

S.G.V.C Vidya Prasarak Trust's

M.G.V.C ARTS, COMMERCE AND SCIENCE COLLEGE MUDDEBIHAL

DEPARTMENT OF PHYSICS

Teachers Use ICT enabled tools for Effective teaching learning process

Name of the Staff Member: Annapurna Katti

Topic- Diffraction Of Light

Class: B.Sc-III Semester

Date: 06.12.2023

Time: 9:30 to 10:30am



PRINCIPAL,

M.G.V.C. Arts, Commerce & Science College
MUDDEBIHAL-586212. Dist: Vijayapur.

S.G.V.C Vidya Prasarak Trust's

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DEPARTMENT OF PHYSICS



**M.G.V.C ARTS, COMMERCE AND SCIENCE
COLLEGE MUDDEBIHAL**

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DIFFRACTION OF LIGHT

PRESENTED BY

A. B. KATTI

DIFFRACTION:

- × The phenomenon of bending of light waves around edges of small obstacles and hence it's spreading into the geometrical shadow of the obstacle is called diffraction.
- × The diffraction effects were first observed by Grimaldi in 1665.
- × The effects can be observed only when the size of the obstacle is very small and comparable to the wavelength of light.

FRESNEL'S DIFFRACTION:

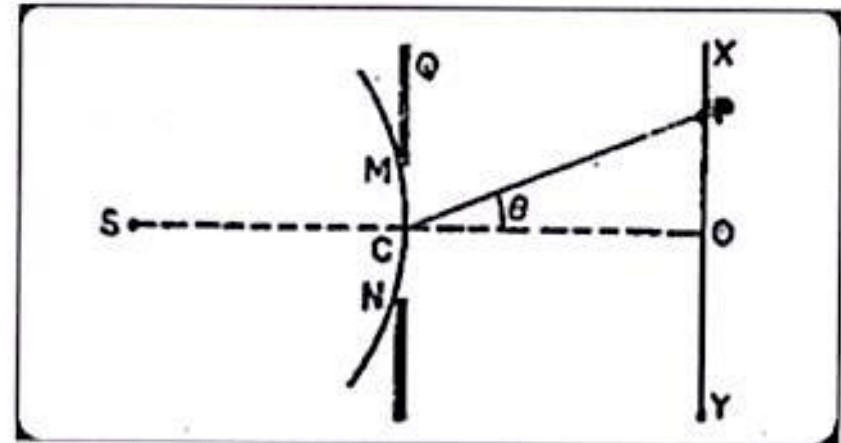
- × 1. The source of light and the screen on which the diffraction pattern is observed are at finite distance from the obstacle or aperture
- × 2. The incident wave front and the diffracted wave fronts are spherical or cylindrical.
- × 3. The incident beam is a divergent beam whereas the diffracted beam is a convergent beam.

FRAUNHOFER'S DIFFRACTION

- × 1. The source of light and the screen on which the diffraction pattern is observed are at infinite distance from the obstacle or aperture.
 - 2. The incident wave front and the diffracted wave fronts are plane wave fronts.
 - × 3. The incident beam is a parallel beam and the diffracted beam is also parallel beam.
-

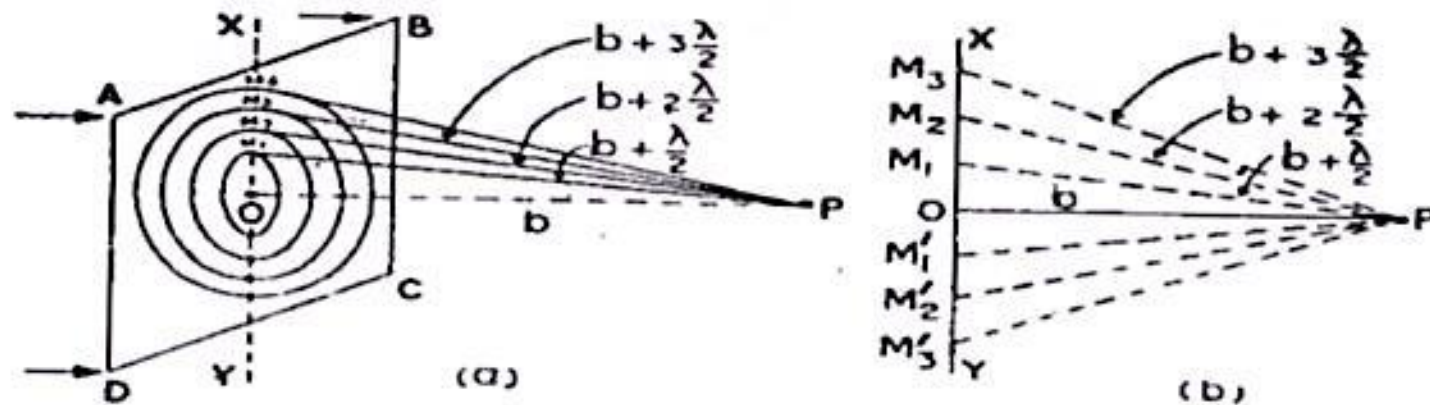
Fresnel's assumptions

Fresnel in 1815, combined the Huygens principle of wavelet and the principle of interference to explain the bending of light around obstacles and also the rectilinear propagation of light.



- According to Huygens' principle, each point of a wavefront (wavefront is a locus of points in a medium that are vibrating in same phase) is a source of secondary disturbance and wavelets coming from these points spread out in all directions with the speed of light. The envelope of these waves constitute the next wavelet.

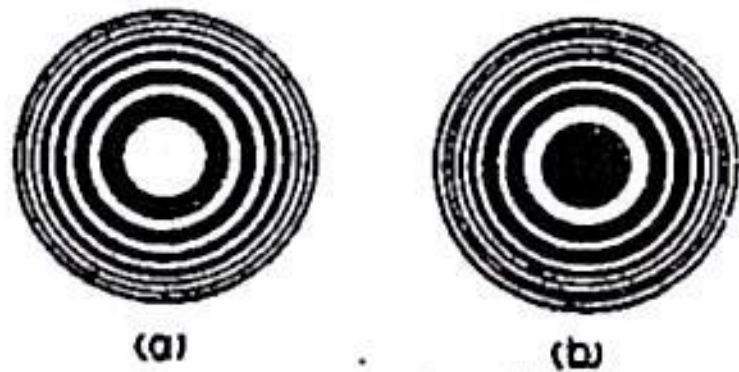
DIVISION OF WAVEFRONT INTO FRESNEL'S HALF PERIOD ZONES



- ABCD is a plane wave front of monochromatic light of wavelength λ . The diagram shows the plane wave front as perpendicular to plane of the paper. Consider a point P at a distance b from the wave front at which amplitude due to the wave is to be found.

- To find the resultant amplitude at P due to entire wave front, Fresnel assumed the wave front to be divided into a number of concentric half period zones.

ZONE PLATE:



A zone plate is a specially constructed screen such that light is obstructed from every alternate zone. The correctness of Fresnel's method in dividing a wave front into half period zones can be verified with the help of zone plate.

•A zone plate is constructed by drawing concentric circles on a white paper such that radii are proportional to the square root of the natural numbers. The odd numbered zones (i.e. 1st, 3rd, 5th ...) are covered with black ink and a reduced photograph is taken.

•The negative of the photograph appears is as shown in Fig. (a). The negative shows odd zones are transparent to incident light and even zones will cut off light. This is a positive zone plate. If odd zones are opaque and the even zones are transparent then it is a negative zone plate. Fig. (b)

Dispersive power of grating

Dispersive power of a grating is its ability to split the white light into its constituent colours and show them distinctly.

$$\text{Dispersive power } (\omega) = \frac{\text{change of angle of diffraction}}{\text{change in wavelength of light}} = \frac{d\theta}{d\lambda}$$

For a grating $(a + b) \sin\theta = n\lambda$