Electrodynamics and Optics Notes

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Abstract

Abstract of this course

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2.1 Jones's Notation

2.2 Birefringent Material

For isotropic medium : $\mathbf{P} = \epsilon_0 \chi \mathbf{E}$ $\mathbf{D} = \epsilon \epsilon_0 \mathbf{E}$

2.2.1 Discussion 1

Q: How a uniaxial birefringent material can be used to make a quarter wave plate.?

Uniaxial birefringent material have principle refractive indices n_o, n_o and n_e. We can consider a plane-polarised EM wave $e^{i(kz-wt)}$ travels along O_z at a different speeds c/n_f or c/n_s depending on whether $\mathbf{E}$ is parallel to O_x or O_y As the wave trasverse the plate, the phase will shift: $e^{ik(z=0)} \rightarrow e^{ik_f(z=d)}$, where $k_f = \frac{\omega n_f}{c}$.

So the phase shift will depend on the optical thickness,d and also the refractive index:
Along fast axis, the change is $e^{i\omega n_f d/c}$.
Along slow axis, the change is $e^{i\omega n_s d/cs}$.
The Jones matrix for the plate can be written as
A quarter-wave plate is on with difference in phase shift corresponding to $\lambda/4$

3 Electrodynamics

3.1 Gauge in EM

3.2 A in simple cases

3.3 A in quantum mechanics

3.3.1 Hamiltonian

3.3.2 Aharanov-Bohm Effect

3.4 Maxwell Equation in terms of A and ϕ

3.5 Solution for A and ϕ