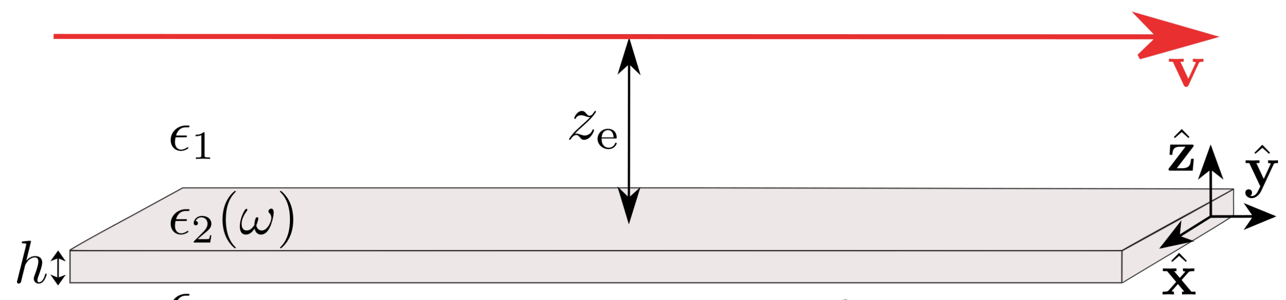
# Integration over the waveguide modes

$$\frac{d\Gamma}{dy}(\mathbf{r},\omega) = \frac{2e^2}{\pi\hbar v^2}\int_0^\infty \frac{dk_x}{k_\parallel^2}\mathrm{Re}\left\{k_{z1}e^{2ik_{z1}z_e(\mathbf{r})}\left[\left(\frac{k_x v}{k_{z1}c}\right)^2 r_{123}^{s}(k_\parallel) - \frac{1}{\epsilon_1}r_{123}^{p}(k_\parallel)\right]\right\},$$ #paper149 Eq. (25)

$$r_{123}^{\nu} = r_{12}^{\nu} + \frac{t_{12}^{\nu}t_{21}^{\nu}r_{23}^{\nu}e^{2ik_{z2}h}}{1-r_{21}^{\nu}r_{23}^{\nu}e^{2ik_{z2}h}},$$




$h = 0.2\ \mu m$

$\epsilon_2(\omega) + i10^{-2}$ Si from Aspnes

Higher Ee:
more modes excited and for bigger ze

$E_e = 100$ keV | $E_e = 200$ keV