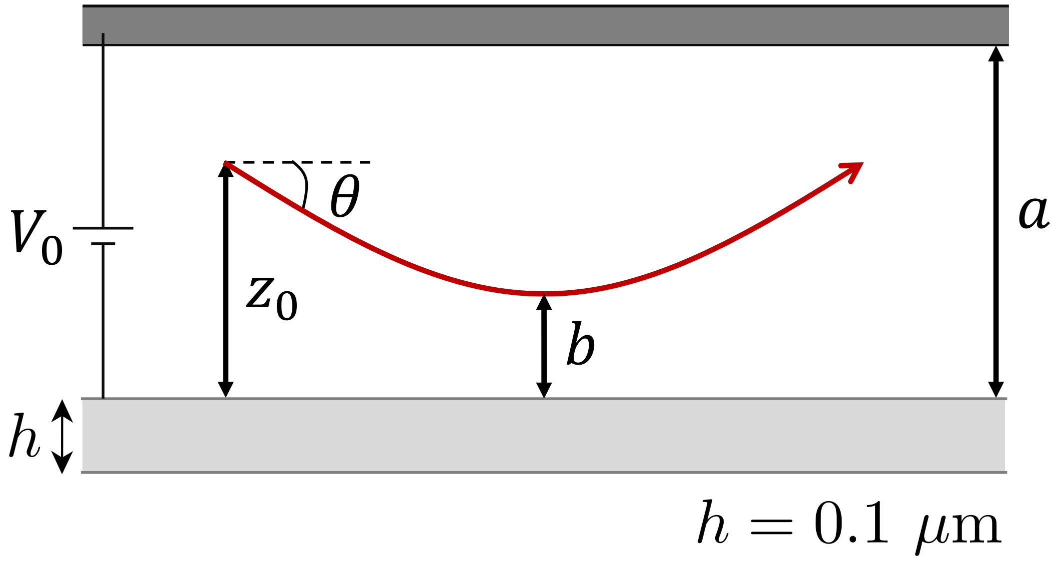
Electron coupling to a waveguide mode

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

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

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

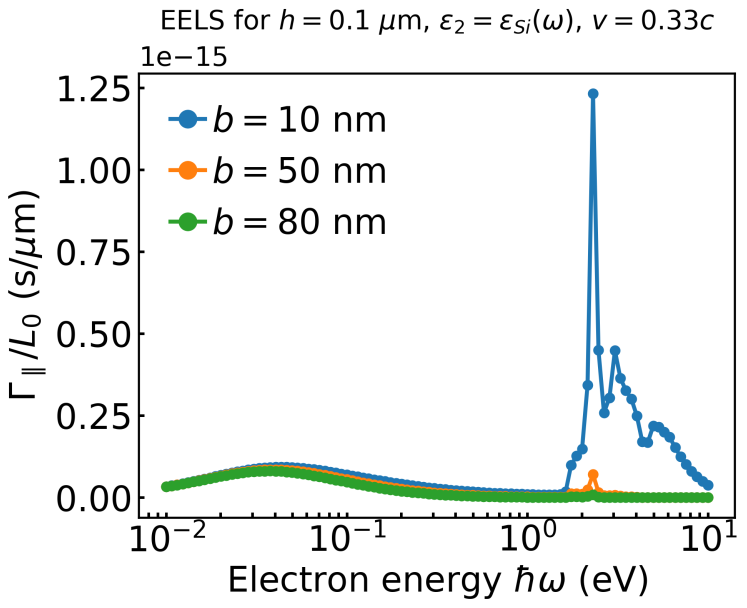


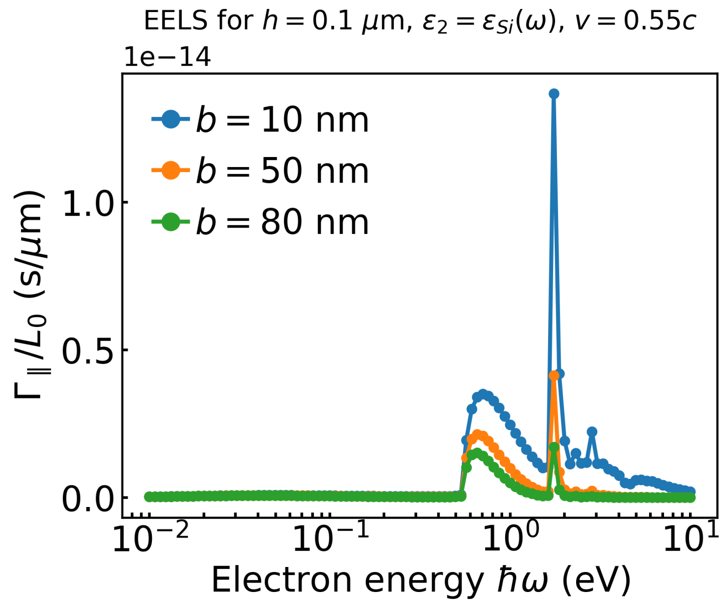
$$L_0 = \sqrt{\hbar\pi a c/eV_0},$$

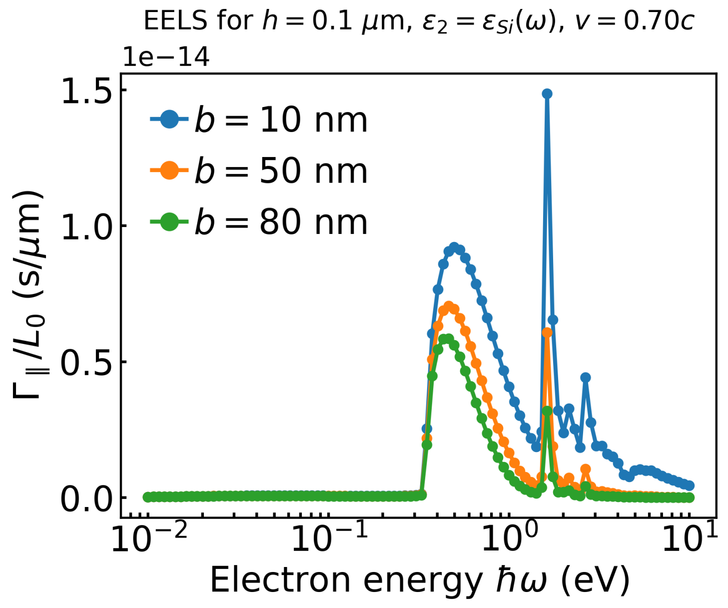
$$q_0 = m_e v\gamma/\hbar,\ \beta = v/c.$$

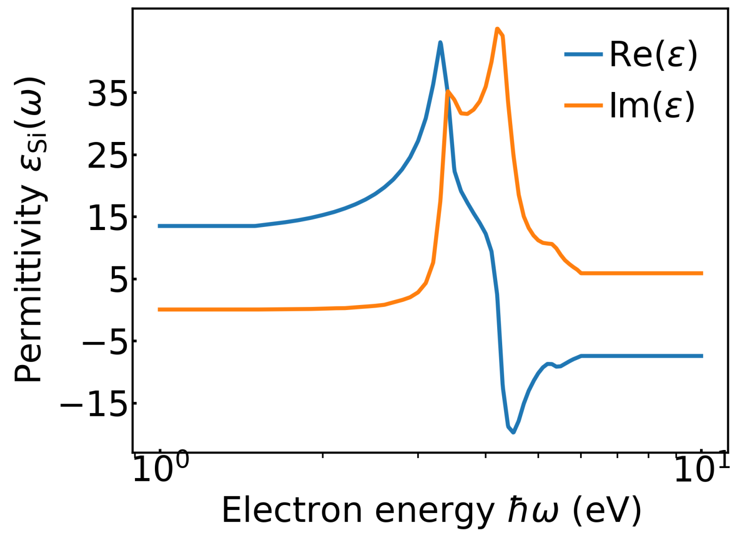
$E_e = 30$ keV | $E_e = 100$ keV | $E_e = 200$ keV

Si









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