1.9 REFERENCES

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3. Introductory University Optics, PHI Learning, New Delhi, 1998.

7.7. RECTILINEAR PROPAGATION OF LIGHT

With the help of the theory discussed so far we can explain the rectilinear propagation of light. Suppose a plane wavefront of monochromatic light is made to incident on a screen with square aperture *ABCD* and whole of the wavefront except *ABCD* portion is blocked by the screen as shown in the figure 7.10. Let *P* be a point at which the intensity of the light is required and its pole *O* with respect to the aperture *ABCD* is well inside from the edges. Taking *O* as centre if we draw the half period zones in the incident wavefront then the number of the wavefronts will be quite large before they intersect the edges *AB*, *BC*, *CD*, and *DA*. Thus practically all the effective zones are exposed and the resultant amplitude at *P* due to aperture *ABCD* is given by equation (7.10). This amplitude is equal to the one half that due to the first zone and since the areas of these zones are extremely small, we can consider the light to be travelling along a straight line along *OP*. This condition is the same as if the screen with square aperture *ABCD* was removed.

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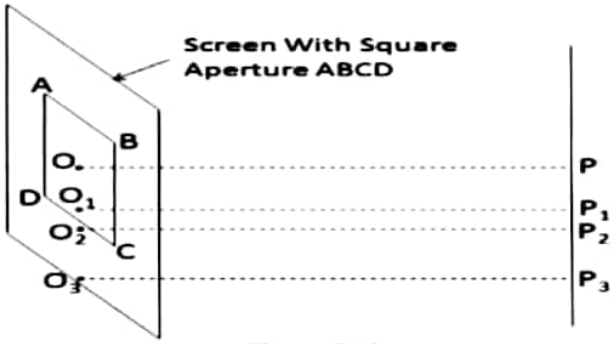

Figure 7.10

The poles O_1 and O_2 of the points like P_1 and P_2 on the screen lie very close to edges of the aperture $ABCD$. If we draw the half period zones around these poles then some of the zones are obstructed and some are exposed. Thus there will be neither uniform illumination nor complete darkness at points P_1 and P_2. For the points near the edges the light, therefore, enters into the geometrical shadow region. The point P_3 is well inside the geometrical shadow region and its pole is O_3. Since the amplitude at a point due to a zone decreases on increasing its order, almost all the effective zones around O_3 are cut off. The amplitude reaching at P_3 is nearly zero and there is a complete darkness. This is possible only when light travels along a straight line.

From the above mentioned facts this may be concluded that there is almost uniform illumination at the points whose poles lie well inside the edges of the aperture and complete darkness at the points whose poles lie well outside the edges. This strongly supports the rectilinear propagation of light. There is a slight deviation from the rectilinear path for the points whose poles lie very close to the edges. However due to very small value of the wavelength of light this region is very small as compared to whole of the aperture. Thus as a whole the propagation of the light may be considered along a rectilinear path.

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