

HOMework SET 6

Due October 1, Thursday

1. (a) Using the Rayleigh criterion, estimate the theoretical diffraction limit for the angular resolution of a typical 20-cm (8-in) amateur telescope at 550 nm. Express your answer in arc-seconds.

(b) Using the information in Appendix C, estimate the minimum size of a crater on the Moon that can be resolved by a 20-cm (8 in) telescope.

(c) Is this resolution limit likely to be achieved? Why or why not?

2. Scientific instrument in the Coude Lab of the New Solar Telescope (NST) is designed to reach diffraction limit of the 1.6-meter telescope in G-band with a wavelength of 430.1 nm. A 2048 by 2048 CCD with a pixel size of $7.5 \mu\text{m} \times 7.5 \mu\text{m}$ is employed to capture image. In compliance with Rayleigh criterion and Nyquist sampling theorem (one pixel corresponds to a half of the NST diffraction limited resolution),

(a) Calculate the image scale (arc-second/pixel) on the CCD.

(b) Calculate the maximum available field of view.

3. The NJIT observatory has a computer controlled 10" Meade LX200GPS telescope. We can use this telescope with an SBIG STL1301 CCD camera for "deep sky" imaging, or use a simple webcam for planetary and lunar imaging. The telescope is an f/10 system, and the two CCD cameras have the following specifications:

CCD	Kodak KAF-1301E	TouCAM II VGA CCD
Pixel Array	1280 x 1024 pixels 20.4 x 16.4 mm	640 x 480 pixels 3.58 x 2.69 mm
Total Pixels	1,310,720	307,200
Pixel Size	16 x 16 microns	5.6 x 5.6 microns
Full Well Capacity (NABG)	~120,000 e ⁻	?
Dark Current	0.5e ⁻ /pixel/sec at -30° C	?

(a) What is the image scale of the TouCAM II VGA CCD (arc-second/pix)?

(b) What is the field of view of the TouCAM II VGA CCD camera, in arc-minutes?