PH2900 (Astronomy)
Problem sheet 2
To be turned in by 5:00 p.m., Wednesday 31 October 2007

1(a): How big of a telescope would one need in order to resolve the equipment left by the Apollo astronauts on the moon? Assume your image is diffraction limited, that the stuff you're trying to see has a size of several metres across, and take $d = 400\,000$ km as an approximate distance to the moon.

(b) Suppose you built such a telescope on the surface of the earth. Would you really be able to see the Apollo equipment? Explain.

(c) How large (in metres) is the smallest feature that you can resolve on the moon with a 25-cm telescope? Make a reasonable assumption for the effects of seeing.

2: Figure 1 shows the 3-metre equatorially mounted Shane telescope.

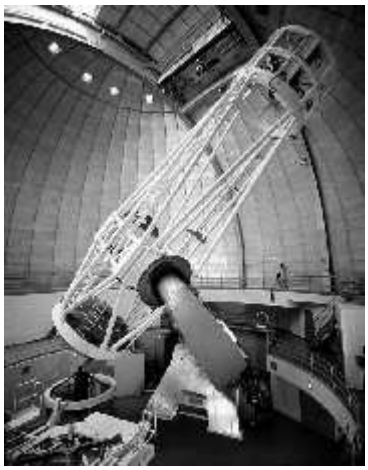

Figure 1: The Shane Telescope.

(a) By looking at the figure, estimate roughly the latitude where the telescope is located.

(b) Estimate roughly the declination and hour angle of the telescope as it is shown.

(c) The star α Centauri has right ascension $\alpha = 14\text{h}40\text{m}$ and declination $\delta = -60^\circ\,51'$. Is it possible to see α Centauri through the Shane Telescope? Explain.

3: A star is observed at different values of the zenith distance z (90° minus the altitude) to have the visual magnitudes shown in Table 1.

Table 1: The zenith distance and visual magnitude for observations of a star (from Smith p 12).

zenith distance	m_V
10°	9.105
20°	9.119
30°	9.146
40°	9.192
50°	9.267

(a) Using a plotting package of your choice (Excel, gnuplot, by hand, etc.) make a plot of the observed magnitude versus $\sec z$.

(b) Extrapolate the data to zero air mass to determine the magnitude of the star above the atmosphere. (For the very keen, do this by fitting a straight line to the data, i.e., a function of the form $f(M) = a_0 + a_1 M$, where M is the air mass.)

(c) A star is observed at an altitude of $45°$ with a visual magnitude as measured on the ground of 8.500. What is its magnitude above the atmosphere?

4: A star is observed with an apparent altitude of $a = 24°37'$. What is the true altitude of the star corrected for the effect of atmospheric refraction? (Use $n = 1.00029$ for the index of refraction of air at the earth's surface.)

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