

# Light

## Speed of Light

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$
$$v = \frac{c}{\sqrt{\mu_r \epsilon_r}}$$

## Intensity EM-Wave

$$I = \frac{1}{2} \sqrt{\frac{\epsilon_0 \epsilon_r}{\mu_0 \mu_r}} E_0^2, \quad B_z = \frac{E_y}{v}$$

## Intensity when two waves are added

$$I_{tot} = I_1 + I_2 + 2\sqrt{I_1 I_2} \langle \cos \delta \rangle$$

where  $\delta$  is the relative phase between the waves.

## Refractive Index

$$n \equiv \frac{c}{v} = \sqrt{\mu_r \epsilon_r}$$

## Snell's Law

$$\frac{\sin \alpha_1}{\sin \alpha_2} = \frac{\lambda_1}{\lambda_2} = \frac{v_1}{v_2} = \frac{n_2}{n_1}$$

## Boundary Angle for Total Reflection

$$\alpha_g = \arcsin\left(\frac{n_2}{n_1}\right)$$

## Prism

$$\sin\left(\frac{A + \delta}{2}\right) = n \cdot \sin\left(\frac{A}{2}\right)$$

Where  $A$  is the prisms top angle and  $\delta$  the reflection angle.

## Fiber Optics, Numerical Aperture

$$N.A. \equiv n_0 \sin \theta_m$$
$$N.A. = \sqrt{n_1^2 - n_2^2}$$