C1.0 DIFFRACTION

A distant point source of light, when imaged by a circular lens or mirror displays the familiar airy intensity pattern around the image point. Instead of a single point image, the image is a bright central disc surrounded by a series of progressively weaker dark and light rings. The width of the central maximum is governed by the diameter of the circular aperture and the wavelength of the light in the relationship

$$\theta = \frac{\lambda}{D} \text{ radians}$$

where θ is the angular spread of the central maximum between the half power intensity points, is the wavelength of the light, and D is the diameter of the circular aperture. The Rayleigh criterion according established by Lord Rayleigh, states that the images of two point sources are resolved if the central maximum of one coincides with the first dark ring of the other. This angular resolution, θ_r, is defined by

$$\theta_r = \frac{1.22\,\lambda}{D} \text{ radians}$$

The combined intensity curve of the images of the two points has a slight dip between the peaks.

Figure C-1 illustrates the numerical relationship between aperture size and diffraction limited angular beamwidth at an operating wavelength of 500 nm. Beamwidth varies linearly with wavelength for the same aperture, so the beamwidths at 1,000 nm and 250 nm are twice and half that for the 500 nm cases, respectively.