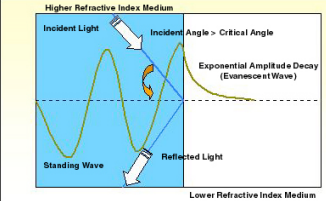


PHY385-H1F Introductory Optics Class 8 – Outline: Finishing Chapter 4

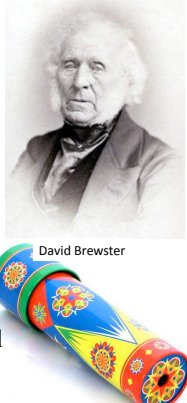
- Total Internal Reflection
- Evanescent Waves
- Colour: Additive and Subtractive Primaries
- Stokes Relations



Evanescent Wave Generation

Brewster's Angle

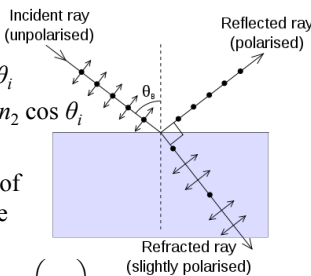
- Sir David Brewster invented the kaleidoscope in 1815
- He discovered the polarization angle empirically.
- Consider light incident on a boundary $n_1 \rightarrow n_2$ at angle θ_i .
- If the reflected and transmitted beams are orthogonal, then only the component polarized parallel to the surface will be reflected.



David Brewster

Brewster's Angle

- $\theta_i + \theta_r + 90^\circ = 180^\circ$
- $\theta_i = 90^\circ - \theta_r = 90^\circ - \theta_i$
- $n_1 \sin \theta_i = n_2 \sin \theta_t = n_2 \cos \theta_i$
- $\tan \theta_i = n_2/n_1$
- This particular angle of incidence is called the Brewster's angle.



$$\theta_p = \tan^{-1}\left(\frac{n_2}{n_1}\right)$$

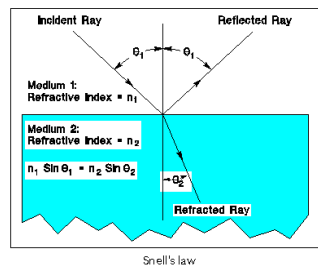
Two Special Angles at n_1/n_2 boundary!

$\theta_p = \tan^{-1}\left(\frac{n_2}{n_1}\right)$

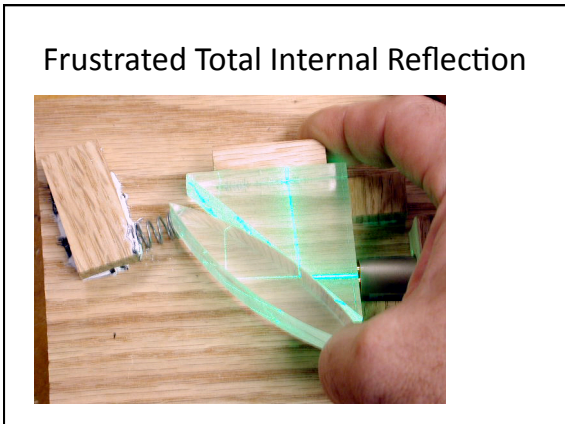
Linear Polarization by Reflection is maximum when $\theta_i = \theta_p$

$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$

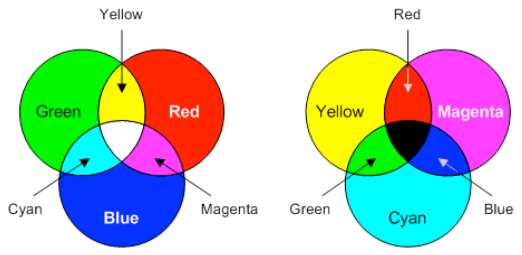
Total Internal Reflection occurs when $\theta_i > \theta_c$



Snell's law



Additive Primary Colours (light bulbs) and Subtractive Primary Colours (ink)



Additive (light) Subtractive (paint)

Additive and subtractive color combinations

Term Test 1

- Test 1 on Tuesday will cover all of Chapters 2, 3 and 4, including some stuff I did *not* cover thoroughly during lecture
- Exceptions: Section 3.7 and 4.11, the last sections of chapters 3 and 4, will *not* be covered in this course
- There will be 6 conceptual multiple choice questions (6 points), plus 3 problems for which you must show your work (14 points). The test is out of 20.

Term Test 1

- | | |
|---|--|
| • One-Dimensional Waves | • Index of Refraction |
| • Wave Equation | • Dispersion |
| • Harmonic Waves | • The Electromagnetic Spectrum |
| • Phase Velocity | • Rayleigh Scattering |
| • Superposition | • Transmission of Light through a Medium |
| • Phasor Addition | • Reflection, Refraction |
| • Plane Waves, Spherical Waves, Cylindrical Waves | • Huygen's Principle |
| • Maxwell's Equations | • Fermat's Principle |
| • Electromagnetic Waves | • The Fresnel Equations |
| • Poynting Vector | • Reflectance and Transmittance |
| • Irradiance | • Total Internal Reflection |
| • Photons | • Evanescent Waves |
| • Radiation Pressure and Momentum | • Waves in a Metal |
| • Synchrotron Radiation | • Colour |
| • Electric Dipole Radiation | • Stokes Relations |
| • Emission and Absorption | |

Term Test 1

- Test 1 will be held IN HERE: MP134
- Tuesday Oct. 11, 1:10 to 2:00pm (50 minutes)
- There will be assigned seating; please try to be here early and we can all begin exactly at 1:10
- AIDS ALLOWED: Your textbook and a calculator
- You may NOT use your notes. You may use the equivalent of 1 page, double-sided, of notes in your textbook, if you wish