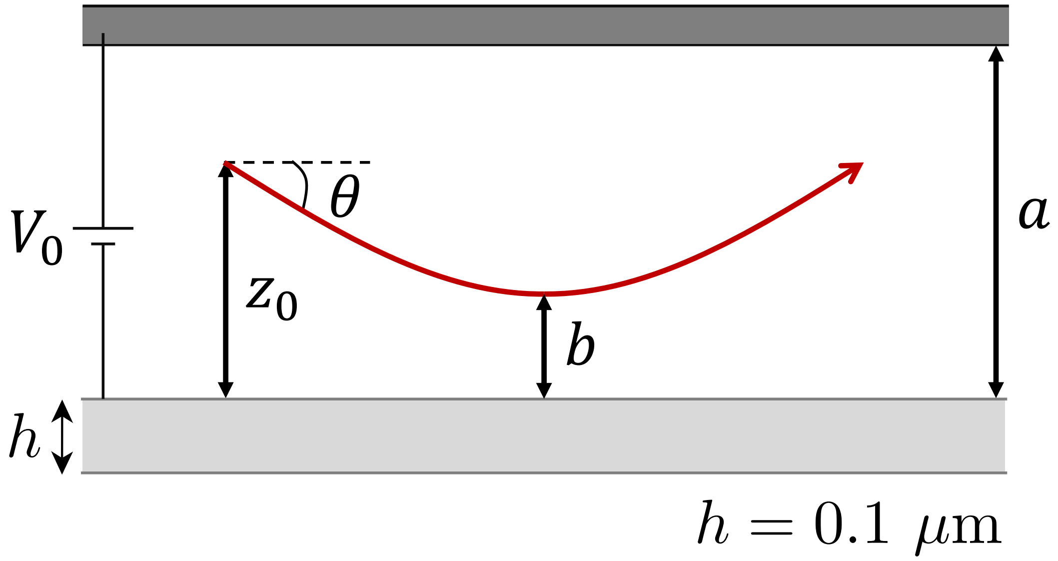
Electron coupling to a waveguide mode

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

$$\Gamma(\omega)=\frac{2e^2}{\pi\hbar v^2}\int_0^\infty \frac{\mathrm{d}k_x}{k_\parallel^2}\mathrm{Re}\left\{\underbrace{\int_{-\infty}^{\infty}\mathrm{d}y\,\mathrm{e}^{2\mathrm{i}k_{z1}z_\mathrm{e}(y)}}_{L^\mathrm{eff}(k_\parallel)}\,k_{z1}\left[\left(\frac{k_x v}{k_{z1}c}\right)^2 r_{123}^\mathrm{s}(k_\parallel)-\frac{1}{\epsilon_1}r_{123}^\mathrm{p}(k_\parallel)\right]\right\},$$

$$L^\mathrm{eff}(k_\parallel)\approx L_0\mathrm{e}^{2\mathrm{i}k_{z1}b}\sqrt{\frac{\beta q_0}{k_\parallel}},$$



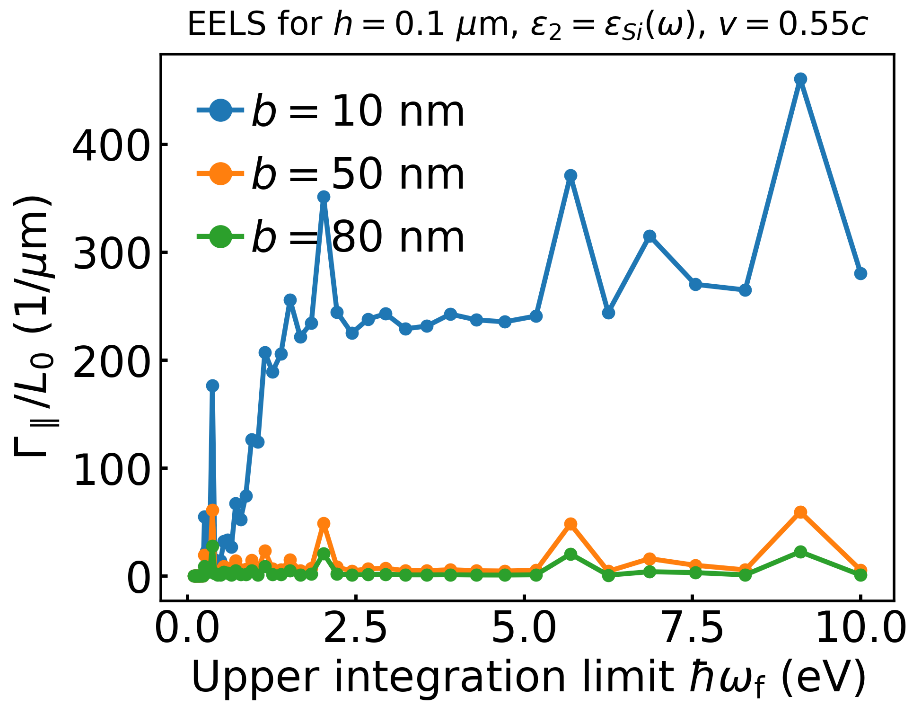
$$L_0=\sqrt{\hbar\pi ac/eV_0},$$

$$q_0=m_\mathrm{e}v\gamma/\hbar,\ \beta=v/c.$$

$$\frac{\Gamma(\omega_\mathrm{f})}{L_0}=\int_0^{\omega_\mathrm{f}}\mathrm{d}\omega\frac{\Gamma(\omega)}{L_0}$$

double integral
preliminar results

$E_\mathrm{e}=100$ keV



$E_\mathrm{e}=200$ keV