Problem Set 2

Due: February 13th at 17:00

Problem 1. Included alongside this assignment are 6 data files and a python script. The data files "* filter_response.txt" are the response curves for the SDSS filter system, while the file Spectrum.dat contains the simulated black body spectrum for a star with some radius and temperature, and which lies some distance from the Earth. Within the python script, there is code which will load these responses and the spectrum for you.

Using these and the stars parallax, calculate what the apparent and absolute magnitude of this star is in each filter in the AB system. Then, estimate the stars temperature based on its absolute magnitude and its colour.
10 marks

Problem 2. Proxima Centauri (α-Centauri C) is the closest star to the Sun and is part of a triple star system. It has the epoch 1950.0 coordinates $(\alpha, \delta) = (14\,\mathrm{hr}\,26.3\,\mathrm{min}, -62^{\mathrm{o}}28')$ while the centre of the system is located at $(\alpha, \delta) = (14\,\mathrm{hr}\,36.2\,\mathrm{min}, -60^{\mathrm{o}}38')$.
(a) What is the angular separation of Proxima Centauri from the centre of the triple star system?
(b) If the distance to Proxima Centauri is $4 \times 10^{18}\,\mathrm{cm}$, how far is the star from the centre of the triple system? (Assume the system is oriented perpendicular to our line of sight)
(c) Using the given transformations, precess the coordiantes of Proxima Centauri between 1950.0 and 1990.0
(d) The proper motion of Proxima Centauri is $3.84''\,\mathrm{yr}^{-1}$ with the position angle 282^{o}. Calculate the change in α and δ due to proper motion between 1950.0 and 1990.0
(e) Which effect makes the largest contribution to changes in the coordinates of Proxima Centauri: precession or proper motion?
10 marks

Problem 3. Assume your vision is diffraction limited at λ =5000 Å, and that your eye has a diameter of 8 mm. What angular resolution can you achieve with your unaided eye? How does this compare with the maximum angular size of Venus and Jupiter as seen from Earth? (You will need to look up the radius and distances to both these planets).
5 marks

Problem 4 A charge-coupled device (CCD) detector is mounted at the focus of an f/7 reflecting telescope with a cm mirror. The CCD chip contains 1024x1024 pixels, with each square pixel being on a side.
(a) What is the area (in square arcseconds) of the sky that is imaged on a single pixel?
(b) What is the area (in square arcminutes) of the sky that is imaged on the entire chip? Would the image of the full Moon fit onto the chip?
(c) How many separate exposures would be required to cover the entire celestial sphere (

steradians)?

5 marks