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Welcome!

# Physics 194 - Lecture 19

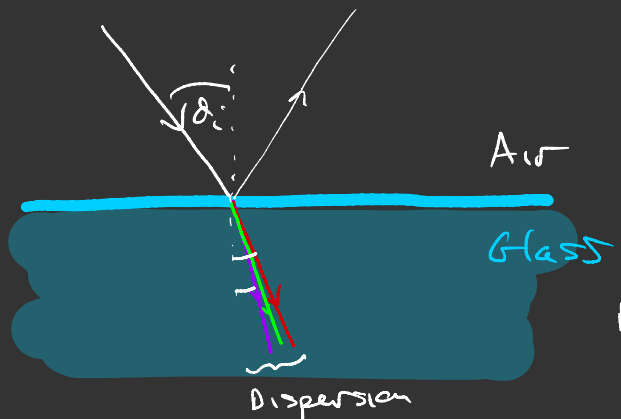
Have a question during class? Please ask it right away, even if it means interrupting in the middle of a thought. I want you to!

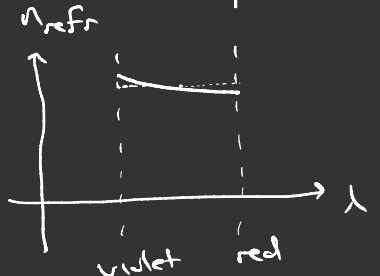
## Agenda

- Speed of light and dispersion
- Mathematical model for mirrors
- Lenses

Class starts @ 2:15 pm

# Refraction




Visible spectrum

$\lambda_{violet} = 400nm = 4 \times 10^{-7} m$

$\lambda_{red} = 700nm = 7 \times 10^{-7} m$

$$n_i \sin\theta_i = n_{refr} \sin\theta_{refr}$$

Because there is a range of $\theta_{refr}$, it means glass has a range of $n_{refr}$.

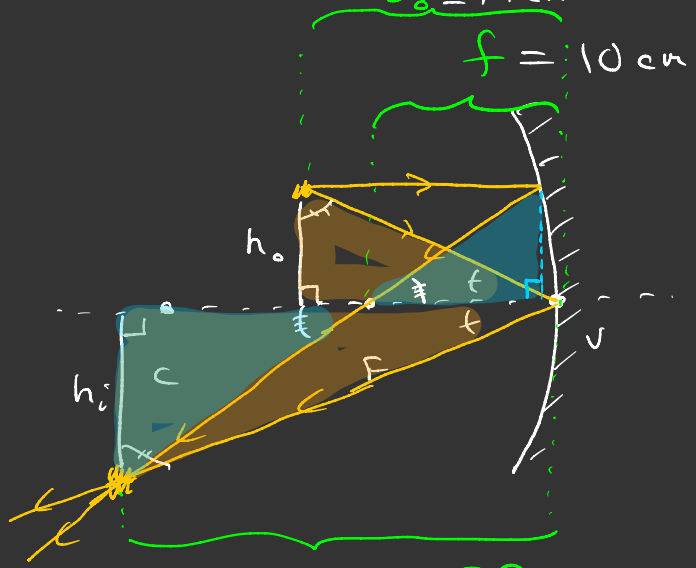
The index of refraction also describes the speed at which light travels through the material.

$$n = \frac{c}{v}$$

$c$ ← speed of light in vacuum

$v$ ← in a transparent material

# Mathematical model of image formation.




Given $f$ and $d_o$, let me calculate $d_i$.

$$\frac{d_o}{d_i} = \frac{h_o}{h_i} = \frac{f}{d_i - f}$$

$$\frac{d_o}{d_i} = \frac{f}{d_i - f}$$

$$d_o(d_i - f) = f d_i$$

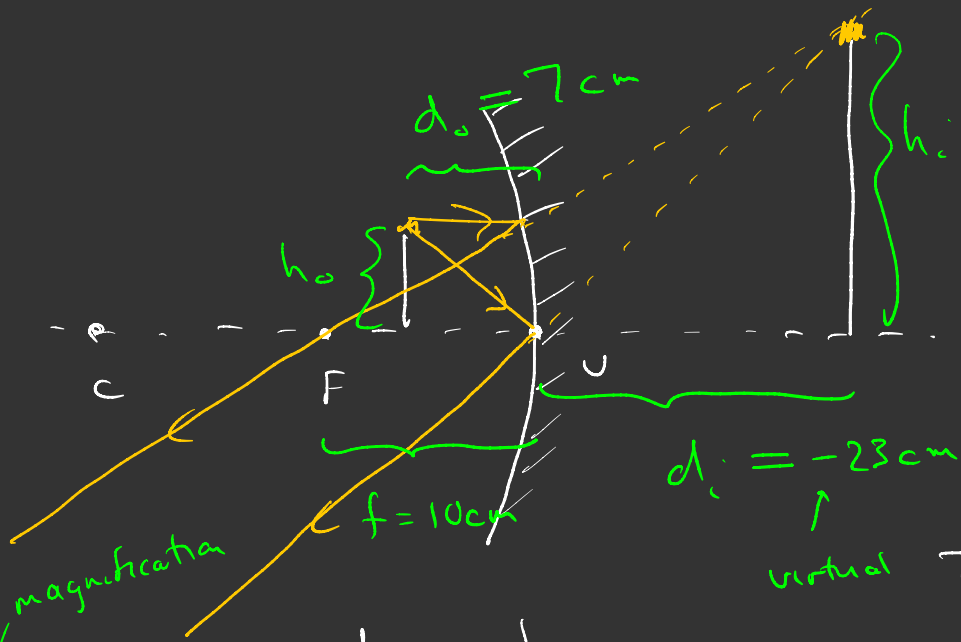
$$\frac{d_o d_i}{d_o d_i f} - \frac{d_o f}{d_o d_i f} = \frac{f d_i}{d_o d_i f}$$

$$\frac{1}{f} - \frac{1}{d_i} = \frac{1}{d_o}$$

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

Mirror equation.

GT: Where does the mirror equation say the image will form? $(d_i)$ $d_i = 35\text{cm}$




GT: What about the image location in this case?

$d_i = -23\text{cm}$ ← virtual

$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$

$7\text{cm}$ ? $10\text{cm}$

$d_i = \left(\frac{1}{f} - \frac{1}{d_o}\right)^{-1}$

magnification

$M = \frac{h_i}{h_o} \overset{?}{=} \frac{d_i}{d_o}$ $\qquad \frac{d_o}{d_i} = \frac{h_o}{h_i}$

magnification eqn.

$\boxed{M = \frac{-d_i}{d_o}} = \frac{-(-23\text{cm})}{7\text{cm}} = +3.3$

upright (inverted if negative)

~~$M = \frac{d_i}{d_o} = \frac{-23\text{cm}}{7\text{cm}}$ (less than zero!)~~

# Lenses