Ninth lecture

Polarization

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Electric and Magnetic Fields

the light wave exhibits both electrical and magnetic properties, and, hence, the name electromagnetic radiation. the sun or from a lamp. Nevertheless, electrical and magnetic fields make up electromagnetic radiation. traveling light waves can characterized by a simple sine function. Its equation is:

$$y = A \sin(2\pi f t)$$

where y is the height of the wave or vibration from the reference plane at time t. The wave has an amplitude (i.e. peak height) of A and frequency f. In reality, an electromagnetic wave consists of two types of vibrations, one representing the electrical component, the other the magnetic component. The two waves lie in perpendicular planes with respect to each other, as shown by the simplified diagram in Figure [1].

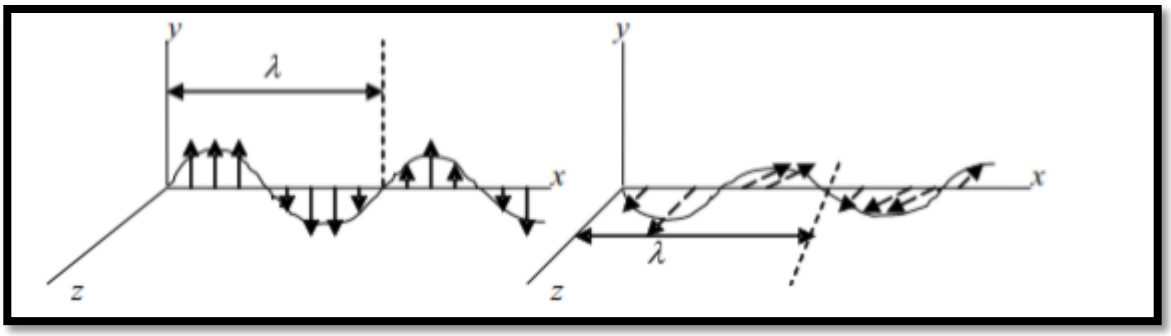

Figure [1]: Electric and magnetic fields

- The figure on the left hand side represents the electrical wave. The electrical wave lies on the plane of the paper on which it is drawn, i.e., the x-y plane. For the corresponding case, the magnetic wave is shown on the right hand side. Here the wave oscillates in the x-z plane, i.e., in a plane perpendicular to the paper. The two waves, the electrical wave on the left and the magnetic wave on the right, lie in planes perpendicular to each other and the light wave is a composite of both. The light we orientations and planes. receive from typical sources have the electrical waves existing in many different
- In each case, the magnetic wave will be in a plane perpendicular to the electrical wave. Thus, light from such sources are called un-polarized, i.e. the electric wave (or field) is not preferentially confined to any one plane. A vector is a quantity which has a magnitude and a direction. We also use the terminology E-vector to denote the electrical wave. The E-vector lies in the x-y plane. The corresponding magnetic wave, called the B-vector is confined to the x-z plane as shown in figure[1] by the dashed arrows. The wavelength of the electrical, magnetic, and light wave are all the same, equal to λ .