REFLECTION & REFRACTION

SEMINAR 6

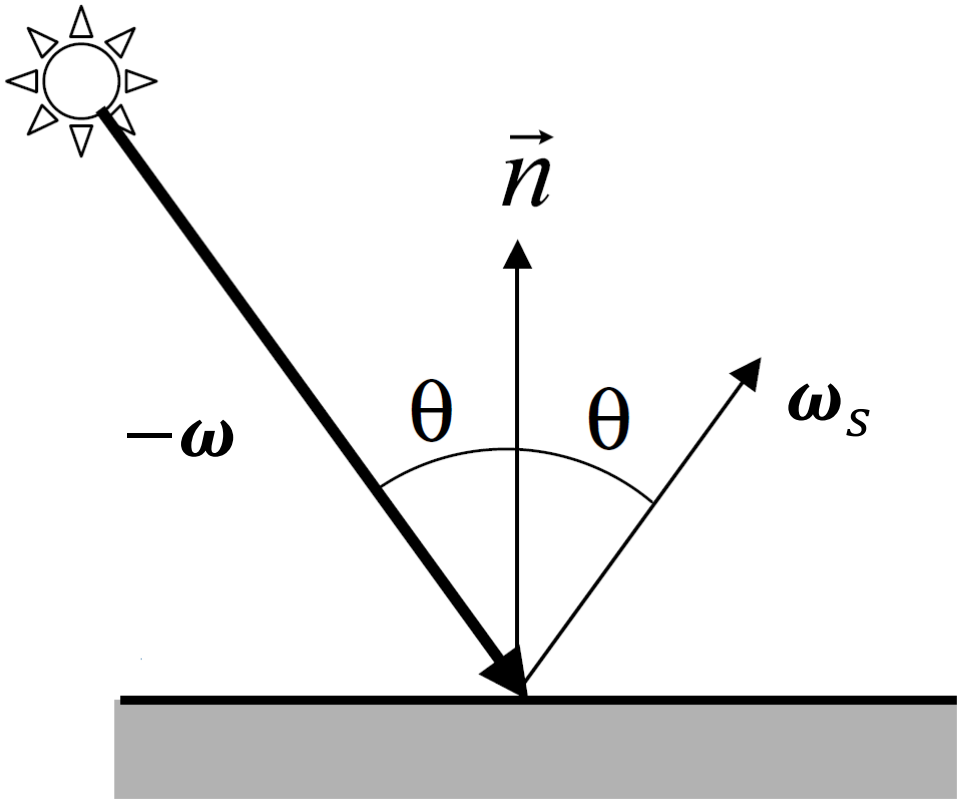
Computer Graphics 2

Reflection

Depends upon:

- Light polarization
- Light direction
- Surface normal

$$\omega_s = 2(\omega \cdot n)n - \omega$$

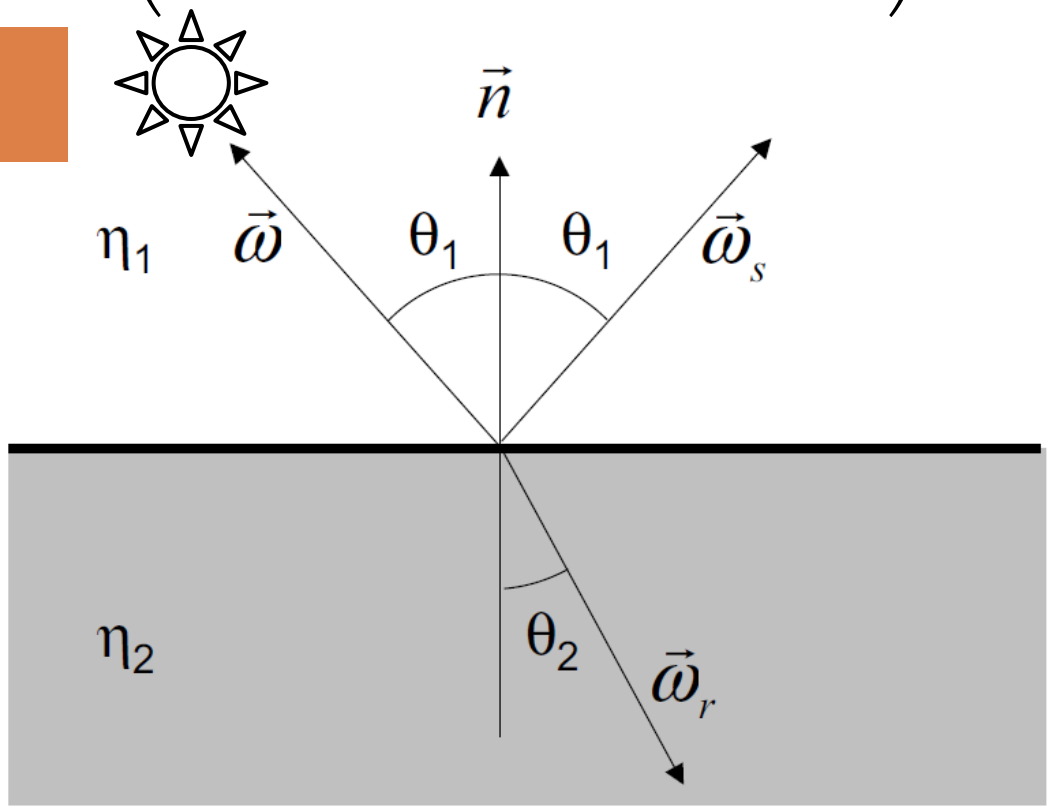


Refraction

$$\boldsymbol{\omega}_r = -\frac{\eta_1}{\eta_2}(\boldsymbol{\omega} - (\boldsymbol{\omega}\cdot\boldsymbol{n})\boldsymbol{n}) - \left(\sqrt{1 - \left(\frac{\eta_1}{\eta_2}\right)^2 (1 - (\boldsymbol{\omega}\cdot\boldsymbol{n})^2)}\right)\boldsymbol{n}$$

Depends upon:

- Light polarization
- Light direction
- Surface index of refraction



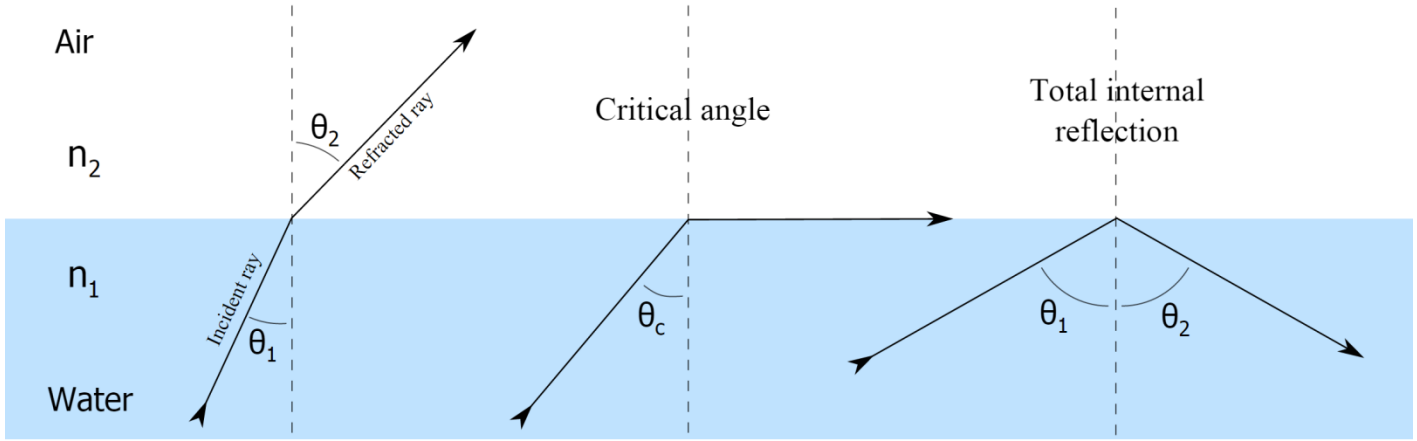
Snell's Law

- Describes relationship between angle of incidence and angle of refraction with respect to index of refraction of two surfaces

$$\frac{\sin\theta_1}{\sin\theta_2} = \frac{\eta_2}{\eta_1}$$

Total Internal Reflection

- Light strikes surface with angle larger than a certain critical angle
- Wave cannot pass and is reflected instead of refracted
- Only occurs when going from a medium with higher refractive index to a medium with lower refracting index



Fresnel Equations

- Describe lights behavior when moving between media with different refractive indices
  - Part of the light is reflected
  - Part of the light is refracted

  } Adds to 1 due to energy conservation
- Complex formulas not suitable for real time rendering
- Usually approximated using Schlick's approximation

Schlick's Approximation

- Approximates Fresnel factor
- Formula calculates specular reflection coefficient

$$R(\theta) = R_0 + (1 - R_0)(1 - \cos\theta)^5$$

Where: θ is the angle between view direction and half vector

$$R_0 = \left(\frac{\eta_1 - \eta_2}{\eta_1 + \eta_2}\right)^2$$

Then: $ReflectiveFactor = R(\theta)$

$RefractiveFactor = 1 - R(\theta)$

Questions?