PH481 Homework 5

Due: Monday, 10th of February 2020

9.13* White light falling on two long narrow slits emerges and is observed on a distant screen. If red light ($\lambda_0 = 780$ nm) in the first-order fringe overlaps violet in the second-order fringe, what is the latter's wavelength?

9.16* Considering the double-slit experiment, derive an equation for the distance $y_{m'}$ from the central axis to the m'th irradiance *minimum*, such that the first dark bands on either side of the central maximum correspond to $m' = \pm 1$. Identify and justify all your approximations.

9.18* With regard to Young's Experiment, derive a general expression for the shift in the vertical position of the mth *maximum* as a result of placing a thin parallel sheet of glass of index n and thickness d directly over one of the slits. Identify your assumptions.

9.33* If the plate in Fig. 9.27 is glass in air, show that the amplitudes of E_{1r}, E_{2r}, and E_{3r} are, respectively, $0.2\,E_{0i}$, $0.192\,E_{0i}$, and $0.008\,E_{0i}$, where E_{0i} is the incident amplitude. Make use of the Fresnel coefficients at normal incidence, assuming no absorption. You might repeat the calculation for a water film in air.

9.41* Suppose a wedge-shaped air film is made between two sheets of glass, with a piece of paper 7.618×10^{-5} m thick used as the spacer at their very ends. If light of wavelength 500 nm comes down from directly above, determine the number of bright fringes that will be seen across the wedge.

9.50* Suppose we place a chamber 10.0 cm long with flat parallel windows in one arm of a Michelson Interferometer illuminated by 600 -nm light. If the refractive index of air is 1.000 29 and all the air is pumped out of the cell, how many fringe-pairs will shift by in the process?