EC-89
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Elliptical Polarisation :-

When the field components E_x and E_y have different magnitude but have 90' phase diff. then the resultant field envelopes results is elliplically polarisation.

We know that,

$$\vec{E} = E_x \vec{E}_x + E_y \vec{E}_y$$

Let the magnitude of E_x and E_y be E_{m_z} and respectively, therefore

$$E_x = E_{m_z} \sin \omega t \quad \text{——} (1)$$

$$E_y = E_{m_z}(90^\circ - \omega t) = E_{m_z} \cos \omega t$$

$$\therefore \vec{E} = E_{m_z} \sin \omega t \, \vec{\delta}_x + E_{m_z} \cos \omega t \, \vec{\delta}_y \quad \text{——} (2)$$

$$|E| = (E_{m_z} \sin \omega t)^2 + (E_{m_z} \cos \omega t)^2$$

$$= E_x^2 + E_y^2$$

Now, from eq. (1) and (2), we get,

$$\frac{E_x}{E_{m_z}} = \sin \omega t \text{ and } \frac{E_y}{E_{m_z}} = \cos \omega t$$

$$\therefore \sin^2 \omega t + \cos^2 \omega t = 1 = \frac{E_x^2}{E^2_{m_z}} + \frac{E_y^2}{E^2_{m_z}} \quad \text{——} (3)$$

Thus, the locus of the above eq. (3) is ellipse. This is why it is called elliptically polarised.