

**SIERRA COLLEGE OBSERVATIONAL ASTRONOMY
LABORATORY EXERCISE**

NUMBER IV.F. TITLE: Photoelectric Photometry of the Pleiades (M-45)

Adapted from 'CLEA', a project sponsored in part by NSF

DATE-	PRINT NAME/S AND INITIAL BELOW:	GROUP <input style="width: 40px; height: 30px;" type="text"/>
DAY-		
LOCATION		

PURPOSE:

- To use a simulated photometer to measure the m_B & m_V magnitudes of stars.
- To make and compare HR diagrams to find the relationship between absolute and apparent magnitudes.
- To determine the distance to a star cluster.

INTRODUCTION/DESCRIPTION:

The computer program you will use is a realistic simulation of a UBV photometer attached to a research telescope. The telescope is controlled by a computer that allows you to move from star to star and make measurements. Different filters can be selected for each observation, and the length of time the photometer samples the starlight (integration time) is adjustable. The computer converts photon counts into apparent magnitudes and provides an estimate of the quality of the collected data.

You will use the instrument to collect data on 24 stars in the Pleiades star cluster. The apparent magnitudes will be measured for each star, in each of two colors (B & V). Since the stars are in a cluster, they are all essentially the same distance from us—this simplifies the analysis considerably.

The B-V color index is the apparent blue magnitude (m_B) minus the apparent visual magnitude (m_V). Using the B-V color indices and apparent V magnitudes, you will plot a Hertzsprung-Russell (HR) diagram.

USING THE COMPUTER SIMULATION AND PROCEDURES:

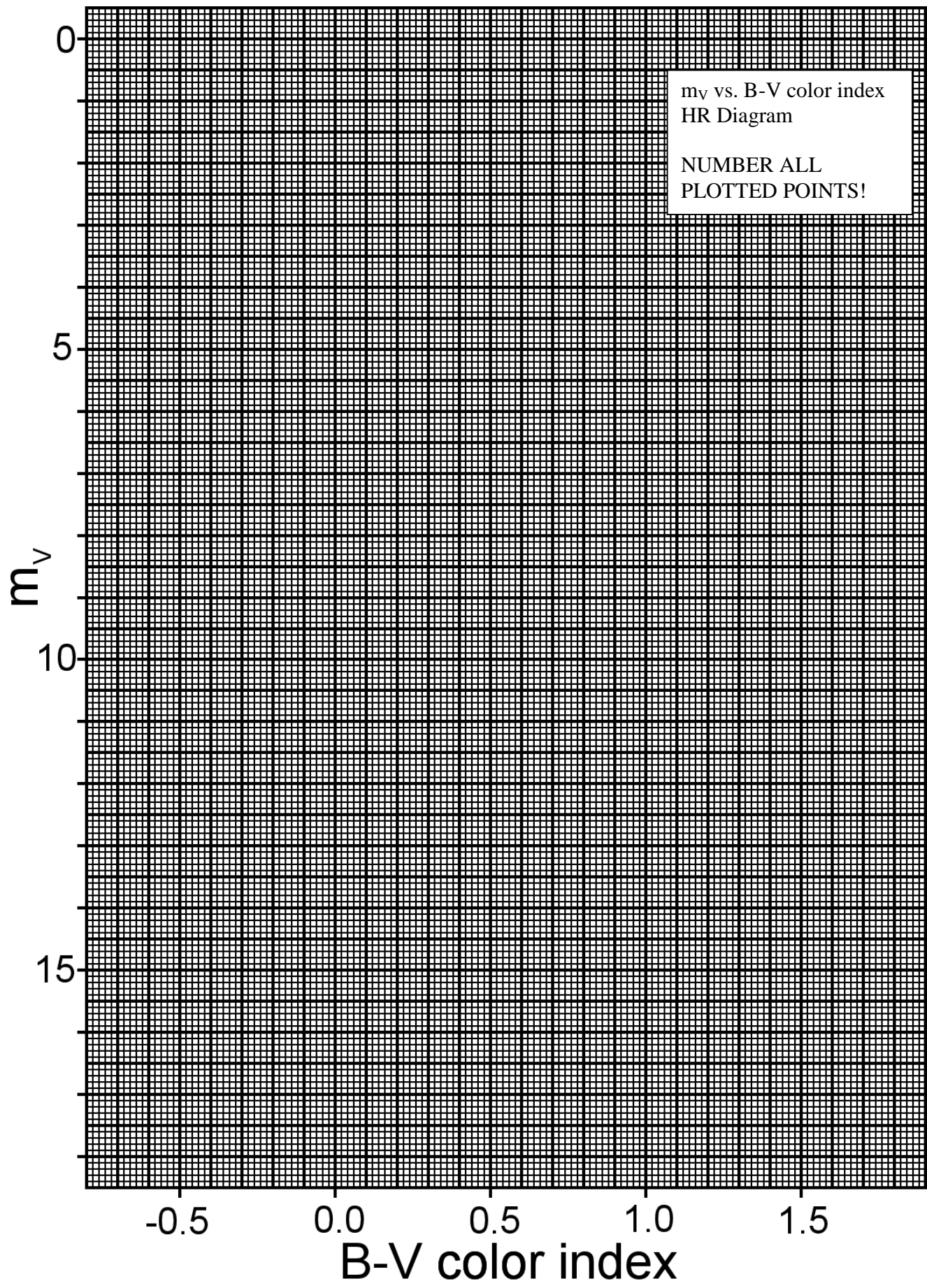
The instructor will guide you through the following steps in data collection:

- Using the program
- Inputting coordinates from Table A
- Taking sky counts
- Signal to noise ratios ($s/n = 100$ or more)
- Taking B and V counts - record to 0.01 magnitude accuracy
- Calculating B-V color index - record to 0.01 magnitude accuracy
- Constructing HR diagram
- Using Equation 1
- Determining the distance to the cluster using graphical methods

$d = 10 \times 10^{(m-M)/5}$ or $d = 10^{(m-M+5)/5}$	Eq. 1
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TABLE A: PHOTOELECTRIC PHOTOMETRY DATA SHEET

Baseline Sky Readings (5 integrations at 10 seconds each)						
Mean sky brightness readings				B: _____	V: _____	
Star Readings (3 integrations at 10 seconds each)						
Note ('x') s/n ratios which are less than 100						
Indicate with an "x" any unreliable data (i.e., either m_B or m_V has $s/n < 100$)						
STAR	RA	Dec	s/n < 100	m_B	m_V	$m_B - m_V$
1	3h 41m 05s	24° 05' 11"				
2	3h 42m 15s	24° 19' 57"				
3	3h 42m 33s	24° 18' 55"				
4	3h 42m 41s	24° 28' 22"				
5	3h 43m 08s	24° 42' 47"				
6	3h 43m 08s	25° 00' 46"				
7	3h 43m 39s	23° 28' 58"				
8	3h 43m 42s	23° 20' 34"				
9	3h 43m 56s	23° 25' 46"				
10	3h 44m 03s	24° 25' 54"				
11	3h 44m 11s	24° 07' 23"				
12	3h 44m 19s	24° 14' 16"				
13	3h 44m 27s	23° 57' 57"				
14	3h 44m 39s	23° 27' 17"				
15	3h 44m 39s	24° 34' 47"				
16	3h 44m 45s	23° 24' 52"				
17	3h 45m 09s	24° 50' 59"				
18	3h 45m 27s	23° 17' 57"				
19	3h 45m 28s	23° 53' 41"				
20	3h 45m 33s	24° 12' 59"				
21	3h 46m 26s	23° 41' 11"				
22	3h 46m 26s	23° 49' 58"				
23	3h 46m 57s	24° 04' 51"				
24	3h 47m 29s	24° 20' 34"				



DETERMINING THE DISTANCE TO THE PLEIADES

You are supplied with a transparent overlay, on which is plotted an HR diagram. This HR diagram has been carefully calibrated, so its main sequence was plotted with absolute V magnitudes. Slide the plastic overlay up and down until the main sequence on the overlay aligns with the main sequence on your graph. Keep the y axes in precise coincidence with one another. Seek a best fit for the central portion of the combined patterns.

Once the two main sequences are aligned, you can read the difference between the apparent magnitudes on your HR diagram, and the absolute magnitudes on the plastic overlay HR diagram. So pick any convenient magnitude on the overlay (for example, $M=0$) and read its corresponding apparent magnitude from your HR diagram.

M_V = _____ (from plastic overlay)

m_V = _____ (from graph paper)

$m_V - M_V$ = _____ (distance modulus)

Now use Equation 1 to calculate the distance to the Pleiades in both parsecs and light years. Compare these values to published values provided by the instructor.

d = _____ pc = _____ LY (calculated)

d = _____ pc = _____ LY (published)

% discrepancy = _____

QUESTIONS:

1. Indicate the main sequence on your HR diagram by sketching a line along it. Do NOT attempt to fit it with a straight line. Label it clearly.

2. Identify by star number (Table A) two possible red giant stars.

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3. Examine the data point for star #15.

a. What type of star might this be?

b. Upon what did you base your decision?

4. Suggest sources of error that might contribute to your % discrepancy from published values of distance for the Pleiades