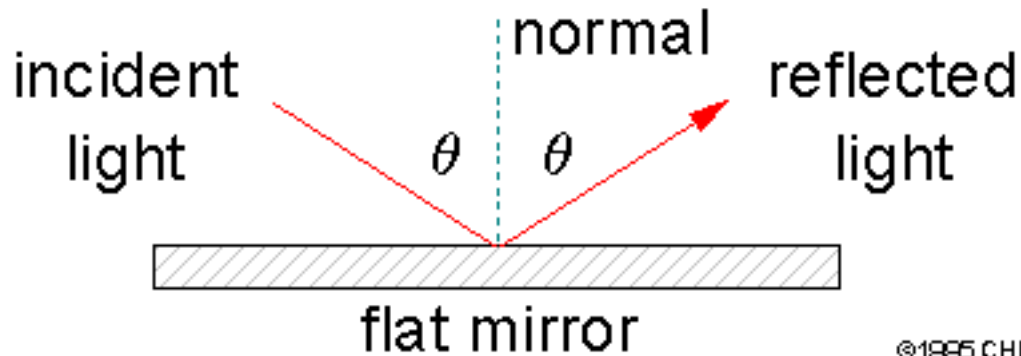


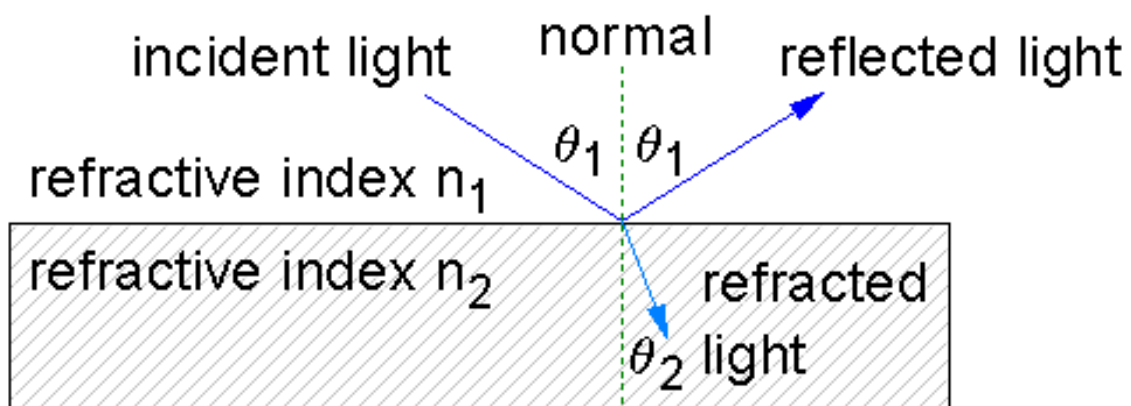
# Light and Ether

## Reflection



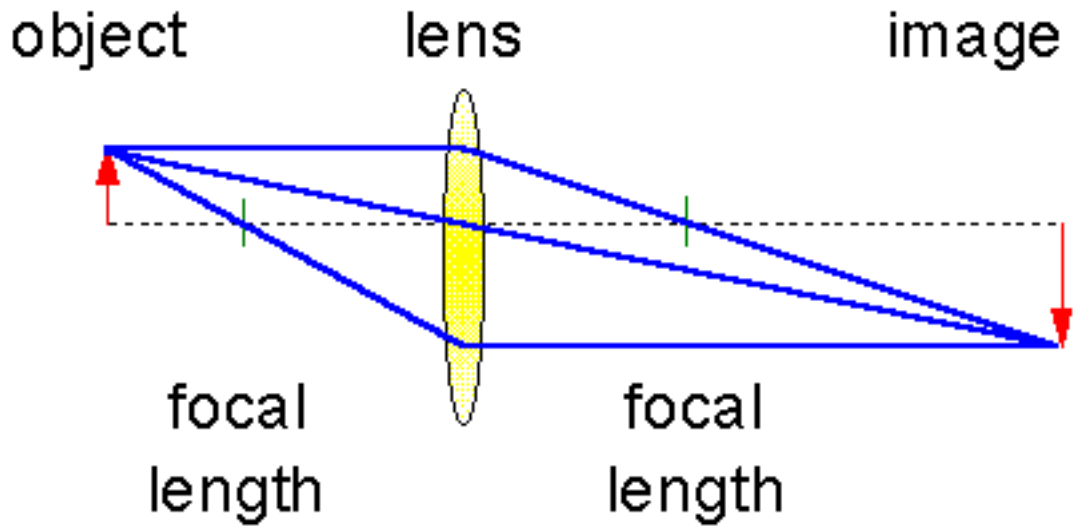
©1995 CHP

## Refraction

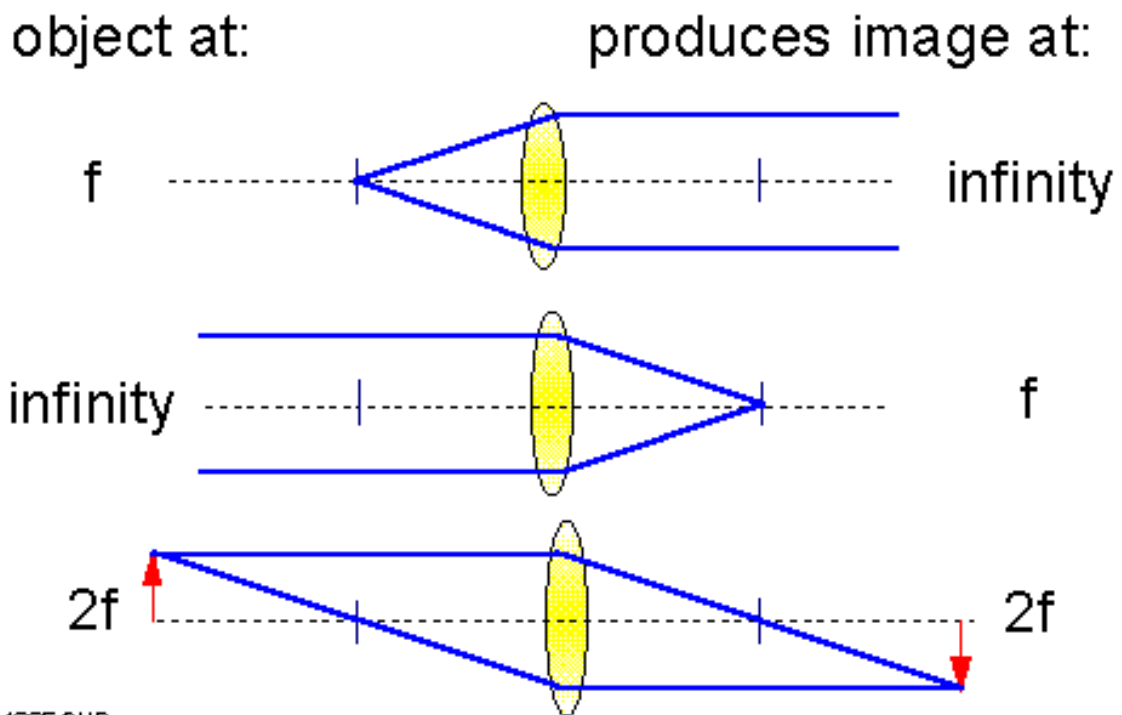


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$$\frac{\sin \theta_1}{\sin \theta_2} = \frac{n_2}{n_1}$$

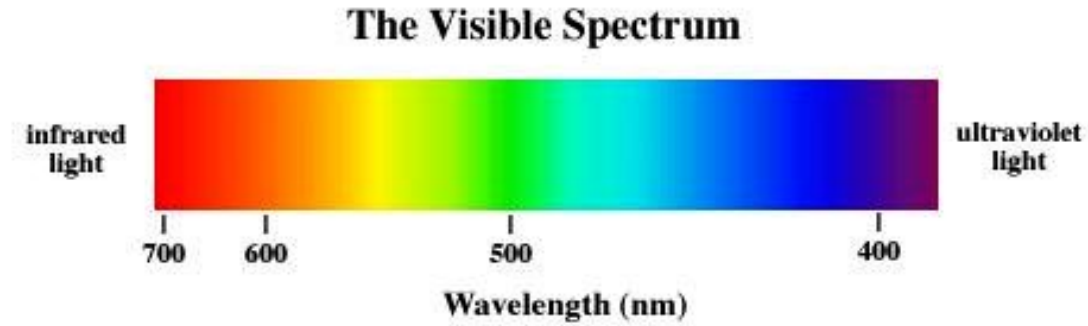


©1995 CHP

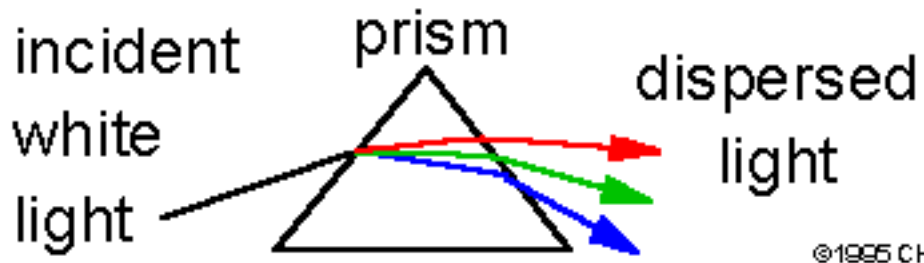


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# Spectrum



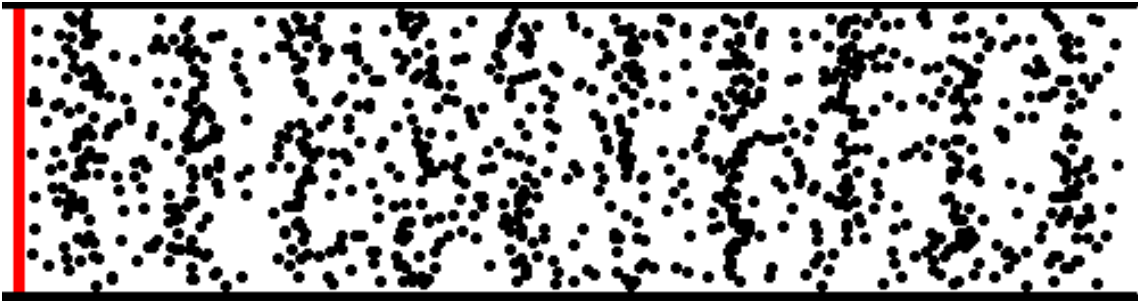
© 1995 CHP



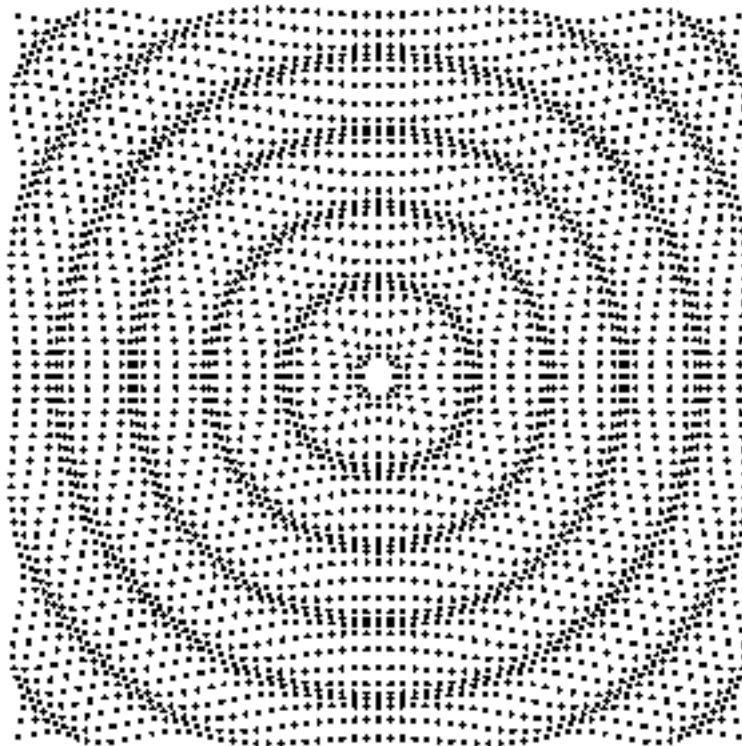
©1995 CHP

# Waves

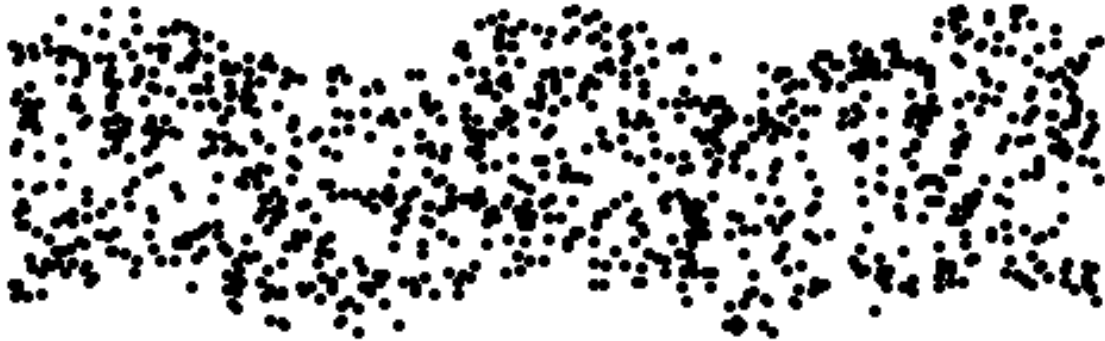
## Longitudinal



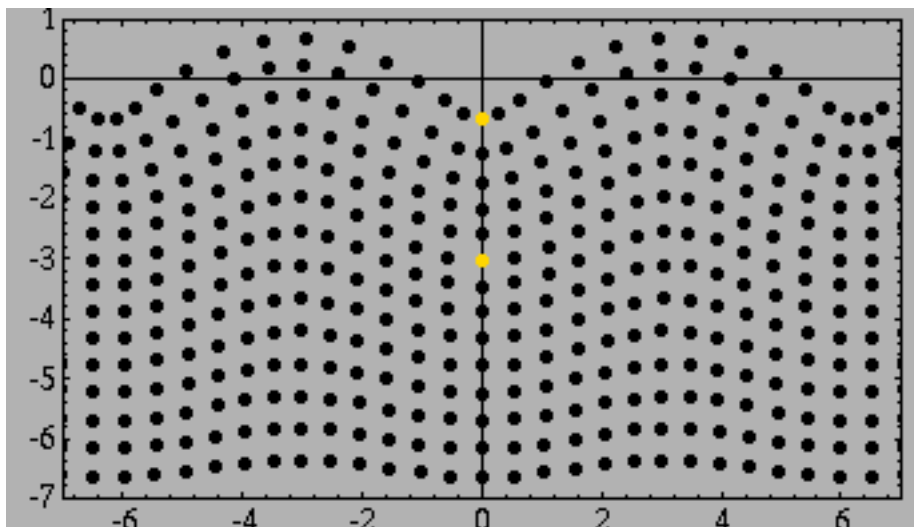
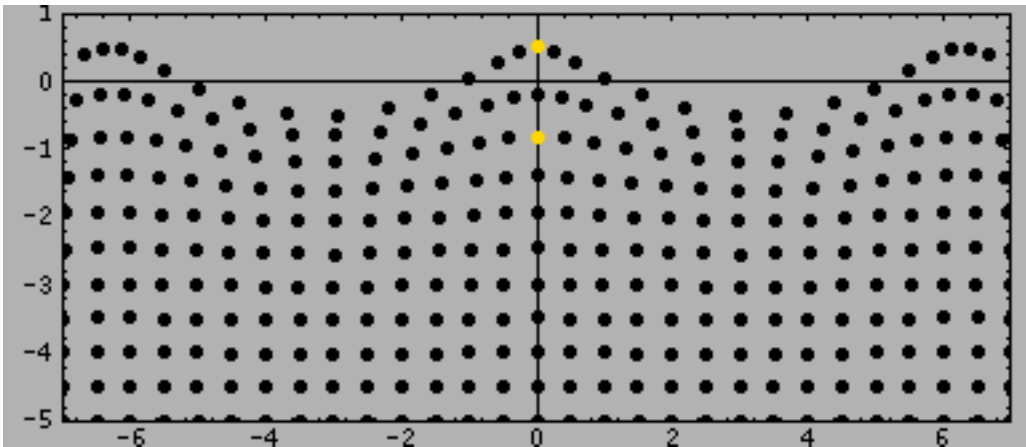
## Sound



# Transverse

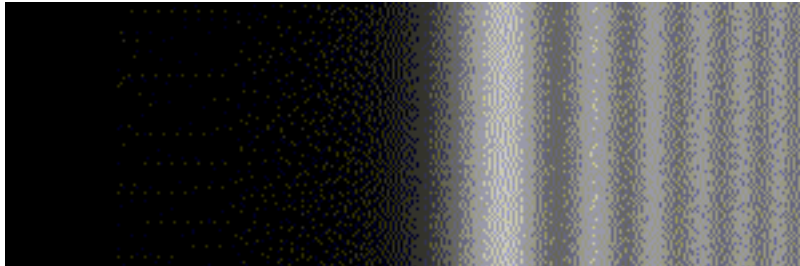


# Water Waves

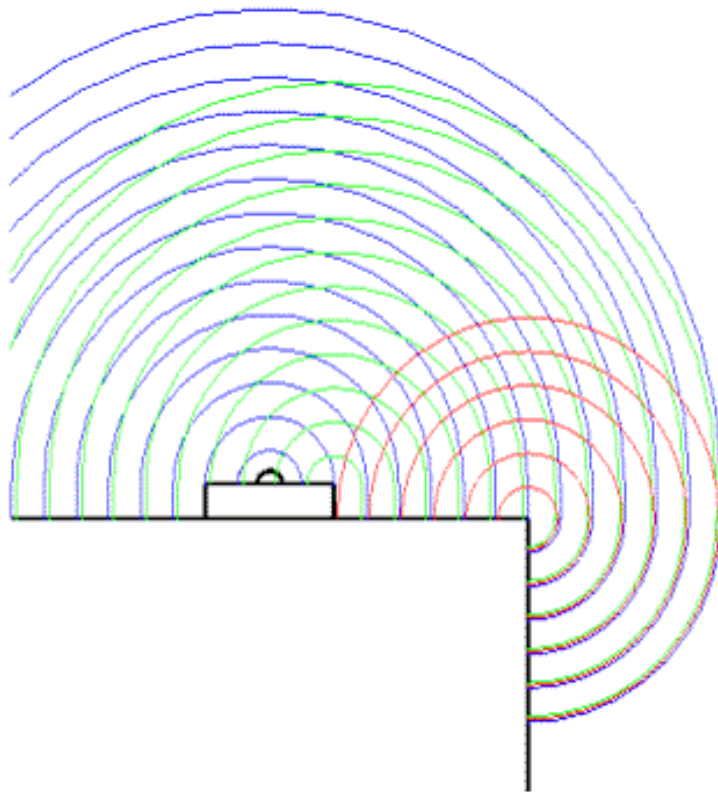


# Diffraction and Interference

## Straight Edge Diffraction



Note: diffraction from left edge of tweeter rim not shown



# Maxwell's Equations

$$\nabla \cdot \mathbf{E} = \rho / \epsilon_0$$

$$\nabla \cdot \mathbf{B} = 0$$

$$\nabla \times \mathbf{E} = - \frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \times \mathbf{B} = \mu_0 \epsilon_0 \frac{\partial \mathbf{E}}{\partial t} + \mu_0 \mathbf{j}_c$$

*where*

$$\nabla = \hat{\mathbf{i}} \frac{\partial}{\partial x} + \hat{\mathbf{j}} \frac{\partial}{\partial y} + \hat{\mathbf{k}} \frac{\partial}{\partial z}$$

# Electromagnetic Waves: Light

$$2: \quad \frac{\partial \mathbf{B}_x}{\partial z} = \mu_0 \epsilon_0 \frac{\partial \mathbf{E}_y}{\partial t}$$

$$1: \quad \frac{\partial \mathbf{E}_y}{\partial z} = \frac{\partial \mathbf{B}_x}{\partial t}$$

$$a: \quad \frac{\partial}{\partial z} \frac{\partial \mathbf{E}_y}{\partial z} = \frac{\partial}{\partial z} \frac{\partial \mathbf{B}_x}{\partial t}$$

$$b: \quad = \frac{\partial}{\partial t} \frac{\partial \mathbf{B}_x}{\partial z}$$

$$c: \quad = \frac{\partial}{\partial t} \mu_0 \epsilon_0 \frac{\partial \mathbf{E}_y}{\partial t}$$

$$d: \quad \frac{\partial^2 \mathbf{E}_y}{\partial z^2} = \mu_0 \epsilon_0 \frac{\partial^2 \mathbf{E}_y}{\partial t^2}$$

$$\boxed{\nabla^2 \mathbf{E} - \mu_0 \epsilon_0 \frac{\partial^2 \mathbf{E}}{\partial t^2} = 0}$$

$$\nabla^2 \mathbf{E} - \mu_0 \epsilon_0 \frac{\partial^2 \mathbf{E}}{\partial t^2} = 0$$

$$\left[ \nabla^2 - \frac{1}{v^2} \frac{\partial^2}{\partial t^2} \right] f(\mathbf{r}, t) = 0$$

$$\frac{1}{v^2} = \mu_0 \epsilon_0$$

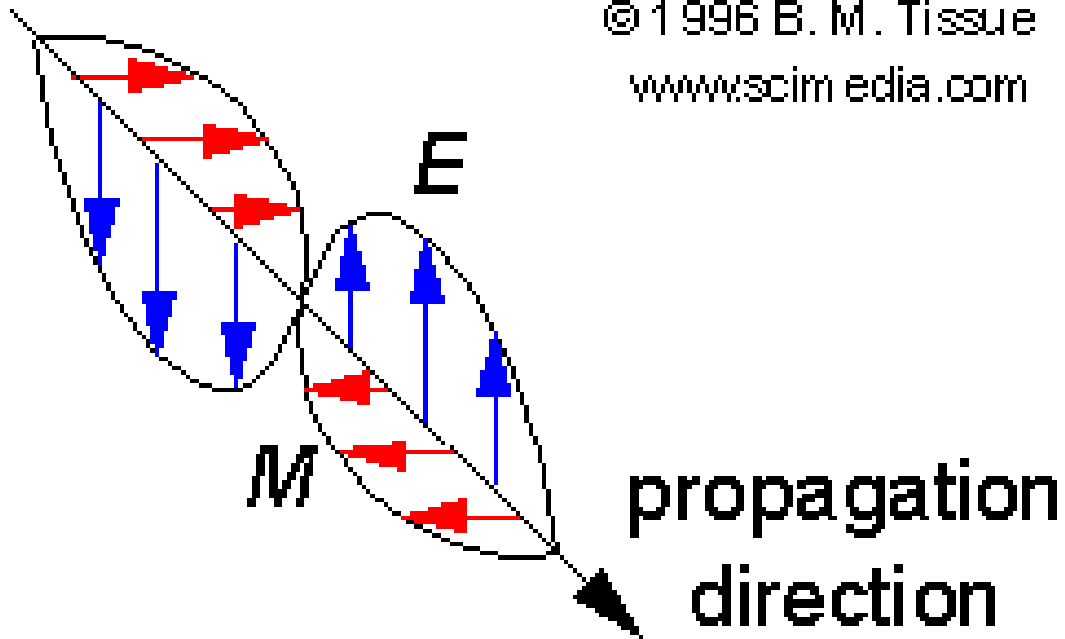
$$v = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

$$\mu_0 \epsilon_0 = (0.4\pi \text{ } \mu\text{H/m})(8.85 \text{ pF/m})$$

$$= 1.11 \times 10^{-17} \text{ s}^2/\text{m}^2$$

$$\frac{1}{\sqrt{\mu_0 \epsilon_0}} = 3.0 \times 10^8 \text{ m/s}$$

***the speed of light!***



- Transverse
- $c = 3 \times 10^{10}$  cm/sec
- Propagate—*where?*

Luminiferous *Ether*—a  
medium for electromagnetic  
waves