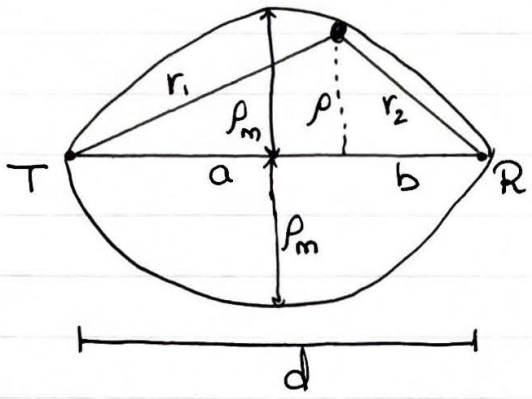
Minor Radius of ellipsoid to be in 1st Fresnel zone



$$\Delta L = r_1 + r_2 - d = \sqrt{a^2 + \rho^2} + \sqrt{b^2 + \rho^2} - a - b$$

$$= a\left[1 + \left(\frac{\rho}{a}\right)^2\right]^{1/2} + b\left[1 + \left(\frac{\rho}{b}\right)^2\right]^{1/2} - a - b$$

$$= a\left[1 + \frac{1}{2}\frac{\rho^2}{a^2}\right] + b\left[1 + \frac{1}{2}\frac{\rho^2}{b^2}\right] - a - b$$

$$= \frac{1}{2}\rho^2\left(\frac{1}{a} + \frac{1}{b}\right)$$

For 1st fresnel zone →

$$\Delta L \ll \frac{\lambda}{2}$$

$$\therefore \frac{1}{2}\rho^2\left(\frac{1}{a} + \frac{1}{b}\right) \lesssim \frac{\lambda}{2}$$

$$\rho \lesssim \sqrt{\frac{\lambda ab}{a+b}}$$

For $\rho_m \Rightarrow a = b = \frac{d}{2}$ → $\rho_m \lesssim \frac{1}{2}\sqrt{\lambda d}$

Pass Grain Factor (F)

* Voltage received from direct wave :-

$$V_d = f(\theta) \frac{1}{4\pi R_1} e^{-jkR_1}$$

* Voltage received from reflected wave :-

$$V_r = f(\theta) \frac{1}{4\pi R_2} e^{-jkR_2} \rho e^{j\phi}$$

* The total received voltage :-

$$V_t = V_d + V_r = f(\theta) \frac{1}{4\pi R_1} e^{-jkR_1} \left[1 + \rho e^{j\phi} e^{-jk(R_2 - R_1)}\right]$$

$$= V_d \left[1 + \rho e^{j\phi} e^{-jk\Delta R}\right]$$

$$= V_d F$$

$$\therefore F = \left|1 + \rho e^{j\phi} e^{-jk\Delta R}\right|$$

with divergence factor :-

$$F = \left|1 + D \rho e^{j\phi} e^{-jk\Delta R}\right|$$