Lab 11
Star Counts
ASTR 250

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1 Objective

To determine the number of stars in the sky at each magnitude interval.

2 Introduction

To approximate the amount of stars enclosed in some given volume we may
do so by making a few simplifications. If we assume a uniform distribution of
stars of the same absolute magnitude in a region of space that has zero dust
extinction we may express the number of stars N as the following:

$logN = K + 0.6m$ Equation 11.7

Where K is a constant 0.6 represents the theoretical slope of a plot of logN as
a function of magnitude.

3 Equipment

Images obtained from the ST-8 camera.

4 Procedure

In IRAF the display library was used to open the image in DS9. Once loaded
the colourmap was inverted and the image printed. 6-8 stars were then located
which were easily identifiable. These stars were then labeled. Next the imex-
amine library was used to measure the brightness of the individual stars using

the epar settings described in the lab manual[1]. After executing imexamine the cursor was placed on each star identified earlier and the r key was pressed. After pressing r the FWHM was determined by the using the a key in the new window. After all the star's FWHM were measured the background noise was measured by pressing the m key while the cursor was placed over a blank patch of sky. This was done a few times and an average standard deviation was calculated.

Next the datapars library in IRAF was setup as described in the lab manual[1]. Next the findpars library was setup in a similar manner. Finally the daofind library was setup and run to find and calculate the magnitudes of the stars. daofind output these magnitudes into a fits file which was then used to generate a histogram.

To create the histogram first the magnitudes were separated from the output file into a new file. Next the histogram library in IRAF was setup to match the settings in the lab manual[1] and to match the name of our magnitudes file. Finally gcur was used to get a hard copy of the plot.

Next the slope was calculated by piping the binned magnitudes from histogram into a new file. AWK was then used to convert these to a logarithmic scale. After this was done the polyfit library in IRAF was setup to match the settings in the lab manual[1] before running it on the logarithmic magnitude file created previously. Poly output the intercept, slope, and corresponding uncertainties.

5   Data and Calculations

See attached data page and graph.

6   Discussion

The slope was determined to be 0.496 ± 0.017 which leaves 0.6 outside the acceptable uncertainties. A lower value is to be expected for the following reasons. First dust is not accounted for in the 0.6 expectation value. Dust will reduce the magnitude and thus reduce the slope value. Secondly we assumed that all the stars are of the same magnitude when in reality there are far more fainter stars than bright one. This again skews the slope to a more downward trend. Thus our result is by no means unreasonable when we consider that we were using real data and equations matching idealized assumptions.

6.1   Bonus

If some process produces a graph with a slope of 0.6 that means that, for that process, the assumptions made were actualy true. This means that the process is not effected by dust, and all instances of the process have uniform magnitude. If the magnitude is known to be uniform the process may be used as a standard

candle for distance using a simple inverse square relation of the flux to determine distance.

7   Conclusion

Although in most cases the assumptions made are highly inaccurate this method provides a means of identifying candidate processes for standard candles. If a process matches this idealized case it has a uniform magnitude which is a very useful thing.

8   References

1. Department of Physics and Astronomy, Astronomy 250 Lab Manual, pp. 96 to 107. (University of Victoria: Victoria, BC). July 2011.