# Astronomical Observing Techniques 2013: Exercises on Telescopes (Due on 8 October 2013 at 11:15)

September 25, 2013

## 1 Focal length of a convex lens

In the dungeons of an observatory you find a convex lens of unknown focal length. How would you determine the focal length of this lens only using a millimeter-scale ruler? Hint: It is a sunny day.

## 2 Resolution and field

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 the resolution of the telescope (in arcsec) looking through the atmosphere.

c) What is the resolution (in arcsec) at 2 $\mu$m using the information in 1b?

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

## 3 Tolerancing of a telescope primary mirror

What is the tolerance (maximum allowable deviation from the theoretical value) on the radius of curvature of the (parabolic) primary mirror of a 50-cm diameter telescope with a primary focal length of 2 m for it to remain diffraction-limited at the original primary focus position at 500 nm?

## 4 Instrument locations

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