

PH481 Homework 2

Due: Monday, 23rd of January 2023

4.22* A laserbeam having a diameter D in air strikes a piece of glass (n_g) at an angle θ_i . What is the diameter of the beam in the glass?

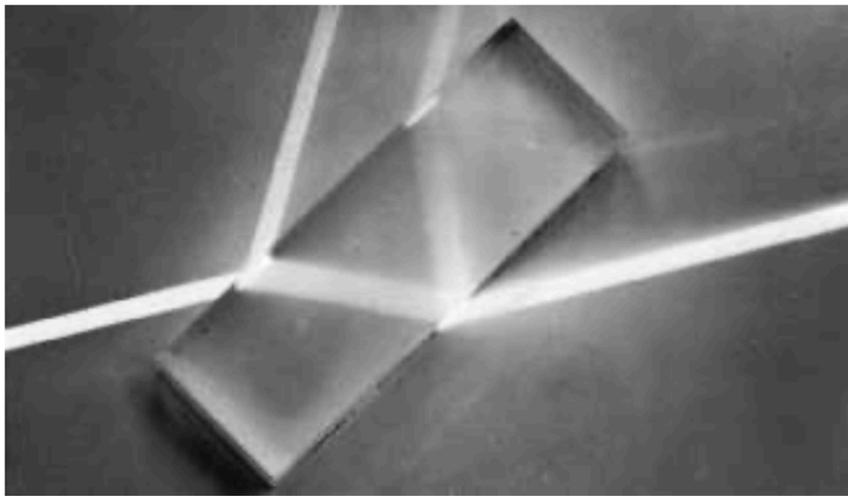
The beam in the glass is no longer circular but rather elliptical. The diameter in this problem refers to the major diameter of the ellipse, which is in the plane of incidence.

4.24* A bowl 10.0 cm deep is filled with olive oil. A coin on the bottom of the bowl is viewed directly from above. How far beneath the surface will the coin appear?

4.36* Derive the Law of Reflection, $\theta_i = \theta_r$, by using the calculus to minimize the transit time, as required by Fermat's Principle.

4.38 Show analytically that a beam (in a medium of index n_1) entering a planar transparent plate (of index n_2 and thickness d), as in Fig. P.4.38, emerges parallel to its initial direction. Derive an expression for the lateral displacement (a) of the beam. Incidentally, the incoming and outgoing rays would be parallel even for a stack of plates of different material.

Figure P.4.38 (E.H.)



4.39* Show that the two rays that enter the system in Fig. P.4.39 parallel to each other emerge from it being parallel.

Figure P.4.39

