

Optics I: Theory CPHY 6/74495

Assignment 6.

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1. A nematic liquid crystal cell, consisting of two parallel glass plates separated by a distance of $d = 25\mu m$, is oriented so that the plates are in the $x - y$ plane, (the normal to the plates is in the z direction). Plane polarized light, polarized along the \hat{x} direction, is normally incident on the cell.
The nematic director \hat{n} is in the $(1, 1, 1)$ direction everywhere inside the cell.
The refractive indices of the liquid crystal are $n_e = 1.7$ and $n_o = 1.4$.
A polarizer in the $x - y$ plane is placed after the cell. It can be rotated about the z axis, its orientation is defined by the angle θ , such that when $\theta = 0$, the polarizer transmits light polarized along the \hat{x} , axis.
 - (a) Plot the normalized intensity of light transmitted by the polarizer as function of the angle θ .
(Ignore reflections.)
 - (b) Calculate the angle between the wave vector and the Poynting vector inside the cell.
 - (c) Sketch the index ellipsoid, and show the fields and the wave and Poynting vectors for both ordinary and extraordinary modes.