Title: Physics in Nature Presentation: Reflections of Nature

Date: Aug 19, 2011 03:45 PM

URL: http://pirsa.org/11080109

Abstract:

Specular Reflection in Nature

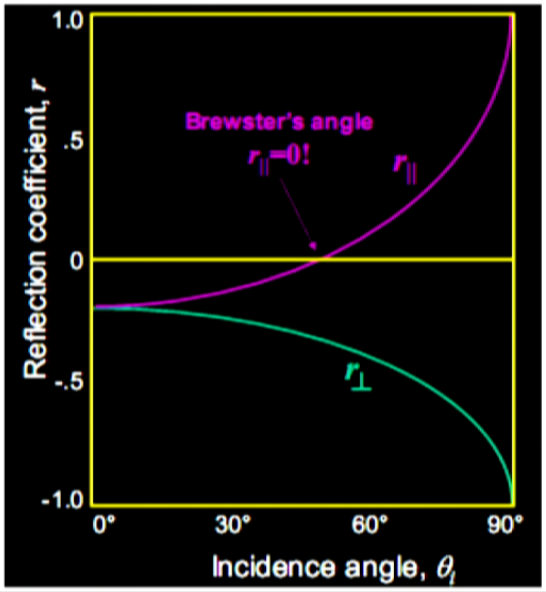
Specular Reflection in Nature

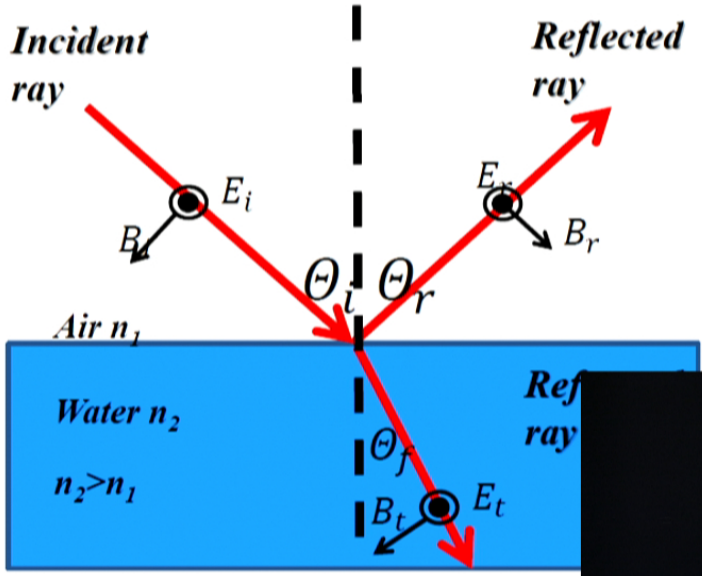
Fraction of light reflected

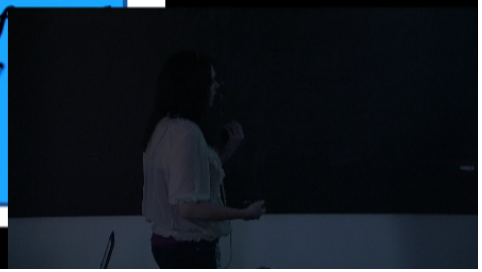
- *One can calculate the fraction of light reflected using*

Fresnel Equations:

$$\left(\frac{E_{0r}}{E_{0i}}\right)_{\perp} = \frac{[n_i \cos\theta_i - n_t \cos\theta_t]}{[n_i \cos\theta_i + n_t \cos\theta_t]} \qquad \left(\frac{E_{0r}}{E_{0i}}\right)_{\parallel} = \frac{[n_i \cos\theta_t - n_t \cos\theta_i]}{[n_i \cos\theta_t + n_t \cos\theta_i]}$$







Back of the envelope calculation

Qn: How much light reflected?

Assume:

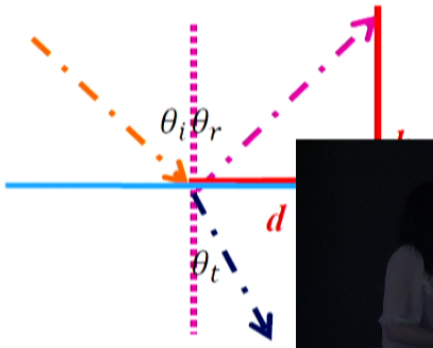
$$n_{air} = 1$$
$$n_{water} = 1.33$$
$$d_{to\ camera} = 10\ m$$
$$h_{of\ camera} = 3.5m$$
$$\theta_t = \theta_r = 30^\circ$$

Amount of light transmitted (Snell's Law)

$$\theta_t = \sin^{-1}\left[\frac{n_{water}}{n_{air}}\sin\theta_i\right]$$
$$\theta_t \approx 42^\circ$$

As the incident light is unpolarised the amount of light reflected is

$$|R| = \frac{1}{2}\left[\left(\frac{E_{0r}}{E_{0i}}\right)_{\perp} + \left(\frac{E_{0r}}{E_{0i}}\right)_{\parallel}\right] = 14\%$$



Back of the envelope calculation

Qn: How much light reflected?

Assume:

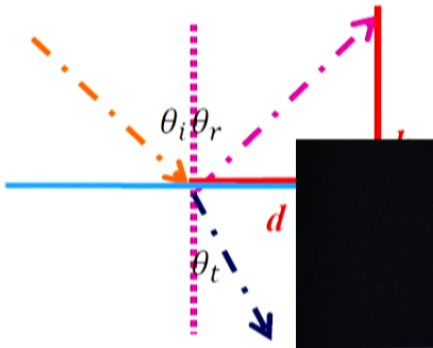
$$n_{air} = 1$$
$$n_{water} = 1.33$$
$$d_{to\ camera} = 10\ m$$
$$h_{of\ camera} = 3.5m$$
$$\theta_t = \theta_r = 30^{\circ}$$

Amount of light transmitted (Snell's Law)

$$\theta_t = \sin^{-1}\left[\frac{n_{water}}{n_{air}}\sin\theta_i\right]$$
$$\theta_t \approx 42^{\circ}$$

As the incident light is unpolarised the amount of light reflected is

$$|R| = \frac{1}{2}\left[\left(\frac{E_{0r}}{E_{0i}}\right)_{\perp} + \left(\frac{E_{0r}}{E_{0i}}\right)_{\parallel}\right] = 14\%$$



Back of the envelope calculation

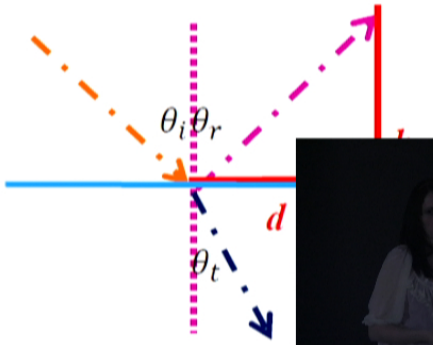
Qn: How much light reflected?

Assume:

$$n_{air} = 1$$
$$n_{water} = 1.33$$
$$d_{to\ camera} = 10\ m$$
$$h_{of\ camera} = 3.5m$$
$$\theta_t = \theta_r = 30^{\circ}$$

Amount of light transmitted (Snell's Law)

$$\theta_t = \sin^{-1}\left[\frac{n_{water}}{n_{air}}\sin\theta_i\right]$$
$$\theta_t \approx 42^{\circ}$$



As the incident light is unpolarised the amount of light reflected is

$$|R| = \frac{1}{2}\left[\left(\frac{E_{0r}}{E_{0i}}\right)_{\perp} + \left(\frac{E_{0r}}{E_{0i}}\right)_{\parallel}\right] = 14\%$$

Conclusion

- Reflection occurs in many different ways in Nature
- The type is dependent on reflecting surface
- Light behaves in a very predictable way
  - Law of Reflection
- Using basic geometry one can explain the behaviour of light between different media.

Conclusion

- Reflection occurs in many different ways in Nature
- The type is dependent on reflecting surface
- Light behaves in a very predictable way
  - Law of Reflection
- Using basic geometry one can explain the behaviour of light between different media.

Optical Phenomenon

Interaction between light and matter.