


PHY385-H1F Introductory Optics
Class 7 – Outline: Sections 4.4, 4.5, 4.6

- Snell's Law of Refraction
- TE mode, TM mode
- The Fresnel Equations
- Reflectance and Transmittance




In-Class Task from Last time.. I asked:

For any wave, it is true that $v = \lambda f$.
Light starts in air, where $n = 1$, and enters glass, where $n = 5$.

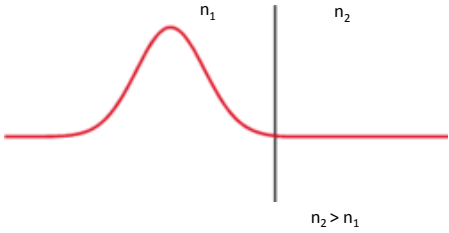
1. Does the speed, v , of the light increase, decrease, or stay the same when it enters the glass?
 $v = c/n, n > 1$, speed decreases
2. Does the wavelength, λ , of the light increase, decrease, or stay the same when it enters the glass?
 $v = \lambda f$, v decreases, f stays the same, so λ must decrease
3. Does the frequency, f , of the light increase, decrease, or stay the same when it enters the glass?
 E and B are continuous across the boundary, therefore f must stay the same

External Reflection ($n_2 > n_1$)




- Animation shows a pulse traveling to the right on a light string attached to a heavier string
- Speed suddenly decreases
- Analogous to light in air reflecting off glass surface
- Phase shift = π

External Reflection – another animation
Partial transmission and reflection amplitudes of a wave travelling from a low to high refractive index medium.

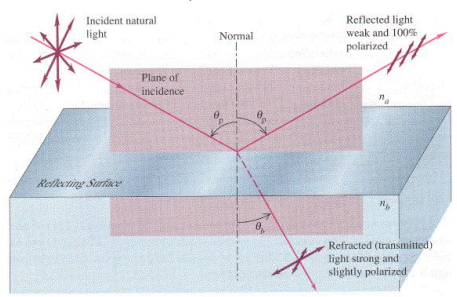


Internal Reflection ($n_2 < n_1$)



- Animation shows a pulse traveling to the right on a heavy string attached to a lighter string
- Speed suddenly increases
- Analogous to light in glass reflecting off the boundary to air
- Phase shift = 0

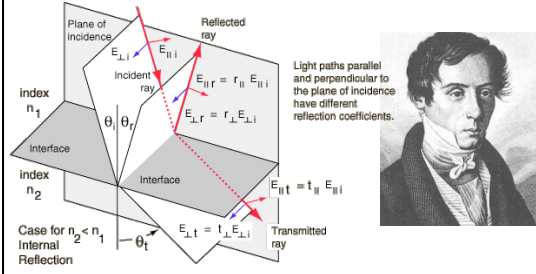
The incident, reflected and transmitted beams each lie in the plane-of-incidence.



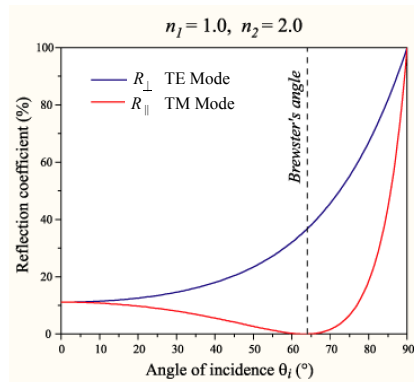
This figure shows the polarization for the particular angle of incidence called Brewster's Angle, θ_p .

Recall Class 1: History of Light

- 1814 – **Jean Fresnel** used the idea of polarization to predict amplitudes of reflected and transmitted light from glass interfaces.



Reflection Coefficient, External Reflection



Reflection Coefficient, Internal Reflection

