Modern Optics: Homework 23

Due: 13 November 2015

1 Diffraction from a circular aperture

A helium-neon laser with wavelength 632.8 nm is equipped with an exit aperture of diameter 2.0 mm.

a) Determine the exact angle at which the first minimum occurs.

b) Suppose that this is projected onto a wall, at a distance of 3.0 m from the aperture. Determine the diameter of the central bright disk.

2 Bennett, *Principles of Physical Optics*, 6.8, page 297.

3 Angular resolution

Two pointlike LEDs, which emit light with wavelength 540 nm are 5.0 mm apart. These are observed by a single eye whose pupil has diameter 4.00 mm.

a) Determine the maximum distance from the eye at which these must be so that diffraction limits the ability to distinguish between the two LEDs.

b) Suppose that eye is just beyond the maximum distance. How would the wavelength emitted by the LED have to be changed so that the diffraction no longer limits the distinguishability of the LEDs.

c) Does it appear that diffraction actually limits the ability of the eye to distinguish such light sources.