
Modern Optics: Advanced optics

FRAUNHOFER DIFFRACTION

Exercises' sheet No 4

Nov. 2017

Exercise 1 *Fraunhofer diffraction*

Assuming that we have a plane wave as the illumination for the aperture on Fig. 2, calculate the Fraunhofer diffraction pattern of the double slit (Fig. 2a) and the grating (Fig. 2b). The distance between the slits is Δ and we only consider that there are N slit in the grating.

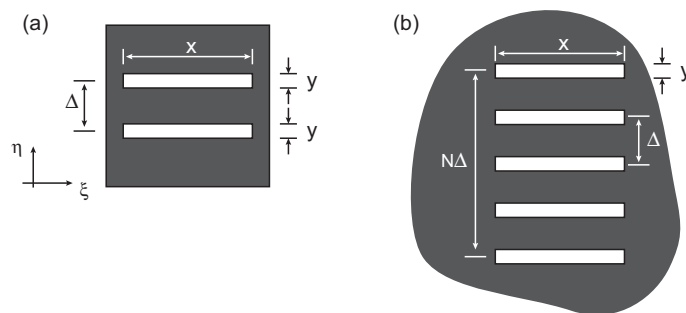


FIGURE 1 – (a) double slit experiment and (b) a grating

Exercise 2 *Fraunhofer diffraction pattern*

Find an expression of the intensity distribution in the Fraunhofer diffraction approximation for the two type of aperture shown on Fig.

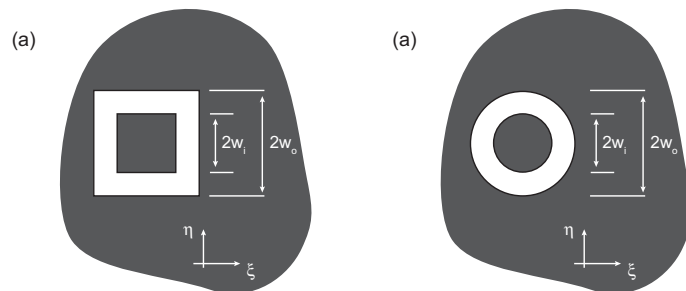


FIGURE 2 – (a) double slit experiment and (b) a grating

Exercise 3 *Diffraction limit*

1. What is the theoretical range of limit of resolution of a human eye^(*)? The size of the pupil can vary from ~ 1.5 mm to 6 mm?
2. In comparison, what is the theoretical limit of resolution of a 5 m diameter telescope?

3. The Rayleigh criterion is based on incoherent illumination of the source. What would happen if both point-source object are coherently illuminated?
[*hint : write the intensity generated by both objects.*]

(*) In both case we assume that the illumination is 560 nm.