

McLean seminar

Sec.2 2.8 Exercises Problem 6
2024.5.10

Problem 6

5 What is the expected value of the Fried parameter at a wavelength of 500 nm if the observed seeing is 0.5 arcsec? What is the corresponding value of r_0 at 1.65 microns in the infrared assuming Kolmogorov turbulence? For a 10 m telescope, how many sub-apertures does this imply for infrared observations?

6 Determine the size of the isoplanatic patch and the isokinetic patch at the 0.5-micron wavelength for the case in Problem 5 assuming a turbulent layer at 5 km above the telescope.

In Problem 5, with the observed seeing is 0.5", the expected value of r_0 at the 0.5 μm can be derived as follows:

$$r_0 = \lambda / \text{seeing} = \frac{0.5 \mu\text{m}}{0.5''} = \frac{0.5 \times 10^{-6} \text{ m}}{0.5 \times \frac{\pi}{180 \times 3600}} = 0.2 \text{ m}$$

Therefore, assuming a 10 m telescope and a turbulent layer at 5 km above it, the sizes of isoplanatic patch (θ_{ip}) and the isokinetic patch (θ_{ik}) can be determined,

$$\theta_{ip} = 0.314 \frac{r_0}{H} = 0.314 \frac{0.2 \text{ m}}{5 \text{ km}} = 2.6'', \quad \theta_{ik} = 0.3 \frac{D}{H} = 0.3 \frac{10 \text{ m}}{5 \text{ km}} = 124''$$

$$\theta_{ip} \ll$$