

Astronomical Observations (Fall 2002)

Midterm Exam

5 November 2002, Tuesday 18:00~20:00

1. The 1-meter telescope at Lulin Observatory has a focal length of 8000 mm. The telescope is equipped with a CCD camera, with 2048 x 2048 pixels, each pixel of physical dimension of 13 micron x 13 micron. (1) What is the theoretical diffraction limit of the telescope optic, in unit of arcsecond? (2) Calculate the field of view of the camera. (15 points)

2. The probability that an electron is at a distance r from the center of the nucleus of a hydrogen atom is given by
$$P(r) = Cr^2 e^{-r/R}$$
(1) Evaluate the constant C . (2) Find the mean radius $\langle r \rangle$ and its standard deviation. (10 points)

3. Describe the advantages and disadvantages, optically and mechanically, of a reflecting telescope (using mirrors) versus a refracting telescope (using lenses). Why are all large, modern telescopes reflectors? (15 points)

4. Compare the performance among the three kinds of detectors, an eye, a photographic plate, and a charge-coupled device, in terms of quantum efficiency, linearity, dynamical range, ease of storage, cost, etc. (20 points)

5. What kind of effects does the Earth's atmosphere have on astronomical observations? Be as elaborative as possible. (20 points)

6. The Sun moves to the vernal equinox around March 21 every year. The Galactic center has equatorial coordinates of Right Ascension 17h, and Declination -30 degrees. What is the best time of the year (i.e., highest up in the sky at midnight) to observe the Galactic center from Taiwan? From the United States? What is its maximum elevation of the Galactic center above the horizon seen in Taiwan? (10 points)

7. In a dark, clear night sky, how does one distinguish a planet from a regular 'fixed' star? Why? (10 points)