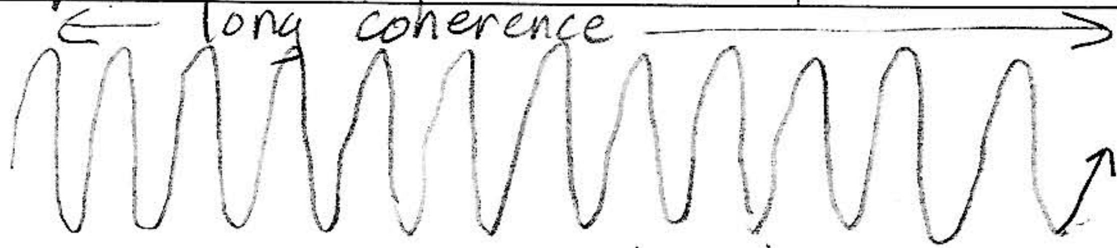
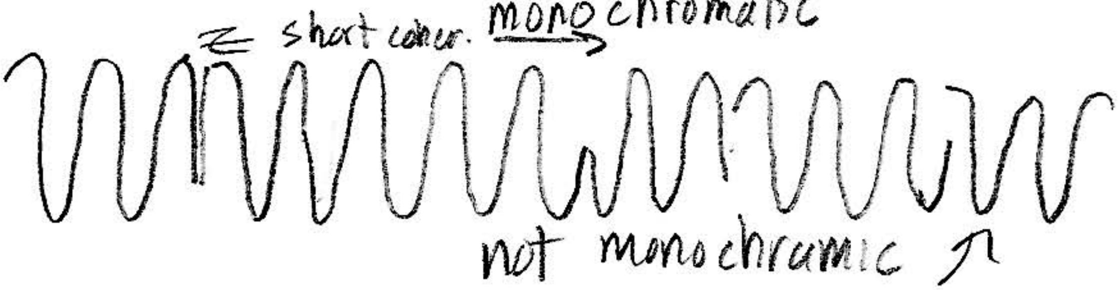
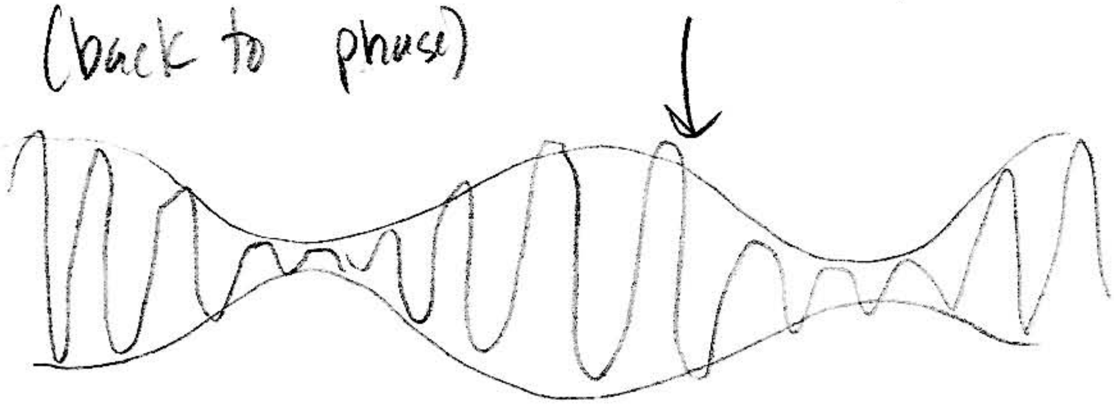
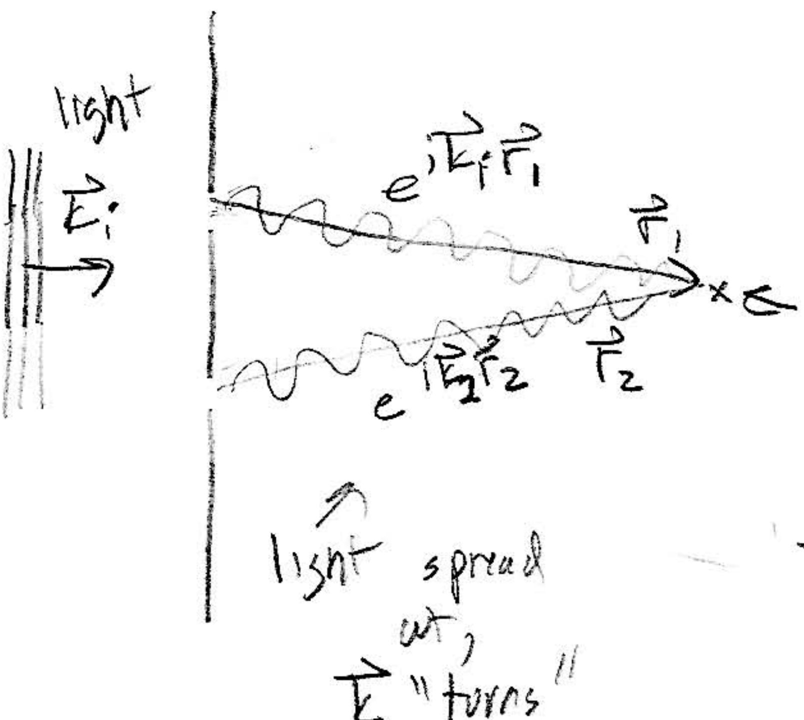




(back to phase)



Interference:



$|\vec{r}_1| = |\vec{r}_2|$

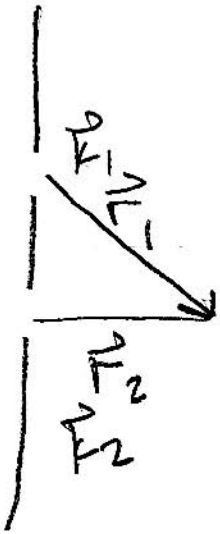
$\vec{k}\cdot\vec{r}_1 = \vec{k}\cdot\vec{r}_2$

"in phase"

$e^{iz} + e^{iz} = 2e^{iz}$

$1 \quad 1 = 2$

True all along mid plane.



$|\vec{r}_1| \neq |\vec{r}_2|$

$$e^{i\vec{k}_1\cdot\vec{r}_1} + e^{i\vec{k}_2\cdot\vec{r}_2} \neq 2\cdot e^{i\vec{k}_1\cdot\vec{r}_1}$$

destructive interference.

can even totally cancel!

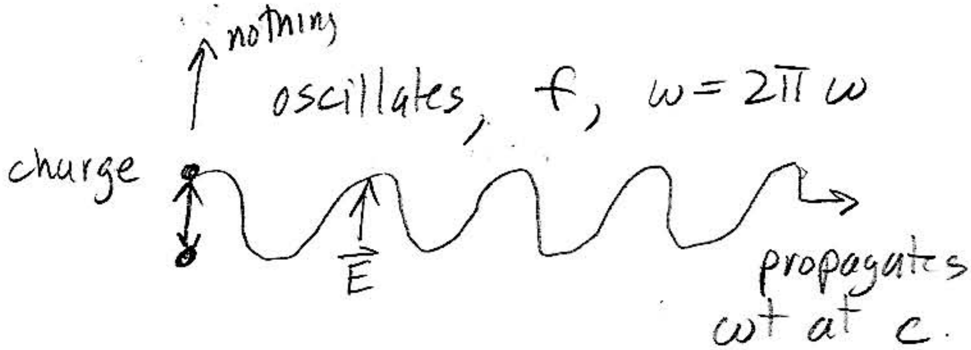
<u>Key point</u> $|\vec{r}_2 - \vec{r}_1| <$ coherence length for cancellation

Long Coherence Length = laser light

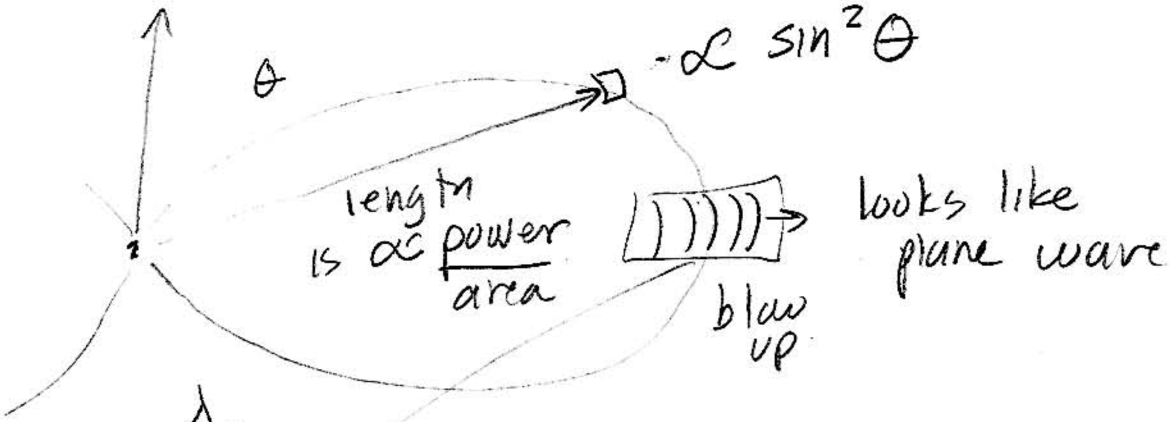
Short " " = sunlight.

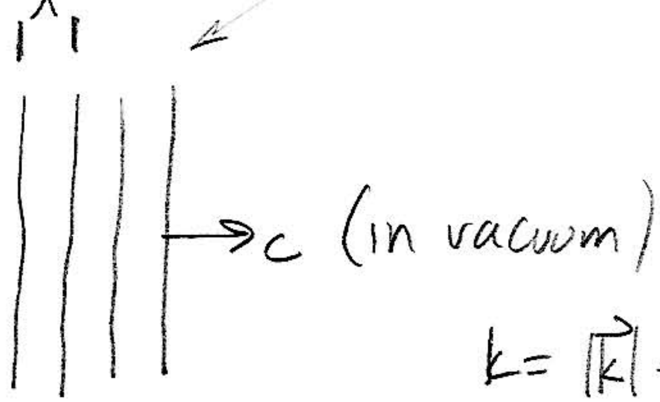
Light Propagation

Origin



Bigger scale:





$$e^{i(\omega t - \vec{k}\cdot\vec{r})}$$

$\omega \to$ given (by charge)

$$k = |\vec{k}| = \frac{2\pi}{\lambda}$$

<u>speed</u> $\omega t - |\vec{k}||\vec{r}| = 0$

(phase velocity) speed $= \frac{|\vec{r}|}{t} = \frac{\omega}{|\vec{k}|} = \frac{2\pi\nu}{\frac{2\pi}{\lambda}}$

vacuum $c = \lambda\nu$

When light goes into medium (water, glass, etc) light slows down... molecules radiate, absorb light; that takes time...

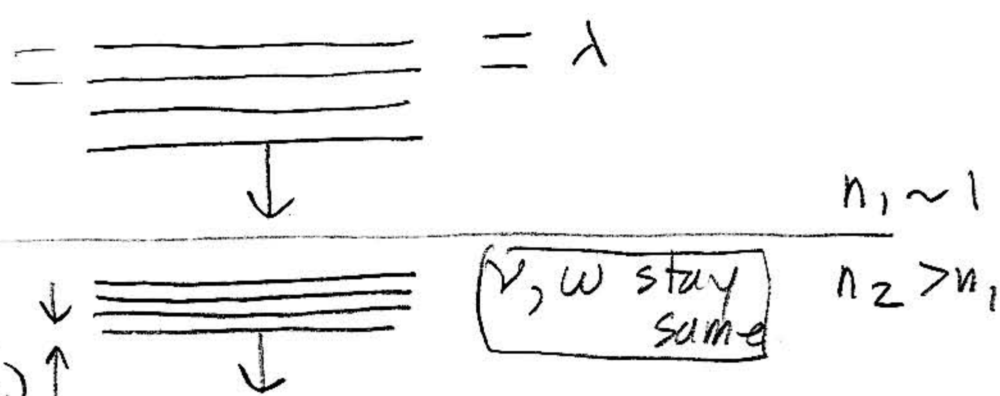
In medium: $v \neq c$, $= \frac{c}{n} = \lambda \nu$

$n > 1$, light slows down.

n:

1.0002926	air	visible
1.333	water	visible
2.419	diamond	visible
10–100	infrared	

phase: $e^{i\vec{k}\cdot\vec{x}}$

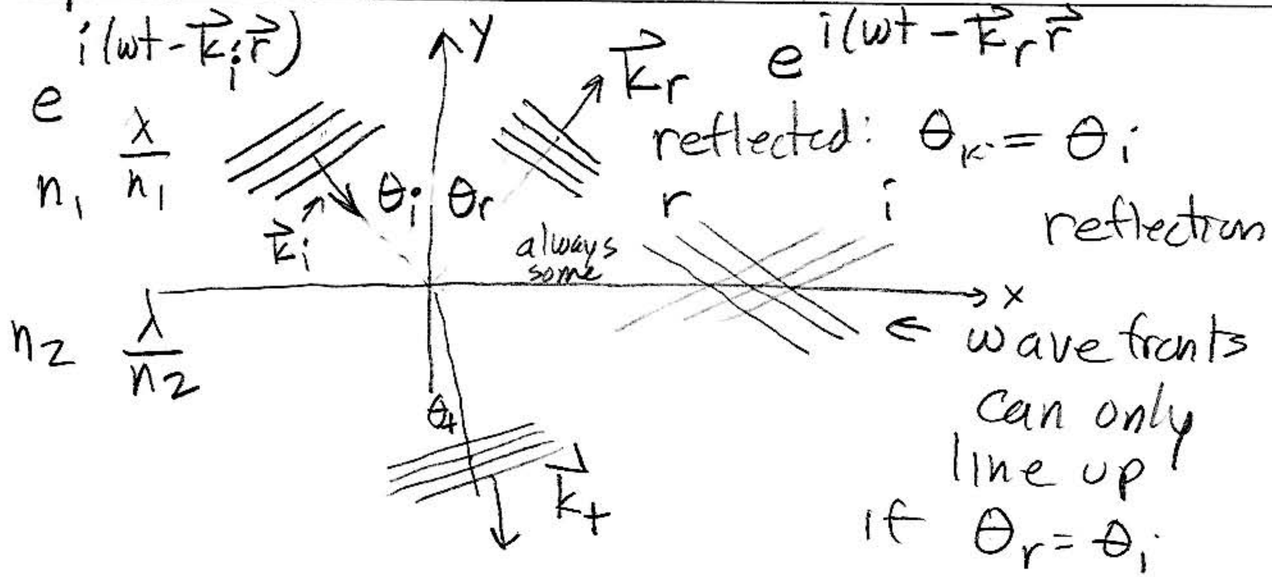


$\lambda_2 = \frac{\lambda_1}{(n_2/n_1)}$

$n_1 = 1$, $\lambda_2 = \frac{\lambda_1}{n}$

consequences:

1. radiation reflects at boundary.
2. Refraction.



$$\vec{k}_i = \frac{n_1 2\pi}{\lambda}(\sin\theta_i, -\cos\theta_i)$$

along $y=0$ surface,

$$k_{ix}\, x = k_{rx}\, x$$

$$\frac{n_1 2\pi}{\lambda}\sin\theta_i\, x = \frac{n_1 2\pi}{\lambda}\sin\theta_r\, x$$

$$\sin\theta_i = \sin\theta_r$$

$$k_{ix}\, x = k_{tx}\, x$$

$$n_1\frac{2\pi}{\lambda}\sin\theta_i = \frac{n_2 \cdot 2\pi}{\lambda}\sin\theta_t$$

$$n_1 \sin\theta_i = n_2 \sin\theta_t$$

when $n_2 > n_1$, $\sin\theta_t < \sin\theta_i$