

Astronomical Observing Techniques 2016:
Exercises on Telescopes
(Due on 22 February 2016 at 11:15)

February 15, 2016

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 μm under the same conditions as in b)?
- d) A $2\text{k} \times 2\text{k}$ pixel CCD camera is placed in the prime focus of the telescope 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 b). 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.