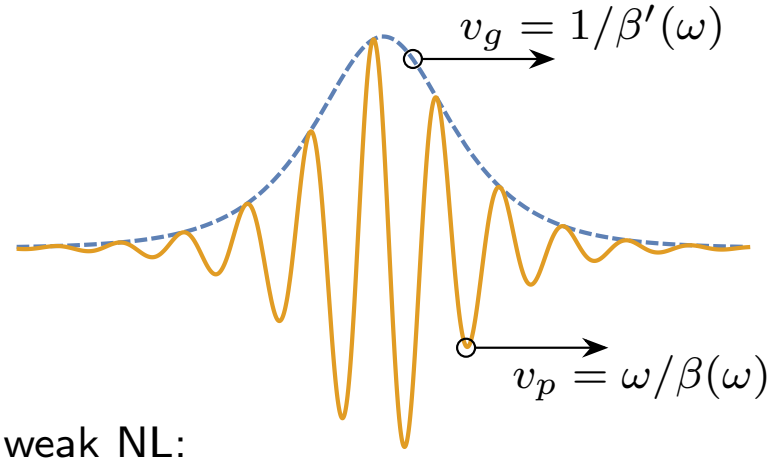
Waves packets that do not move at the group velocity

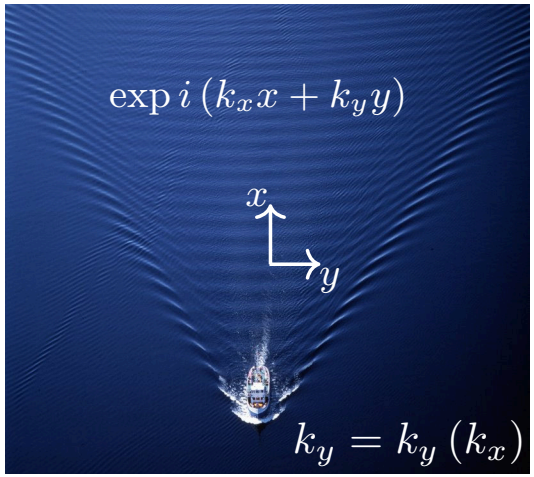
$\psi(x,t)\exp i\left[\beta(\omega)x-\omega t\right]+$ c.c.



weak NL:

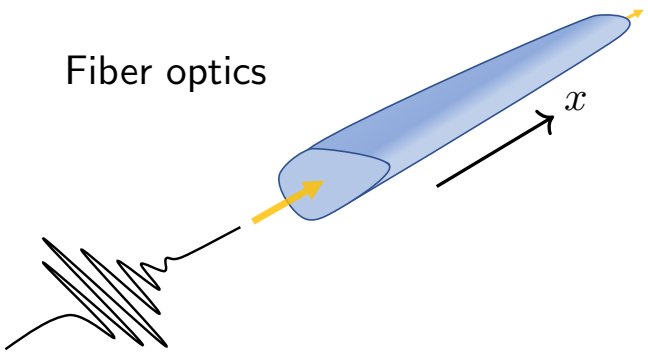
$$i\left(\psi_x+\beta'(\omega)\psi_t\right)+\tfrac{1}{2}\beta''(\omega)\psi_{xx}+\gamma|\psi|^2\psi=0$$

Ship wake

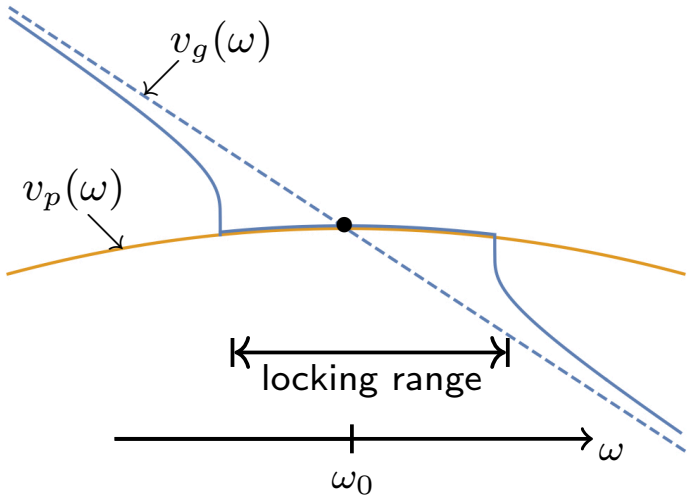


credit: www.jasonhawkes.com

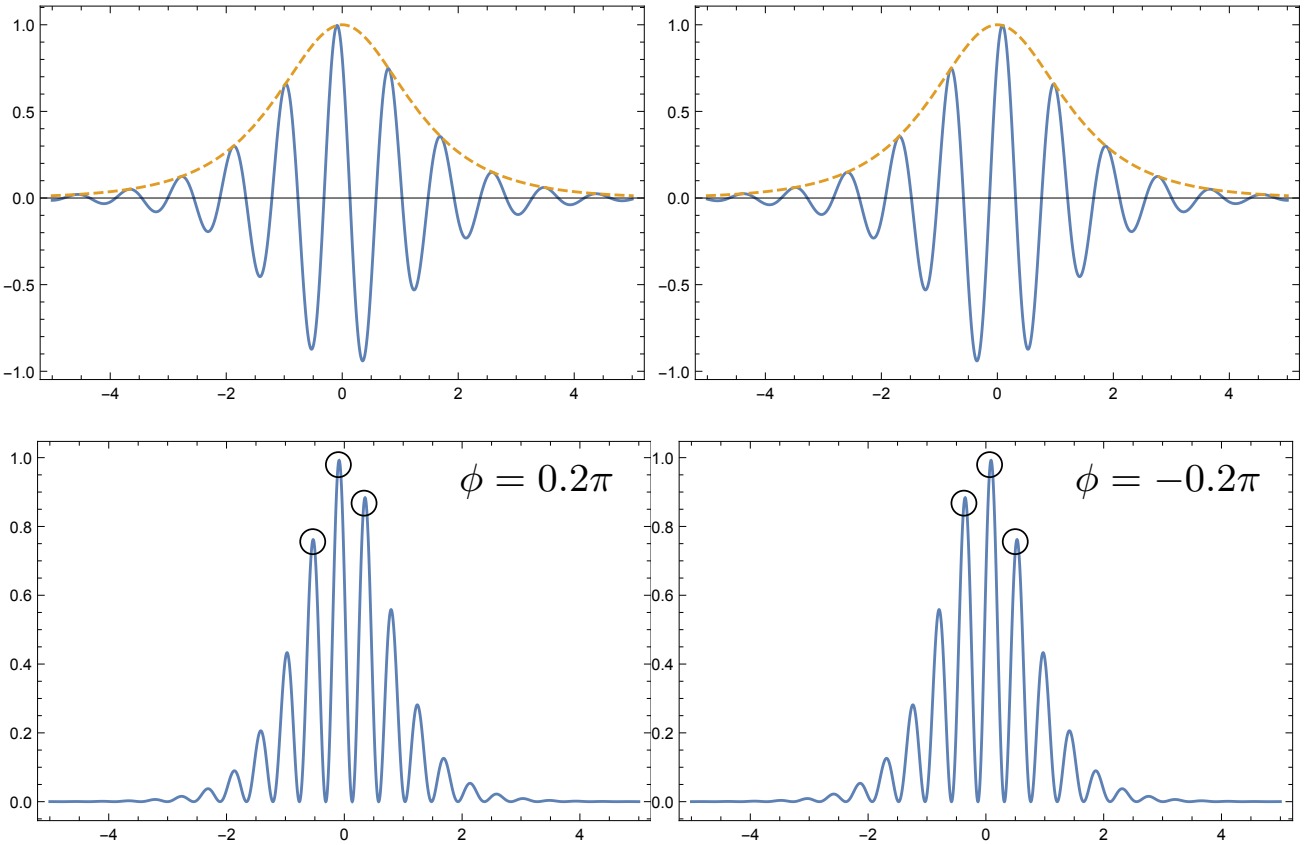
Fiber optics



What we will show is this:



Consider a wave packet of the form $E = \mathrm{sech}(x)\cos(kx + \phi)$, $(k = 7)$



If $v_g \approx v_p$ then $\phi \approx$ const. and the intensity imbalance can persist sufficiently long to completely alter soliton dynamics.