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

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

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

Input File

Results

Transition Matrix Element

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

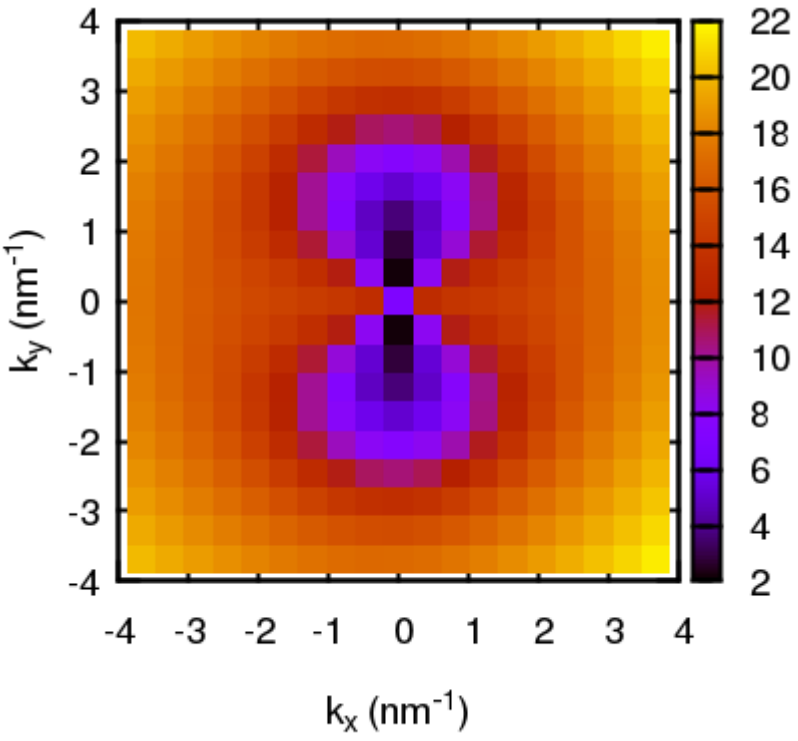

Figure 1: Transition matrix element in ${\bf k}$ space

Eigenvalues

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

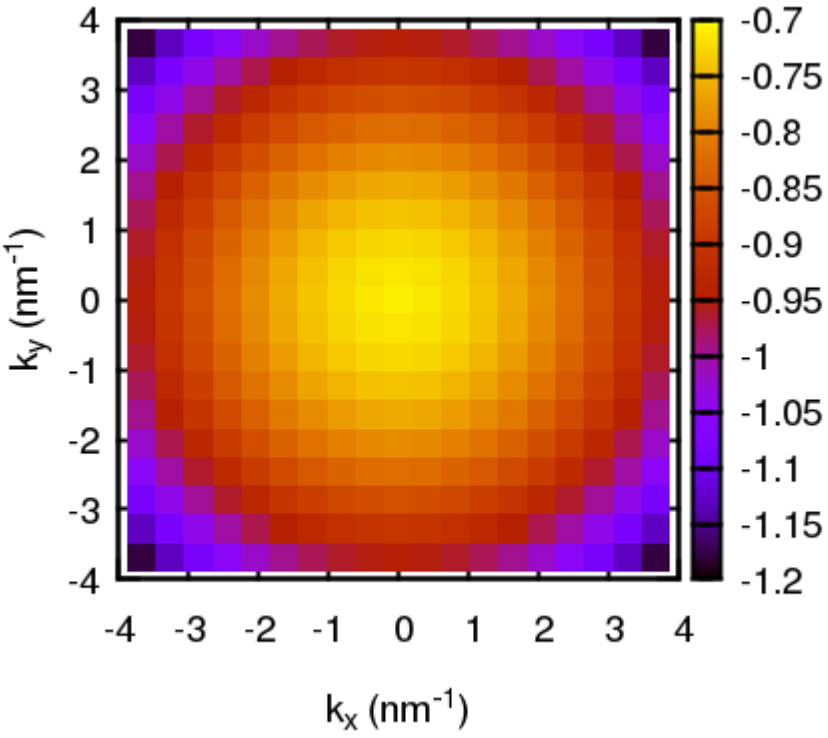

Figure 2: Energy dispersion relation $E(k_x,k_y)$ for the lowest electron eigenvalue

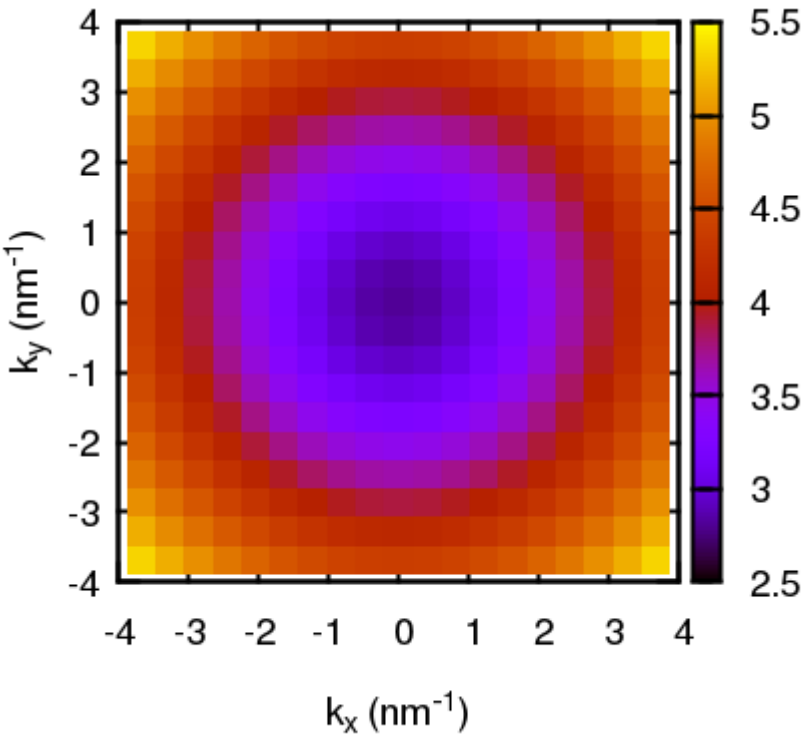

Figure 3: Energy dispersion relation $E(k_x,k_y)$ for the highest hole eigenvalue