Review: Diffraction

Review: Diffraction

Review: Diffraction

Review: Diffraction

Exercise-1: Diffraction patterns from narrow slits

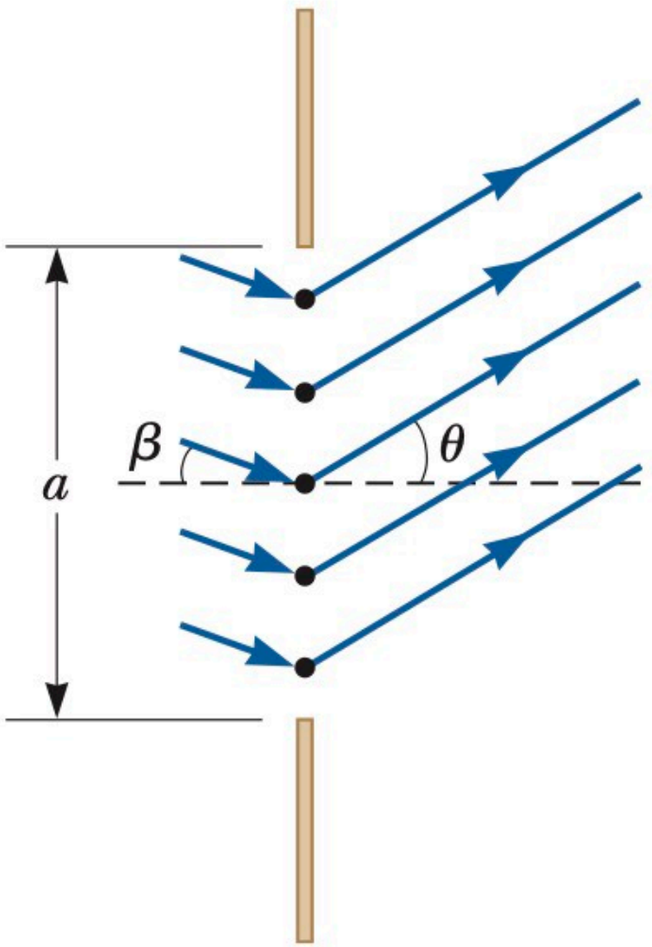
A screen is placed 50.0 cm from a single slit, which is illuminated with light of wavelength 690 nm. If the distance between the first and third minima in the diffraction pattern is 3.00 mm, what is the width of the slit?

Exercise-2: Diffraction patterns from narrow slits

Suppose light strikes a single slit of width a at an angle β from the perpendicular direction as shown in the figure. Show that the condition for destructive interference, must be modified to read $\sin\theta_{\text{dark}} = m\frac{\lambda}{a} - \sin\beta$; where $m = \pm 1, \pm 2,...$

Exercise-3: Circular aperture and resolution

The angular resolution of a radio telescope is to be 0.100° when the incident waves have a wavelength of 3.00 mm. What minimum diameter is required for the telescope's receiving dish?



Exercise-4: Circular aperture and resolution

A circular radar antenna on a Coast Guard ship has a diameter of 2.10 m and radiates at a frequency of 15.0 GHz. Two small boats are located 9.00 km away from the ship. How close together could the boats be and still be detected as two objects?

Exercise-5: Diffraction grating

A helium–neon laser ($\lambda = 632.8$ nm) is used to calibrate a diffraction grating. If the first-order maximum occurs at 20.5°, what is the spacing between adjacent grooves in the grating?

Exercise-6: Diffraction grating

Light of wavelength 500 nm is incident normally on a diffraction grating. If the third-order maximum of the diffraction pattern is observed at 32.0°, (a) what is the number of rulings per centimeter for the grating? (b) Determine the total number of primary maxima that can be observed in this situation.

Exercise-7: Polarization of light waves

The critical angle for total internal reflection for sapphire surrounded by air is 34.4°. Calculate the polarizing angle for sapphire.

Exercise-8: Polarization of light waves

Three polarizing plates whose planes are parallel are centered on a common axis. The directions of the transmission axes relative to the common vertical direction are shown in the figure. A linearly polarized beam of light with plane of polarization parallel to the vertical reference direction is incident from the left onto the first disk with intensity $I_i = 10.0$ units (arbitrary). Calculate the transmitted intensity I_f when $\theta_1 = 20.0°$, $\theta_2 = 40.0°$, and $\theta_3 = 60.0°$.