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 k vector.

Input File

Results

Transition Matrix Element

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

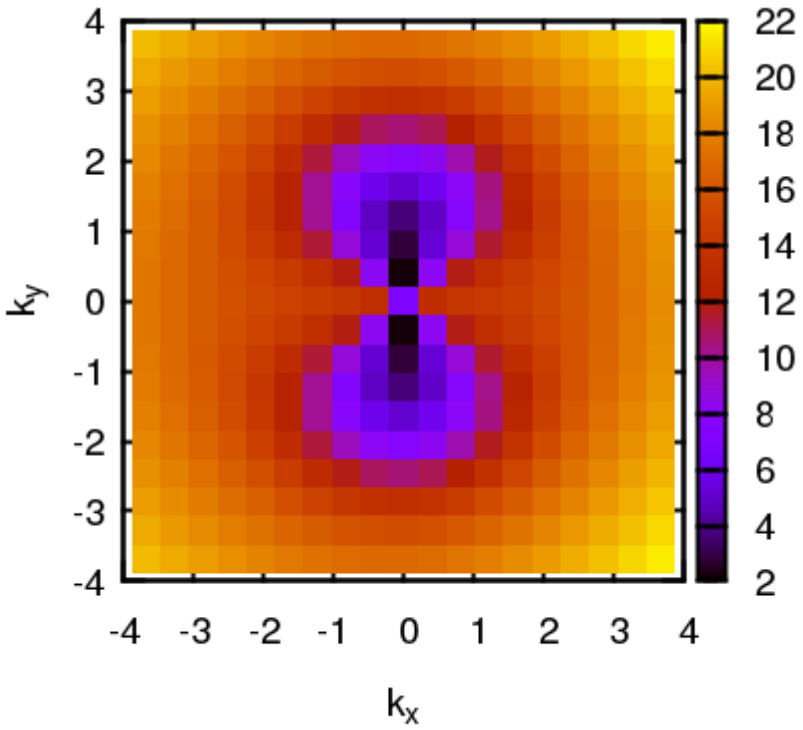

Figure 1: Transition matrix element in the $\vec{k}$ space

Eigenvalues

The first eigenfunction's energy in the kp-space is plotted in figure 2 for electrons, and in figure 3 for holes.

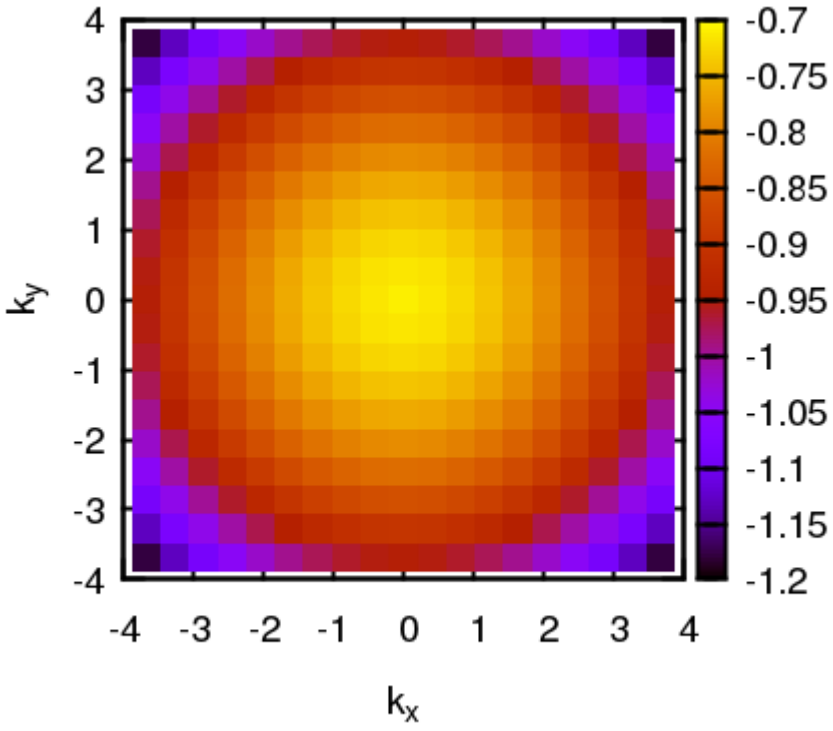

Figure 2: Energy dispersion relation in the $\vec{k}$ space for electrons

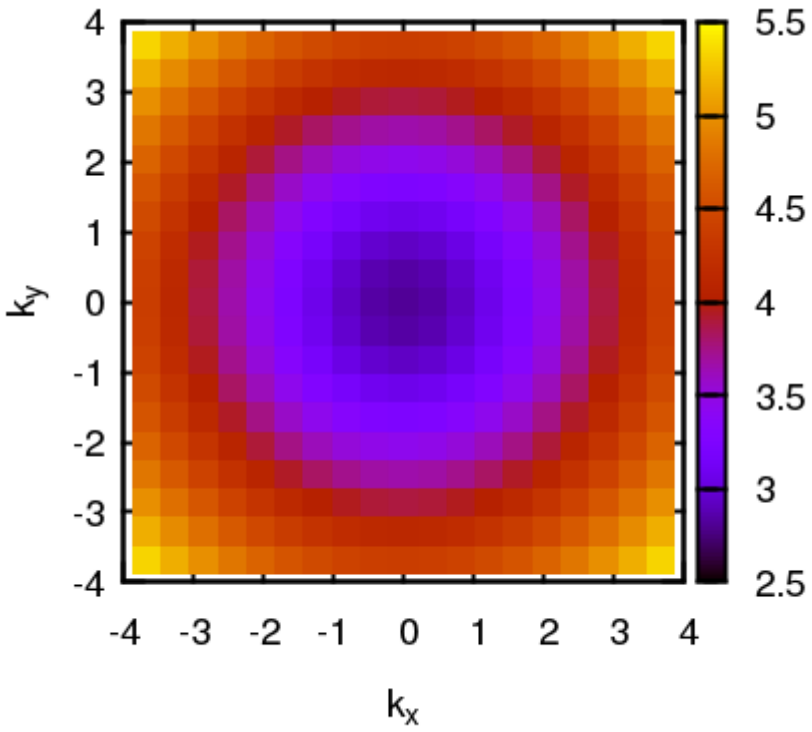

Figure 3: Energy dispersion relation in the $\vec{k}$ space for holes