PHYS 462 (optics) HW#6

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1 8.43

This wave starts as $\tilde{E} = k\begin{bmatrix}1\\ i\end{bmatrix}$. The eighth wave plate will speed the x component by 1/8 its of a cycle so $\tilde{E} = k\begin{bmatrix}1/\sqrt{2}(1-i)\\ i\end{bmatrix}$.

2 8.44

Basically I see a polariser polarizing the light in one direction then the light passing through a half wave plate at 45°. this causes the light to switch polarization so it is now rotated 90° off of the original polariser. Finally it passes through a polariser with the same polarization as the first polariser and is entirely blocked since it is at 90°.

3 8.50

From 8.32 $\Delta\phi = 2\pi/\lambda l(\Delta n) = 2\pi/\lambda l(\lambda K E^2) = 2\pi l K(V/d)^2$

4 8.54

4.1 a

The first one is horizontal and the second is right handed of a intensity 3 times that of the first beam.

4.2 b

We have the Jones vectors $\begin{bmatrix}1\\0\end{bmatrix}$ and $\begin{bmatrix}\sqrt{3/2}\\ i\sqrt{3/2}\end{bmatrix}$. We can add these using POS to get $\begin{bmatrix}1+\sqrt{3/2}\\ i\sqrt{3/2}\end{bmatrix}$. We then get a set of stokes parameters $(4+\sqrt{6}, 1+\sqrt{6}, 0, 3+\sqrt{6})$.

4.3 c

The degree of polarization is one.

4.4 d

well this would be the polarizations $\begin{bmatrix}1\\0\end{bmatrix}$ and $\begin{bmatrix}0\\1\end{bmatrix}$ so we would get $\begin{bmatrix}1\\1\end{bmatrix}$. This is $(2, 0, 2, 0)$.

5 8.55

$$\frac{1}{2}\begin{bmatrix}1 & 0 & 1 & 0\\0 & 0 & 0 & 0\\1 & 0 & 1 & 0\\0 & 0 & 0 & 0\end{bmatrix} \cdot \begin{bmatrix}1\\0\\0\\0\end{bmatrix} = \begin{bmatrix}1/2\\0\\1/2\\0\end{bmatrix}$$

This has half of the original radiance and is fully polarized.

6 8.62

In 60 we would see the same light emerging as we put in since all of the light is travelling along the slow axis. For 61 we do have a component along the fast axis and another along the slow axis, since the beam is at 45° to the polariser we know why will happen, it will change phase by 90° and emerge as vertically polarized light.

7 8.71

These lenses will take vertically polarized light and make it circularly polarized. The first one will take vertical light to R state and horizontal light to L state the second one does the opposite vertical to L horizontal to R.