

Electron coupling to a waveguide mode

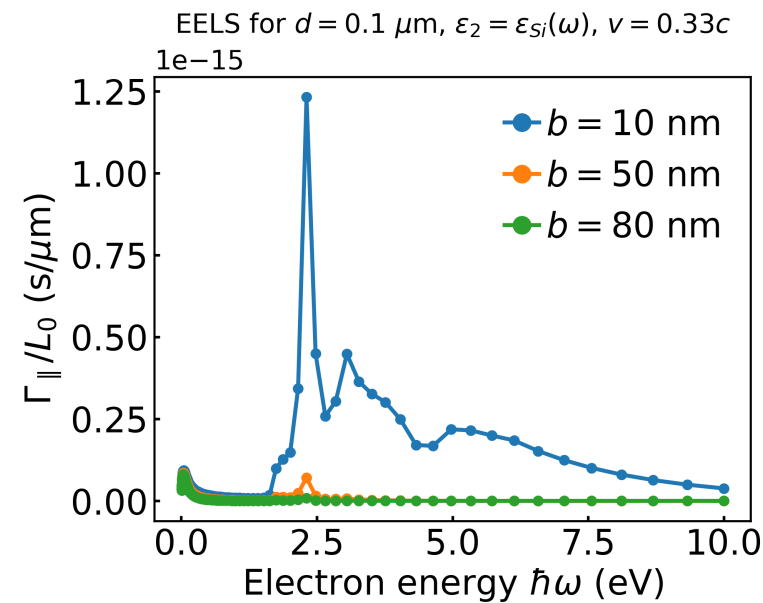
$$\frac{d\Gamma}{dy}(\mathbf{r}, \omega) = \frac{2e^2}{\pi\hbar v^2} \int_0^\infty \frac{dk_x}{k_{\parallel}^2} \text{Re} \left\{ k_{z1} e^{2ik_{z1}z_e(\mathbf{r})} \left[\left(\frac{k_x v}{k_{z1} c} \right)^2 r_{123}^s(k_{\parallel}) - \frac{1}{\epsilon_1} r_{123}^p(k_{\parallel}) \right] \right\},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

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

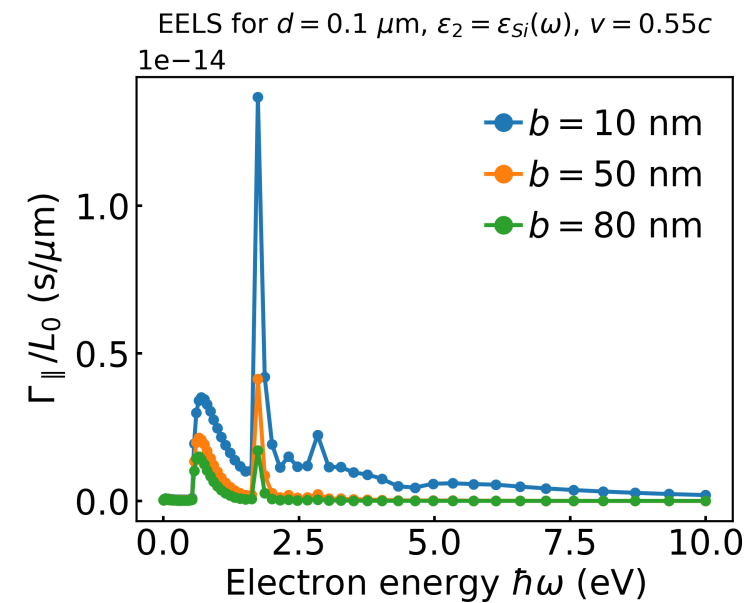
$$L^{\text{eff}}(k_{\parallel}) \approx L_0 e^{-2k_{\parallel} b} \sqrt{\frac{\beta q_0}{k_{\parallel}}},$$

$$E_e = 30 \text{ keV}$$

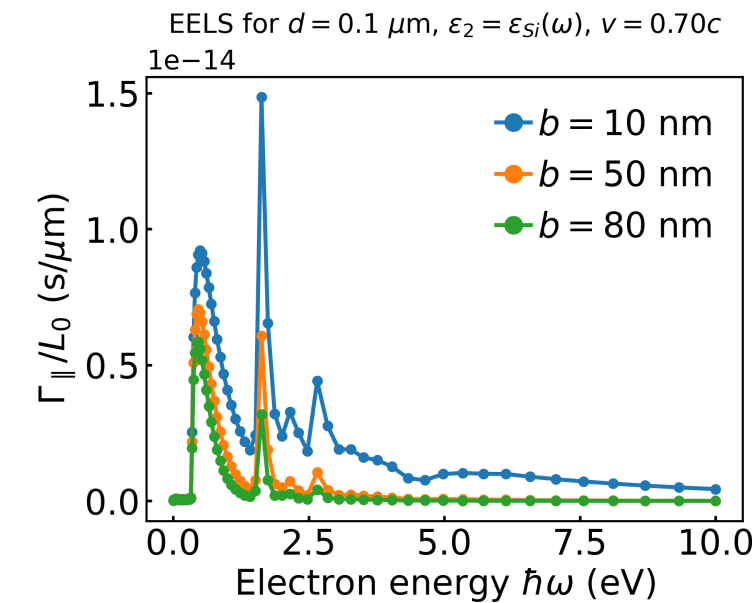
SI



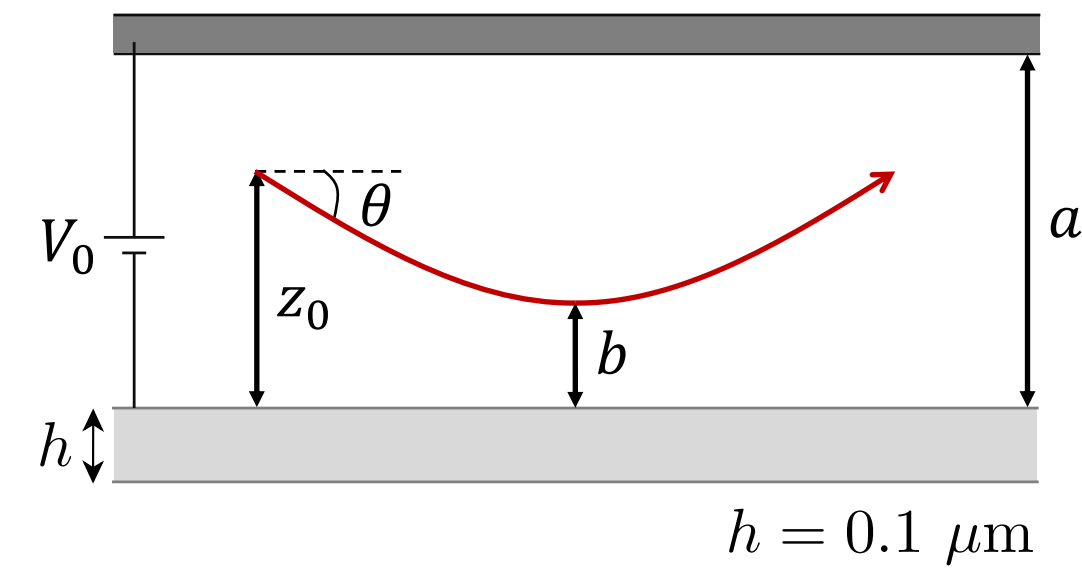
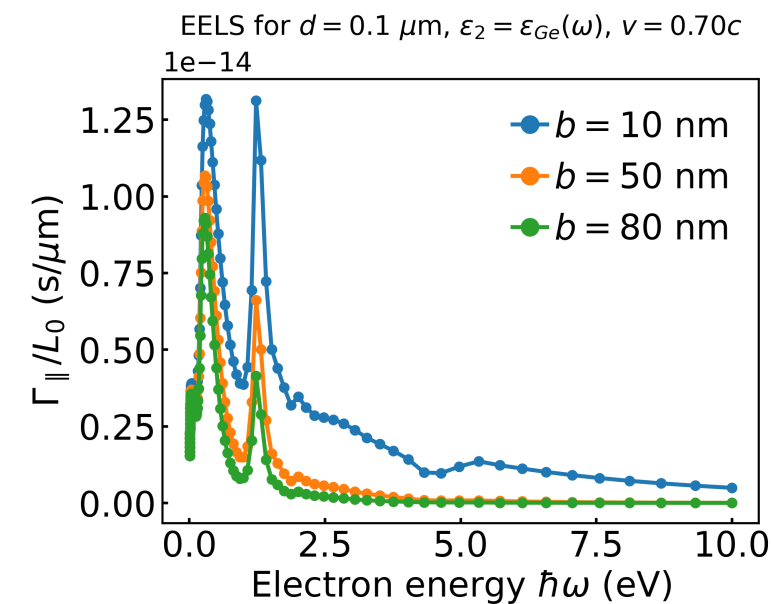
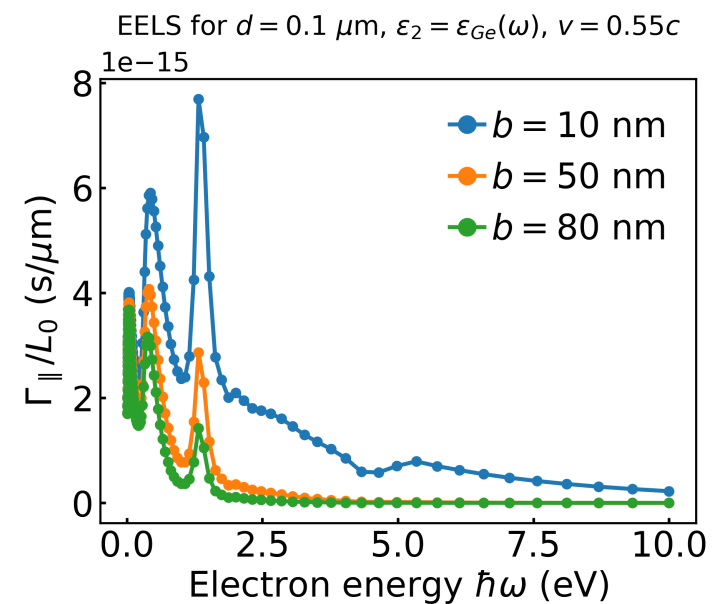
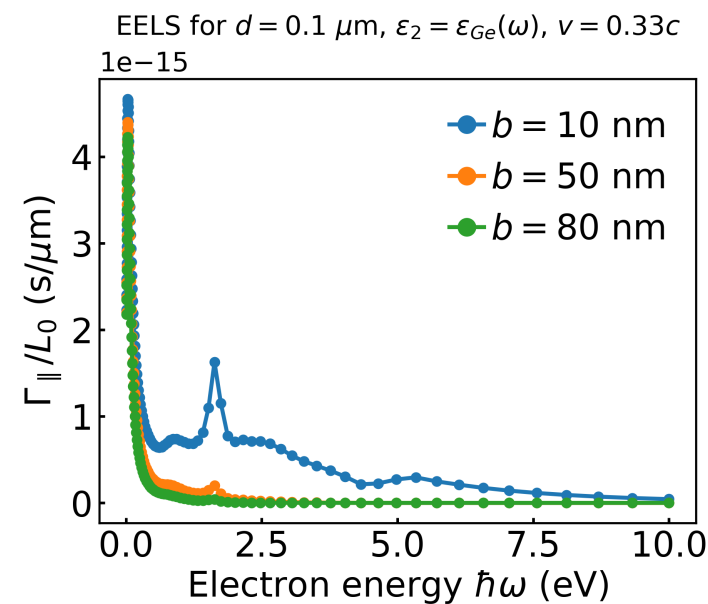
$$E_e = 100 \text{ keV}$$



$$E_e = 200 \text{ keV}$$



Ge



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

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

