Determining Stellar Distance and Magnitude with HIPPARCOS Stars

In this lab, you will take an image of a star field with a bright, named star in the center. You will use PixInsight to perform astrometry on the image and label its brightest stars. Then you will perform calculations on a set of stars of your choosing and record your results compared to a standard source.

Start a new file in Docs, Sheets, Mathematica, or other computer program and answer the questions below. Show as much work as possible for the calculations in order to support your results.

Identify the bright star in your field -- your 'main' star, the one you targeted with the telescope. Answer these questions about the star:

- What is the star's common name?
- What constellation is the star in?
- What is the star's Bayer designation? (http://en.wikipedia.org/wiki/Bayer_designation)
- What is the star's HIP number?
- What is the star's Right Ascension (RA) and Declination (Dec)?
- What is the star's **parallax angle** (according to the Hipparcos measurement, which can be found on Stellarium)
- Calculate the star's **distance from Earth in Parsecs** using the equation we discussed in class
- Look up the distance to the star using Wolfram Alpha. This is your 'expected' value
- Calculate the percent error of this calculation using the standard equation:

  (Measured – Expected) / Expected x 100

The measured value is the one you calculated; the expected value is the value from **Wolfram Alpha**.

- Choose 5 bright HIP stars that are also in your image.
- Label them on the image as A, B, C, D, and E.
- Make a table on your lab sheet and list them to match your image labels, including your main star.
- Look up the distance and magnitude data for these stars in Stellarium or Wolfram Alpha.

Ex. (do not copy and paste)

Star	HIP	m	M	d (pc)
Alhena	31681			
A	32020			
B	31503			
C	32224			
etc.	…			

Using the calculations and equations we worked on in class, show the calculations to answer these questions. **You can use the tool** (Excel, MMA, calculator) **that you used in class to do the math, but you must show the equation that the tool used.** Summarize every answer with a simple sentence in your own words; don't just leave a dangling answer with no explanation.

This site will be useful:
https://www.atnf.csiro.au/outreach/education/senior/astrophysics/photometry_magnitude.html#magnmagcalculations

1. How much brighter is your main star than Star A? Do the calculation and show your work.

2. Compare the absolute magnitude of your main star and Star A. Is your main star really brighter than Star A? Or is it just closer? Support your answer with the numbers.

3. Look at the apparent magnitude and distance to Star B. Calculate the absolute magnitude of Star B with this information. Compare your answer with the absolute magnitude found on Wolfram Alpha and calculate the percent error.

4. Look at the absolute and apparent magnitudes of Star C. How far away is Star C? Calculate the distance in parsecs *and* light years. Calculate the percent error compared to Wolfram Alpha.

5. Look at the distances to Stars D and E. Which is further away from Earth? What is the distance between the two stars? (assume they are in a straight line from Earth, the angle difference is SO small…) Which star is brighter in reality? Show the calculations.

6. Look at the magnitude data for Stars A – E. Which is the brightest as seen from Earth? Which of the five is the brightest star in reality? Give the numbers to support your answers.

7. Look at the distance and magnitude data for your Main Star and Stars A – E. Are any stars closer than 10 pc from Earth? Which are further? For each star, look at its absolute and apparent magnitude -- What pattern or general rule do these numbers follow? Support your answer with specific numbers.