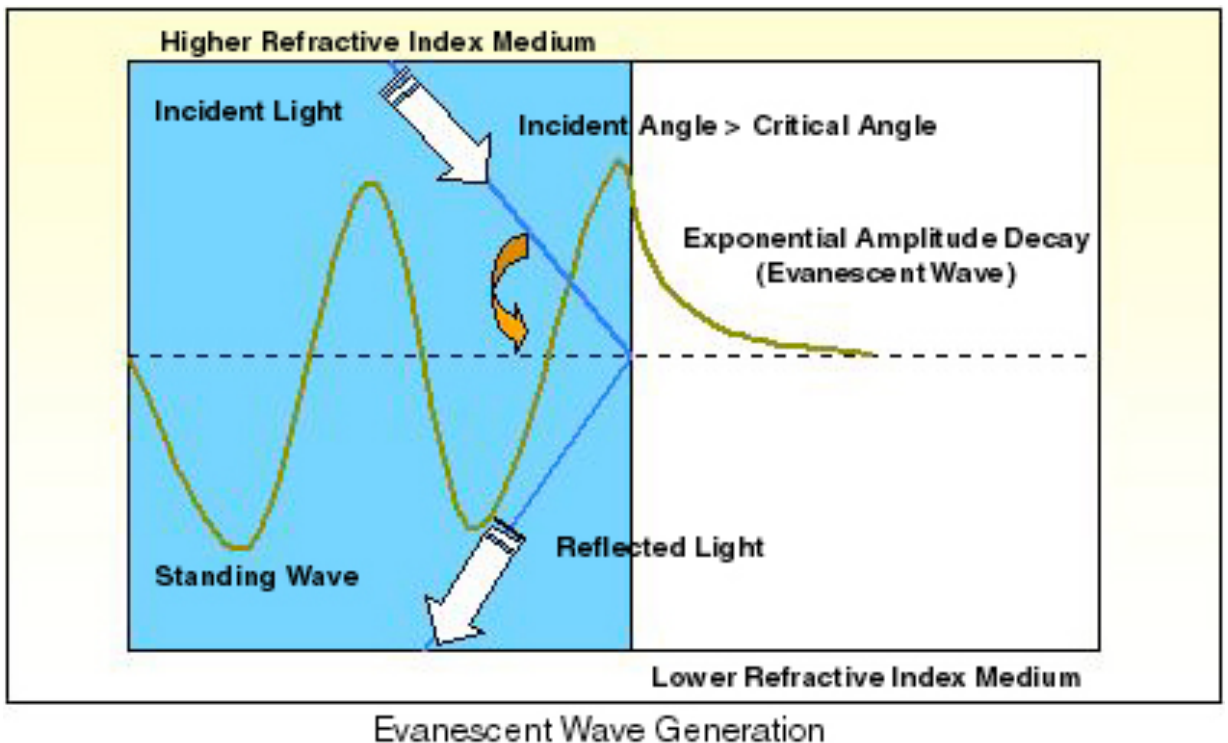


# PHY385-H1F Introductory Optics

## Class 8 – Outline: Finishing Chapter 4

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



# 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  $\theta_i$ .
- If the reflected and transmitted beams are orthogonal, then only the component polarized parallel to the surface will be reflected.

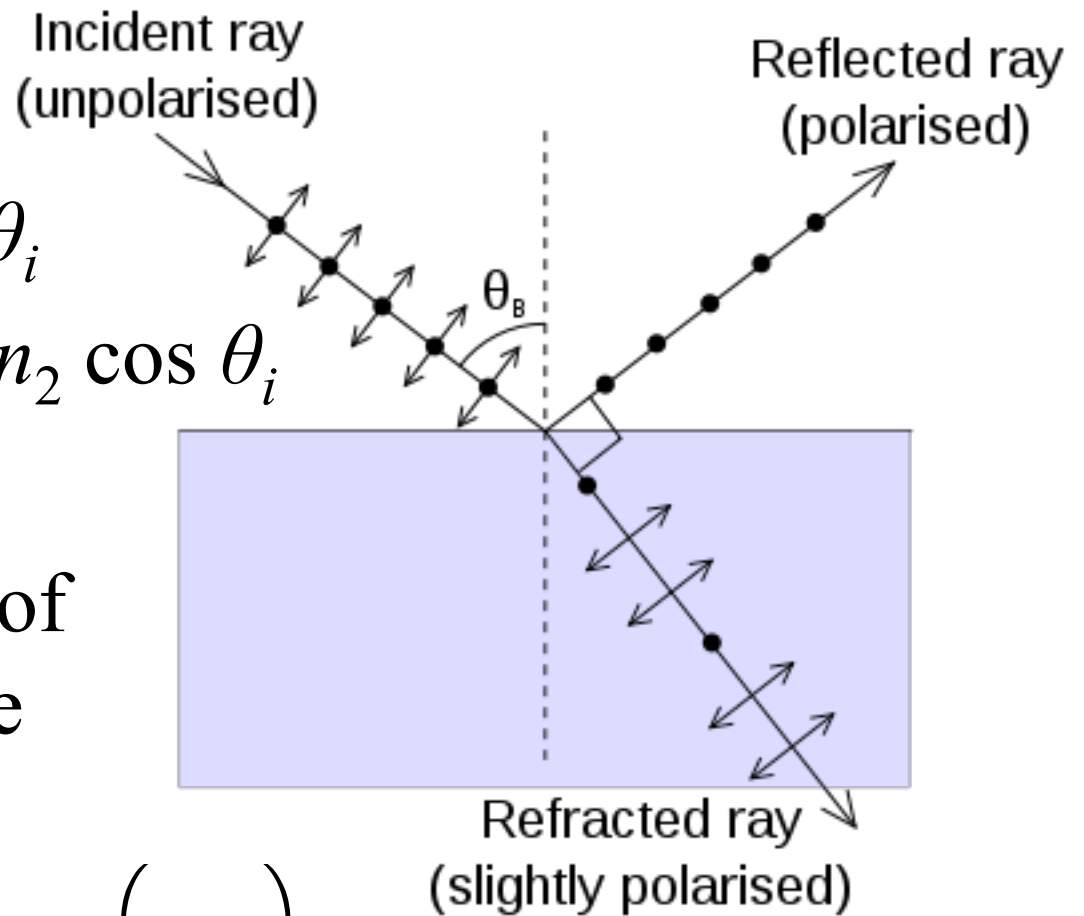


David Brewster



# Brewster's Angle

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



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

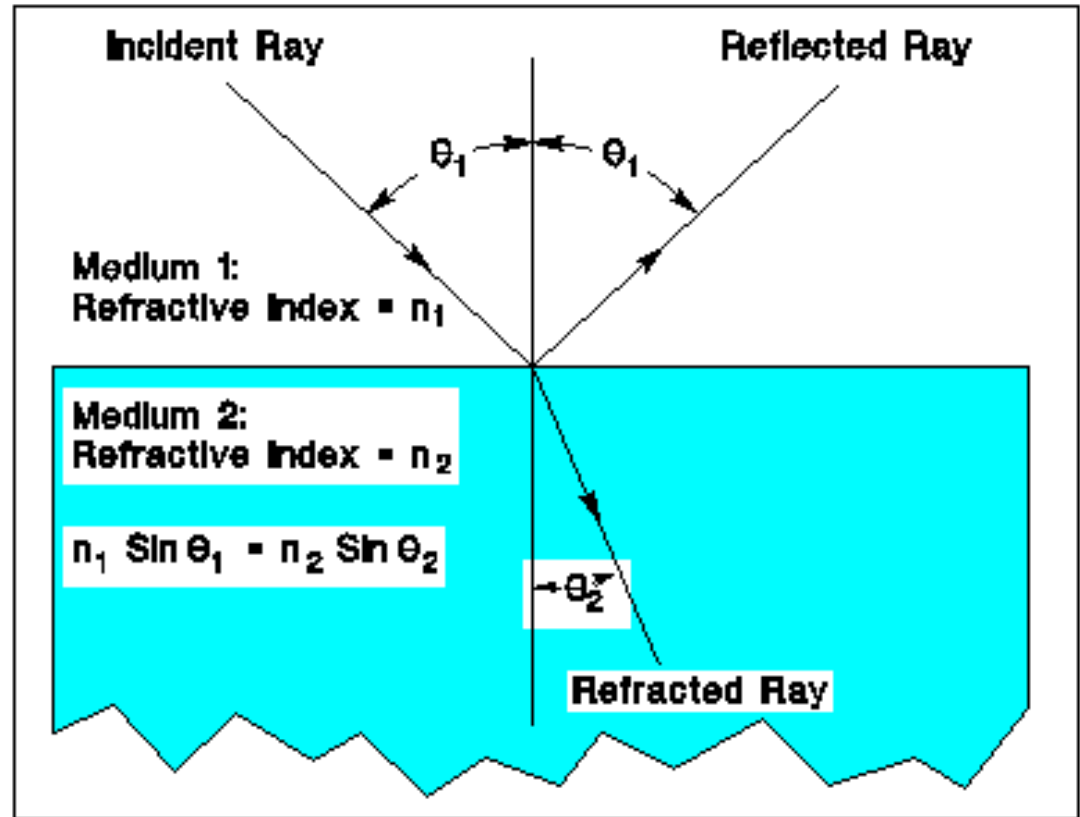
# Two Special Angles at $n_1/n_2$ boundary!

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

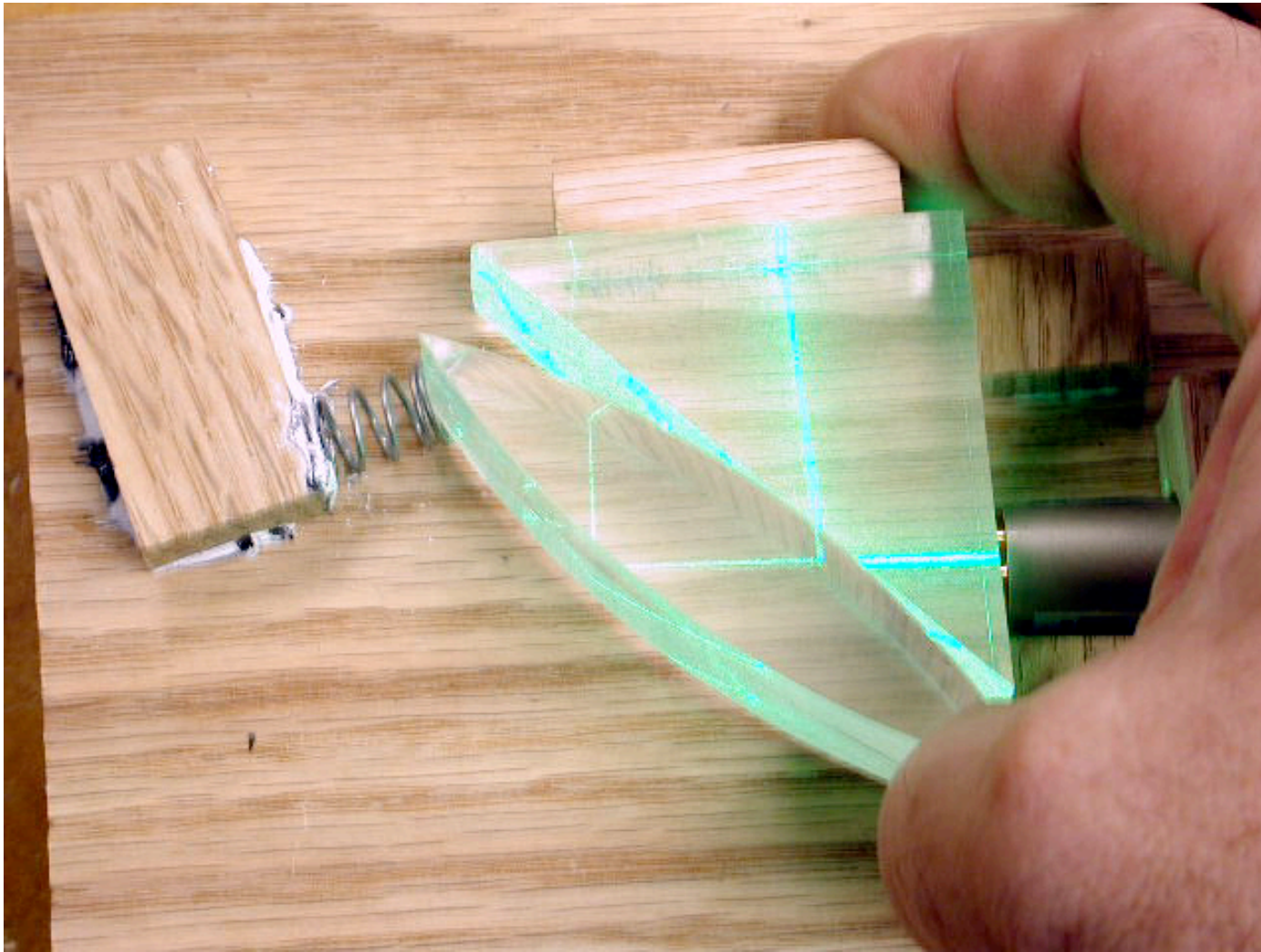
Linear Polarization by Reflection is maximum when  $\theta_i = \theta_p$

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

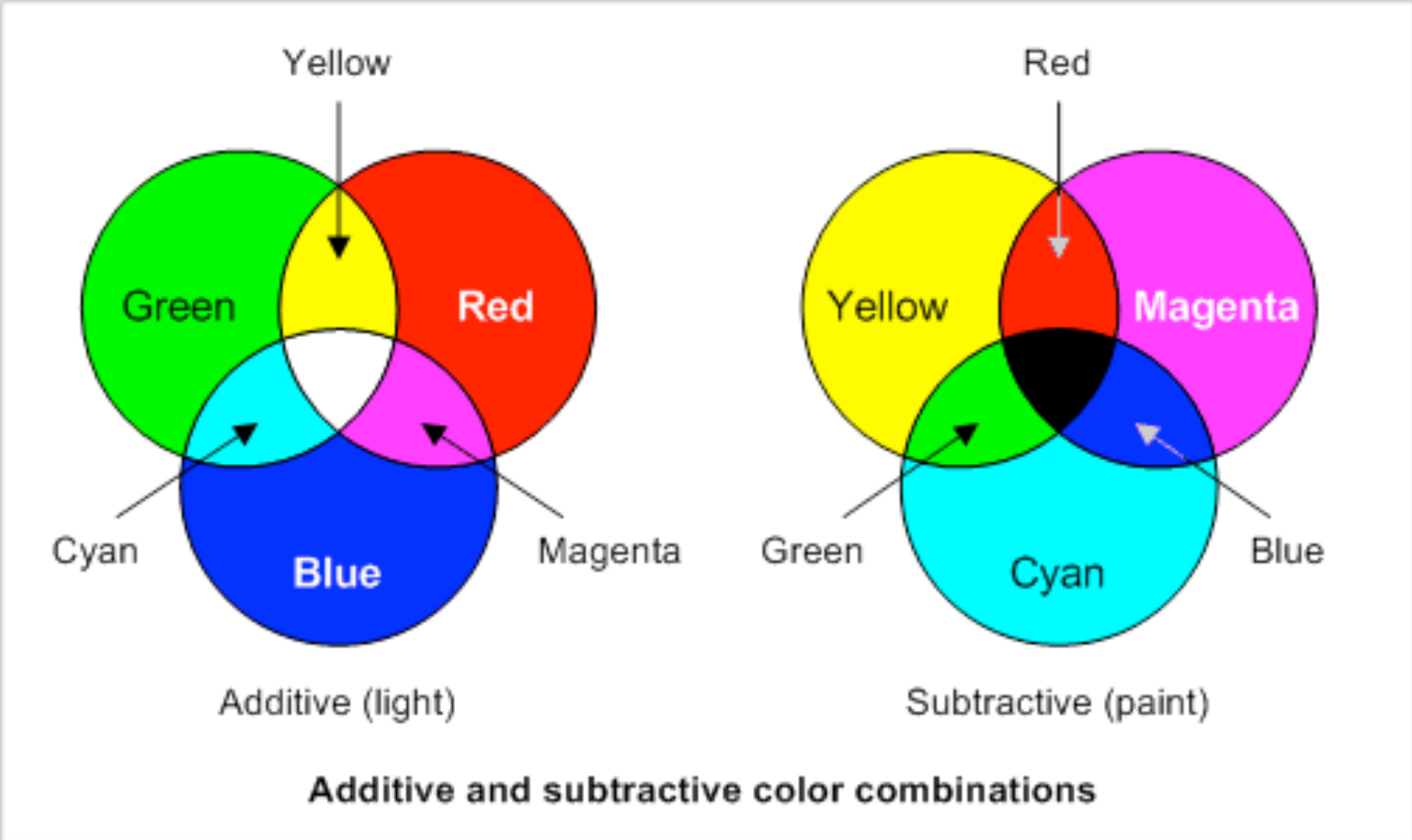
Total Internal Reflection occurs when  $\theta_i > \theta_c$



# Frustrated Total Internal Reflection



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



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



# 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