Exercises Astronomical Observing Techniques, Set 4

Exercise 1

a) Calculate the theoretical resolution (in arcsec) of a 3.6m telescope observing at a wavelength of 500 nm.

b) The Fried parameter (r_0) of the atmosphere is 20 cm at a wavelength of 500 nm. Calculate resolution of the telescope (in arcsec) looking through the atmosphere.

c) What is resolution (in arcsec) at 2 μm using the information in 1b?

d) A 2k $\times$ 2k CCD camera is placed in Prime Focus operating at 500 nm. The telescope has a focal length (f) of 10 m, we want to have 4 pixels per resolution element using the atmospheric conditions described above (1b). Calculate the pixel size and the resulting Field of View (FOV).

Exercise 2

Discuss the advantages/disadvanges of the Coudé over the Nasmyth focus.

Exercise 3

Show that a rotating liquid mirror has a paraboloid shape. The mirror rotates with an angular velocity ω. Use x for the horizontal distance to the centre of the liquid mirror and y for the vertical height.

Exercise 4

The flux of a star is reduced by absorption from the atmosphere: $I = I_0 e^{-\tau}$, with
τ = Airmass $\times \int \rho(z)\kappa\, dz.$, κ the absorption coefficient and z the altitude. The Airmass is given by $1/cos(\theta)$, with θ the zenith angle. The optical depth (τ) is in practice difficult to calculate as $\rho(z)$ and κ are not precisely known. Show that if we do two measurements of the received flux (I_1, I_2) at different Airmasses (A_1, A_2) we can find I_0 (assuming the properties of the atmosphere do not change with time).