

Astronomical Observing Techniques 2014:  
Exercises on Telescopes  
(Due on 23 September 2014 at 09:00)

September 15, 2014

## 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 using only a millimeter-scale ruler (no cost version from Ikea ;-)? Hint: It is a sunny day.

## 2 Resolution and field

- a) Calculate the theoretical resolution (in arcsec) of a 3.6-m 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  $\mu\text{m}$  under the same conditions as in 1b?
- d) A  $2\text{k} \times 2\text{k}$  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 in 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/disadvantages of an instrument in the Cassegrain focus of an equatorially mounted telescope over an instrument located in the Nasmyth focus of a telescope on an alt-azimuth mount.