Stars in Motion - Exercise Sheet

Observational Astronomy

1 Proper Motion

1.1 Observing Proper Motion

After observing the simulation for a while, describe what you've seen. Is Barnard's Star the only star that moves over time? Do the stars all move in the same direction? With the same proper motions?

1.2 Measurement of Proper Motion

Using MaximDL to observe the two images of the star field, find the star that appears to move relative to the others. This is Barnard's Star, which is fairly bright and should be easy to see. Measure its proper motion in arcseconds per year (to the nearest 0.1 arcsec per year). Note if/how you took the difference in pixel dimensions between the two images into account.

1.3 Calculating Transverse Velocity

Given that the distance to Barnard's Star is 1.8 pc calculate its transverse velocity in units of meters per second.

2 Radial Velocity

2.1 Measuring Doppler Shift Using Photographic Plates

Given the image of the overlapped spectra of the star and the iron source, find the wavelength of each stellar emission line and calculate its corresponding Doppler shift. Using this shift, calculate the radial velocity from each individual spectral line. (It might be easiest to plug all the values into a spreadsheet and have it churn out the calculations for you.)

Line	λ (nm)	Shift $\Delta\lambda$ (nm)	Radial Velocity ($m \cdot s^{-1}$)
a			
b			
c			
d			
e			
f			

2.2 Calculating Radial Velocity

Calculate the star's radial velocity by averaging the velocities calculated from each line. The radial velocity of this star is actually $30.4 \times 10^4 m \cdot s^{-1}$, compare your results to this value.

2.3

Is the star approaching the observer or receding? Justify your answer.