Reflection and Refraction
P. Bennett PHY452 Optics

Concepts
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Background Reading
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Special Equipment and Skills
- Pasco light sensor; Laser

Precautions
- Never allow the laser beam into your eye, either directly (“looking” at it) or indirectly (by spurious reflection from metal, glass, etc).

Background and Theory
- "Fresnel equations" for reflection and transmission across boundary

Procedure (in addition to operational notes posted in the lab)
1. Setup:
   a. Open the data acquisition program: Desktop/Labs/PHY452/BrewsterAngle.ds
   b. Setup/CalibrateSensors/(min and max). Sampling = 5point/sec
   c. Summary / Drag "Intensity" to "Digits".
   d. Check the alignment of the laser, target, angle table and detector to see that you can get the reflected and refracted beams into the detector for the full range of incident angles. You may need to shim the target so it reflects back onto the laser. You may need to wiggle the detector gently to "capture" the beam for each angle. Set the 1st polarizer to 45deg and the 2nd polarizer to horizontal. Adjust the target to the Brewster angle, then tweak the 2nd polarizer to get a minimum reflected intensity. This corresponds to "TM mode".
2. Set the polarizer for TM mode, then measure the reflected and transmitted intensities and angles for incident angles from 0 to 90 deg. (One side is sufficient). Space your data points more closely near "interesting points".
3. Change the polarizer for TE mode, then repeat R and T.
4. Remove the 2nd polarizer to get a mixed mode. Qualitatively check the polarization of the reflected and transmitted beams for a few interesting angles.
5. Replace the 2nd polarizer and set for TM mode, then turn the target to get "internal reflection" (beam entering the curved side) and measure R, T for a few angles, including "total internal reflection". Is there a Brewster angle for "internal reflection"?

Analysis and Questions
1. Find "n" from a linearized fit to Snell's law, with "internal reflection".
2. Using "n" from the Brewster angle, plot your data against the Fresnel equations for R and T, for "external reflection". Also show the quantity (R+T) on your plot.
3. Using "n" from the Brewster angle, plot your data against the Fresnel equations for R and T, for "internal reflection". Also show the quantity (R+T) on your plot.