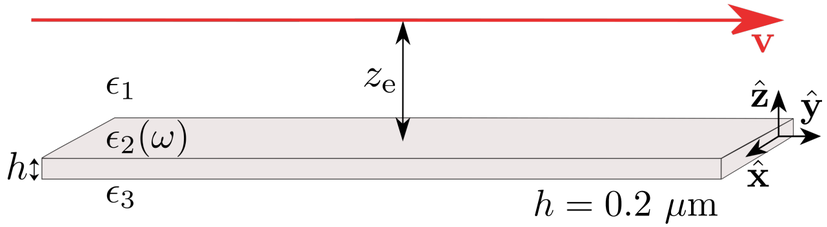
# Electron coupling to a waveguide mode

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

$$r^\nu_{123} = r^\nu_{12} + \frac{t^\nu_{12}t^\nu_{21}r^\nu_{23}\mathrm{e}^{2\mathrm{i}k_{z2}h}}{1 - r^\nu_{21}r^\nu_{23}\mathrm{e}^{2\mathrm{i}k_{z2}h}},$$

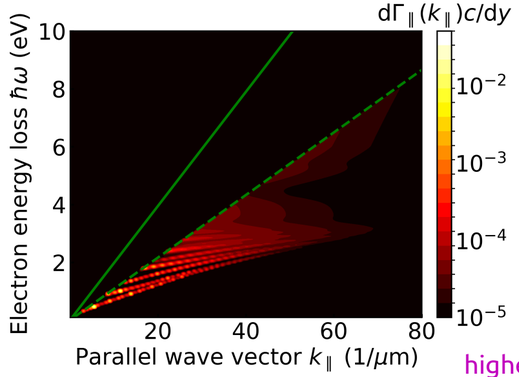
Waveguide modes



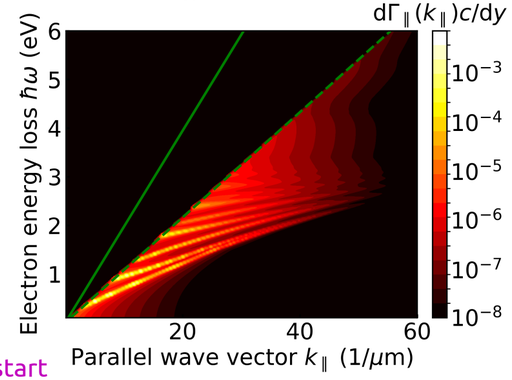

## $\epsilon_2(\omega)$ Si from Aspnes

### $E_\mathrm{e} = 100$ keV

$z_\mathrm{e} = 10$ nm

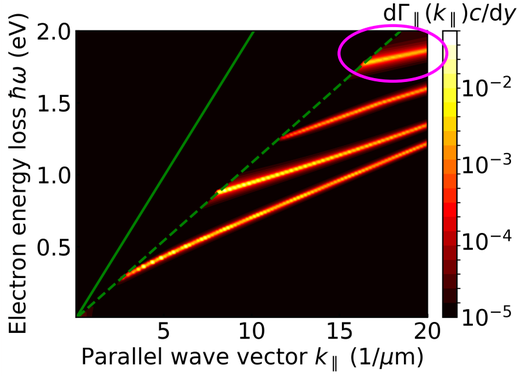



$z_\mathrm{e} = 80$ nm

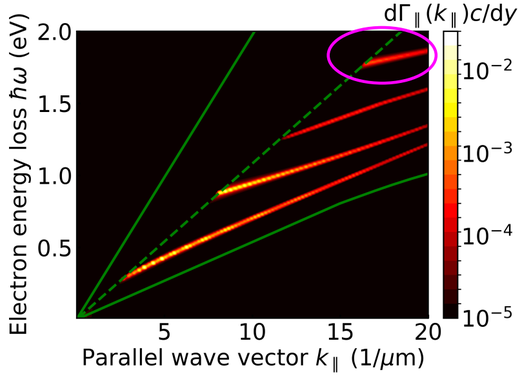



higher modes start dissapearing with bigger ze

zoom:

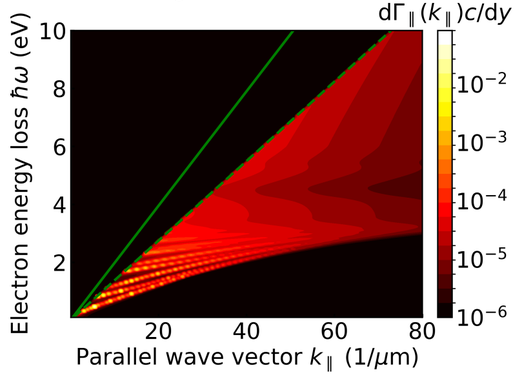



zoom and saturation:

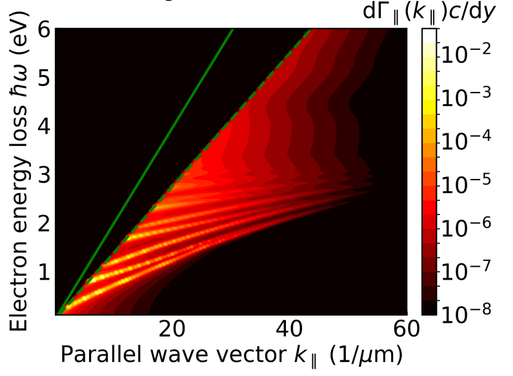



### $E_\mathrm{e} = 200$ keV

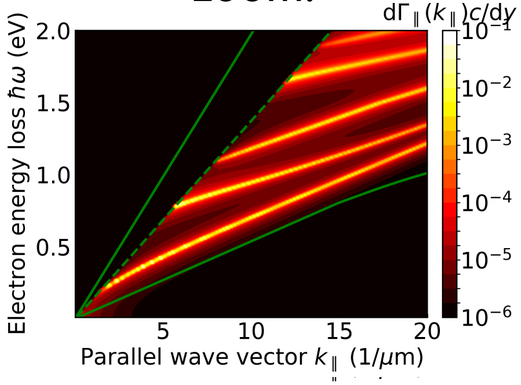
$z_\mathrm{e} = 10$ nm




$z_\mathrm{e} = 80$ nm




zoom:




zoom and saturation: