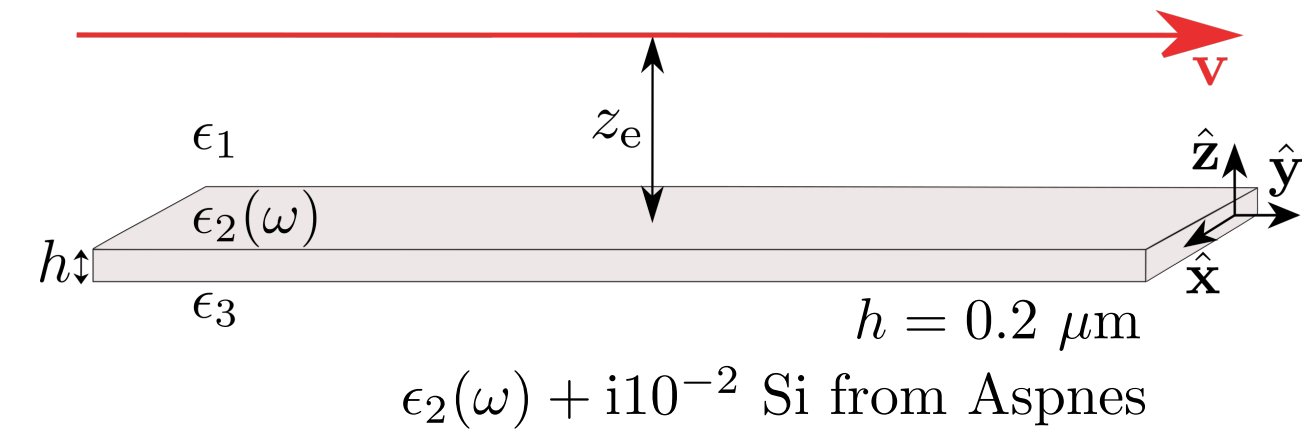


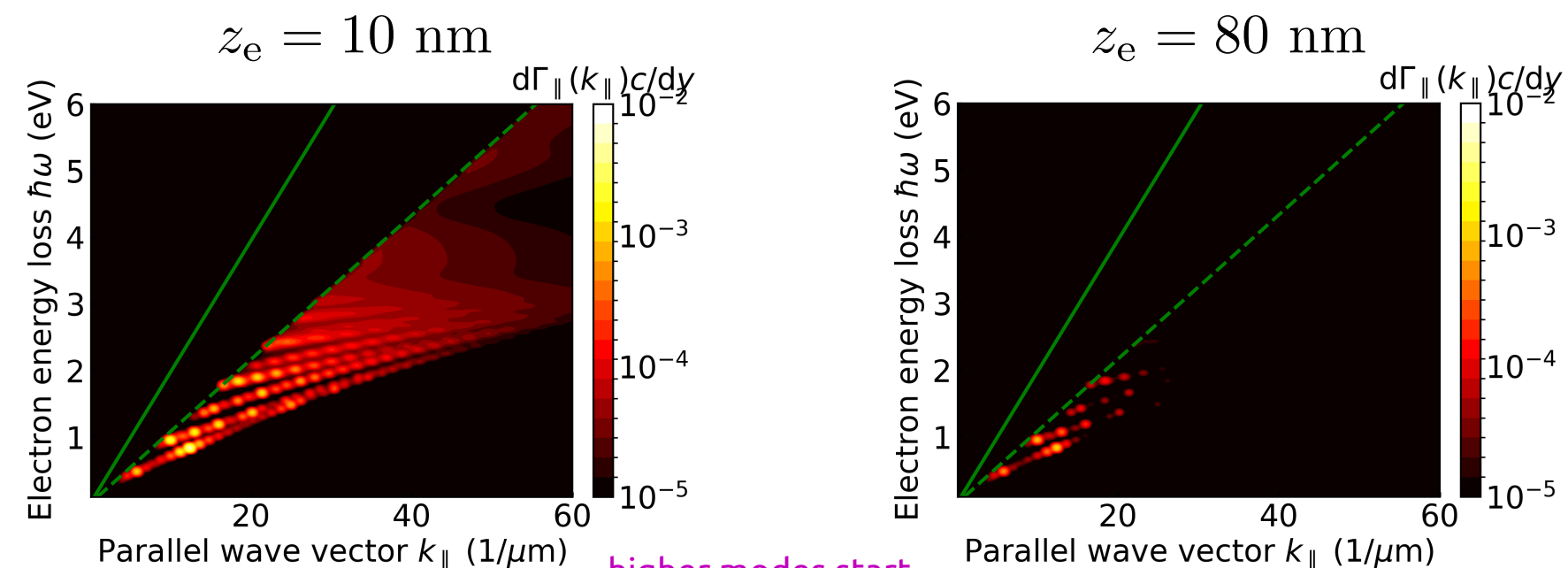
Waveguide modes

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

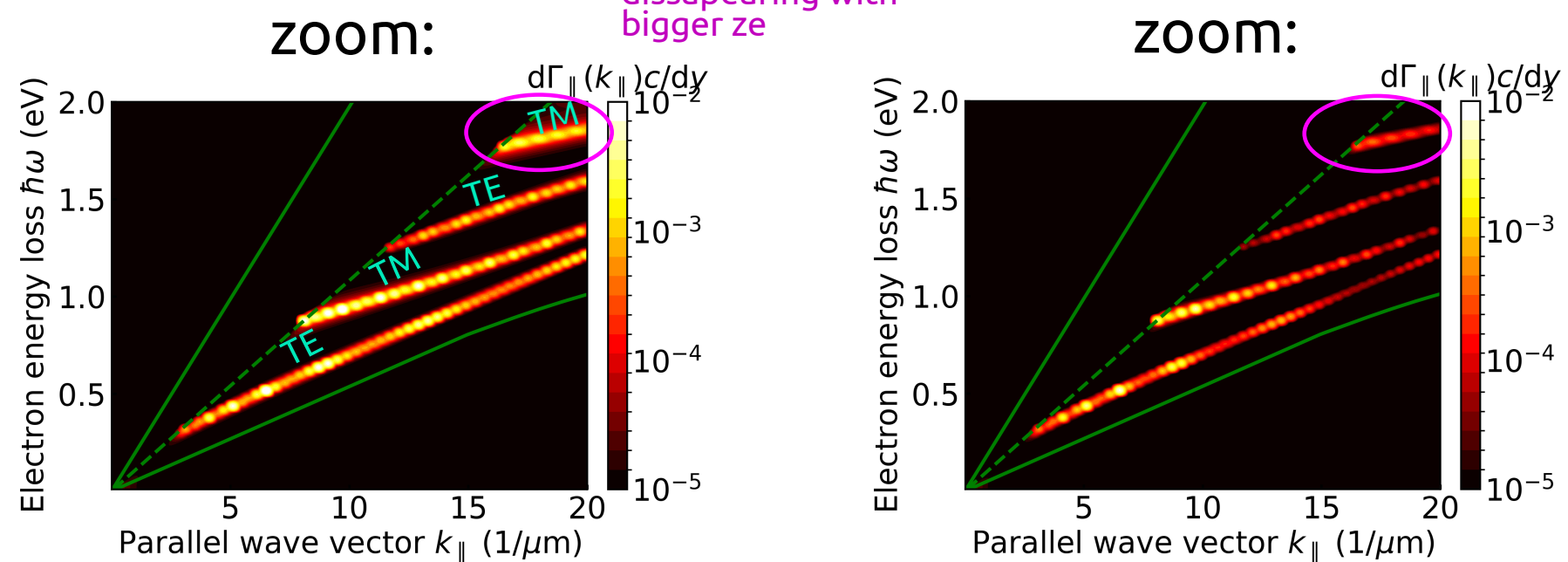
$$r_{123}^{\nu} = r_{12}^{\nu} + \frac{t_{12}^{\nu} t_{21}^{\nu} r_{23}^{\nu} e^{2ik_{z2}h}}{1 - r_{21}^{\nu} r_{23}^{\nu} e^{2ik_{z2}h}},$$



$E_e = 100 \text{ keV}$



higher modes start disappearing with bigger z_e



$E_e = 200 \text{ keV}$

