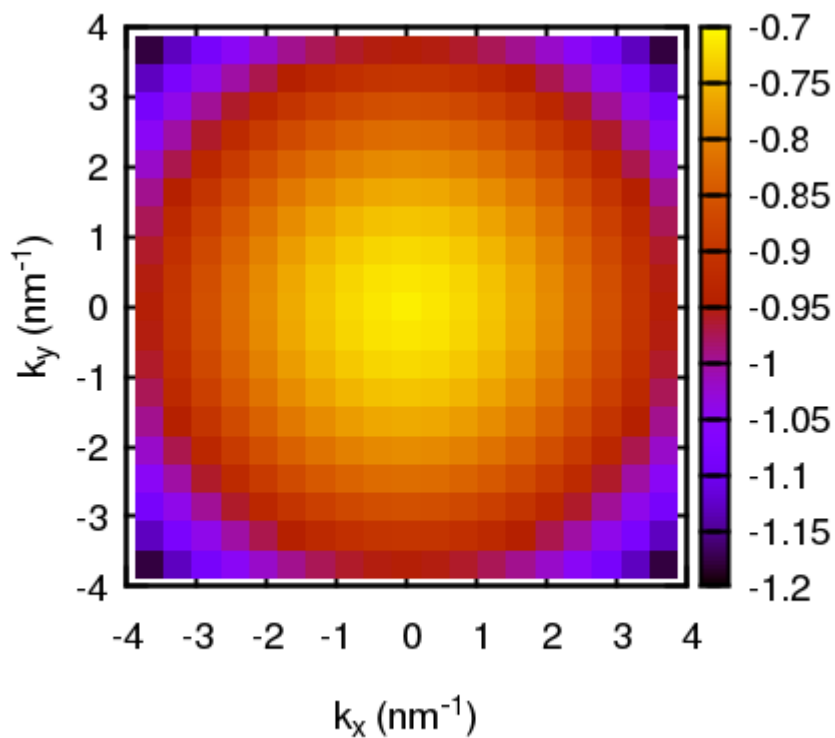


Figure 2: Energy dispersion relation $E(k_x, k_y)$ for the lowest electron eigenvalue

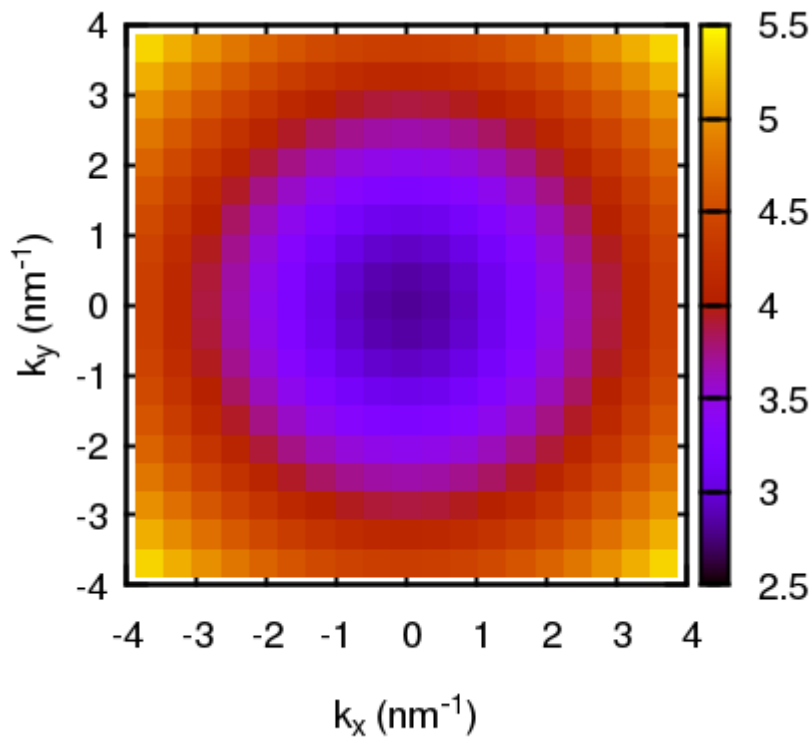


Figure 3: Energy dispersion relation $E(k_x, k_y)$ for the highest hole eigenvalue

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