

# All-optical Modulation of Transmission in Silicon Photonic Crystal Waveguides

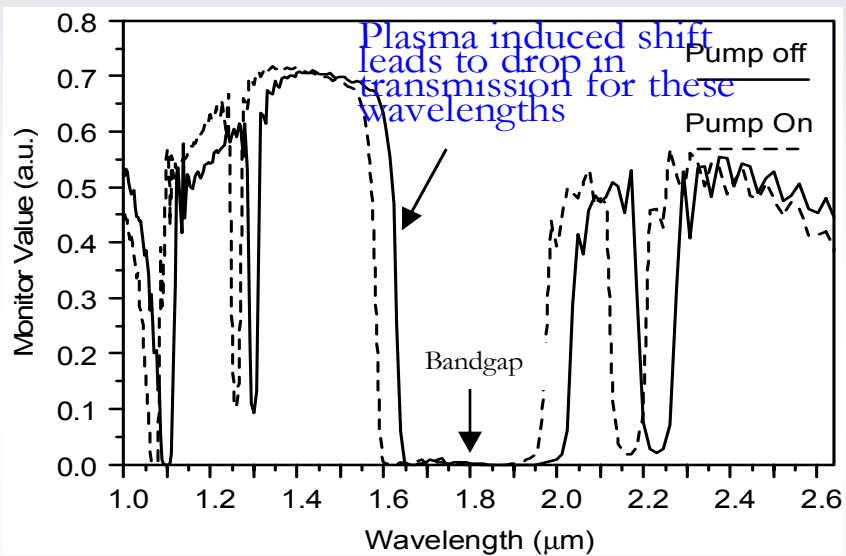
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## The free carrier dispersion effect

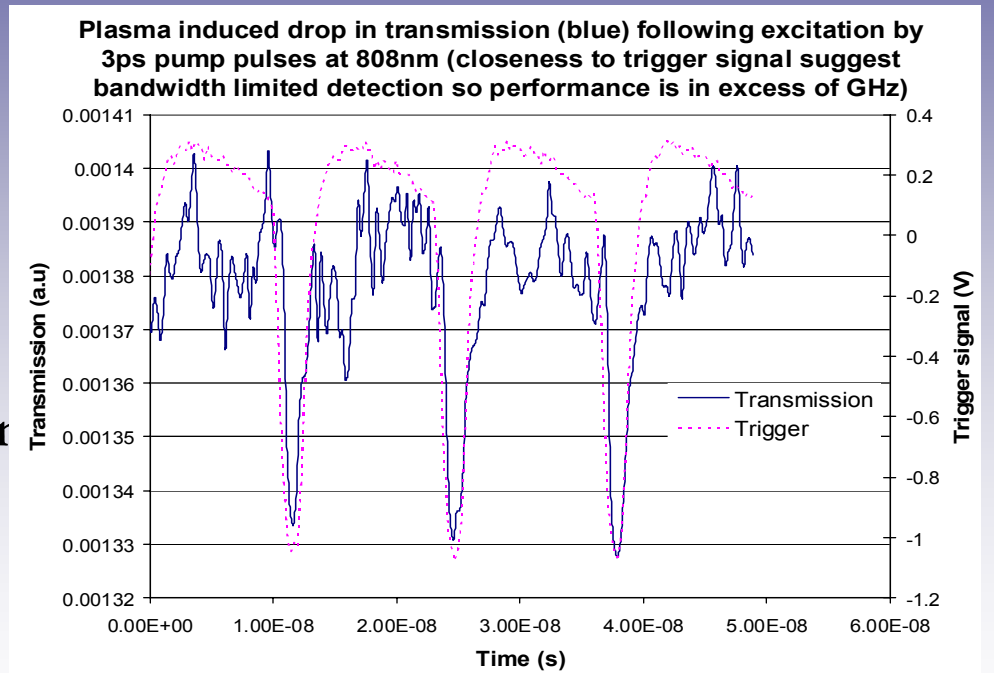
$$\Delta n_r = -\frac{e^2 \lambda^2}{8\pi^2 c^2 \epsilon_0 n_0} \left( \frac{\Delta N_e}{m_e} + \frac{\Delta N_h}{m_h} \right)$$

$$\Delta n_j = \frac{e^3 \lambda^3}{16\pi^3 c^3 \epsilon_0 n_0} \left( \frac{\Delta N_e}{m_e^2 \mu_e} + \frac{\Delta N_h}{m_h^2 \mu_h} \right)$$

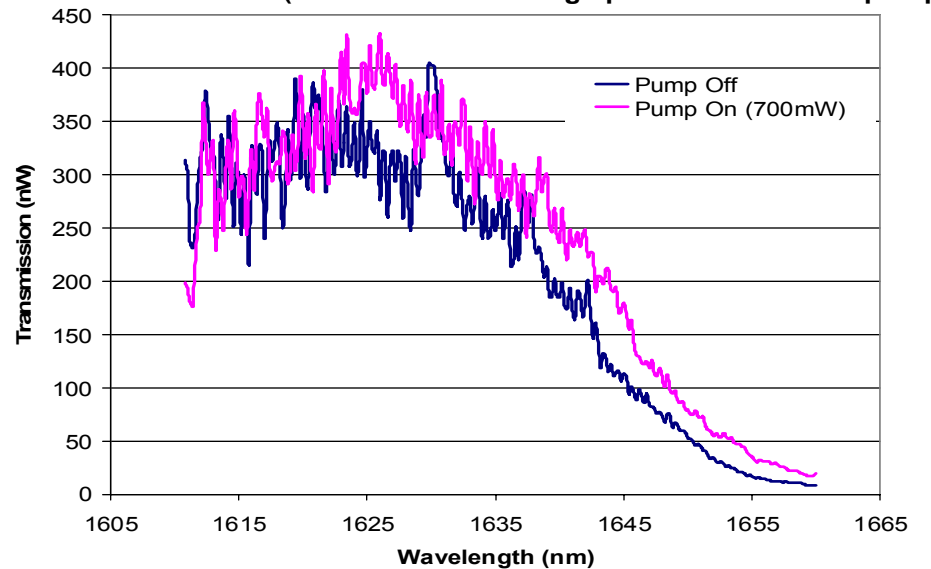
$\Delta n_{r,j}$  = change in real/imag. index  
 $\Delta N$  = change in charge concentration



Shift in transmission spectrum (dotted) of Si photonic crystal waveguide due to optically induced charges ( $\Delta n_r = -0.1$ )



## Slow (adverse) thermo-optic red shift resulting from carrier cooling and recombination (dominant effect at high power levels of the pump)



## Top View of Characterization Set-up

