The *first* intensity *zero* (*i.e*. a diffraction intensity *minimum*) associated with the diffraction of a plane wave through a circular aperture of radius R occurs at:

$$\sin\theta = \frac{3.8317}{kR} = \frac{3.8317\lambda}{2\pi R} = \frac{1.2197\lambda}{D} \simeq \frac{1.22\lambda}{D}$$

where θ is the angle from the symmetry axis (*e.g*. *z*-axis) of the circular aperture.

The situation for acoustic diffraction for sound waves of wavelength λ diffracting through a circular aperture of radius R is the same as that for light/EM waves of wavelength λ diffracting through a circular aperture of radius R. In the latter case, the *bright central annular region* is known as the so-called *Airy Disk*. Most of the intensity/power (~ 98.3%) is contained within this central region.

Acoustic Diffraction *and* Interference:

In the real world, *both* diffraction and interference effects operate simultaneously. For example, a stereo system consisting of two loudspeakers, each of radius R separated by a transverse distance *a* will have an overall intensity pattern, $I_{tot}(\theta)$ arising from the *product* of the intensity pattern associated with *interference* effects arising from the two speakers, *modulated* by the intensity pattern associated with sound *diffraction* effects associated with a *single* loudspeaker, since the latter is a phenomenon common to/operative on *both* loudspeakers. Thus, the overall intensity pattern e.g. associated with a pair of stereo loudspeakers is given by:

$$I_{tot}(\theta) = I_{interference}(\theta)\bullet I_{diffraction}(\theta)$$

Additional info & plots on 1-D and 2-D diffraction and diffraction & interference are available on the Physics 406 Software webpage at the following URL:

http://courses.physics.illinois.edu/phys406/406pom_sw.html