Rayleigh, Mie, and Optical Scattering

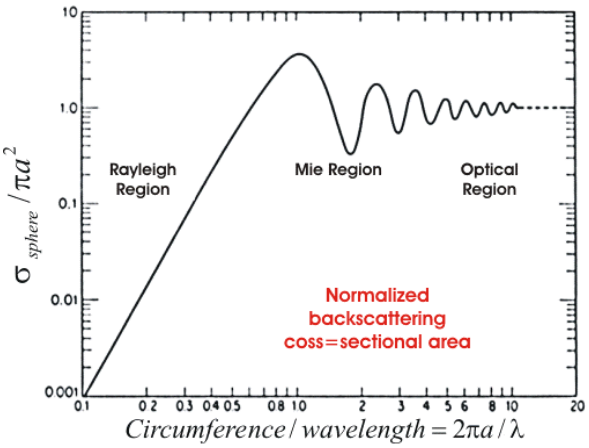

Figure 4.2 Normalized backscattering cross-sectional area of a sphere as a function of circumference normalized by radar wavelength λ. a = radius. From Skolnik, 1980, Introduction to Radar Systems, with permission of McGraw-Hill, Inc.

Good explanation on Web at: hyperphysics.phy-astr.gsu.edu/hbase/atmos/blusky.html

Back scatter from raindrop

$$\sigma = \frac{\pi^5 |\kappa|^2 D^6}{\lambda^4}$$

Where $|\kappa|^2$ is a parameter related to the complex index of refraction of the material. For water it is normally taken as 0.93, and for ice 0.197.

Radar reflectivity ($m^2 m^{-3}$):

$$\eta = \sum_{Unit\ Volume} \sigma_i = \frac{\pi^5 |\kappa|^2}{\lambda^4} \sum D^6 = \frac{\pi^5 |\kappa|^2}{\lambda^4} z$$

$$\boxed{\eta = \frac{\pi^5 |\kappa|^2}{\lambda^4} z}$$

Radar reflectivity factor (m^3)

$$\boxed{z = \sum_{Unit\ Volume} D^6}$$

Why do we need two factors?