

The above equation^{lity} must hold for (13)
ANY x and t if $y(x,t)$ is to be a solution.
This is only possible if the coefficient
 $\left[-\frac{\omega^2}{c^2} + k^2 + a^2 k^4\right]$ VANISHES.

$$\Rightarrow -\frac{\omega^2}{c^2} + k^2 + a^2 k^4 = 0$$

$$\Rightarrow \boxed{\omega = ck\sqrt{1 + a^2 k^2}},$$

which is the desired DISPERSION RELATION
 $\omega = f(k)$.

We see that, unlike the familiar
 $\omega = ck$, this is a NON-LINEAR dispersion
relation, which has significant physical
consequences (e.g., for propagation of pulses)
which we will touch upon later in the
class.
