

SPS 2010 OBSERVATIONAL ASTRONOMY

Stellar Photometry

This lab report is due on Tuesday February 19, 2008.

- 1) The data tables below contain UBV photometric data obtained with a CCD camera. Images have been obtained of the fields around twelve different standard stars (stars of known UBV magnitudes) and around three program stars. The CCD images have been completely processed, and the total number of counts (normalized to a one-second exposure time, after sky subtraction) determined for each stellar image. Table 1 provides the following information for each standard star: the Henry Draper (HD) catalogue number of each star, the airmass (X) at which it was observed, the V magnitude, the B-V color index, the U-B color index, and the total number of counts measured on the V, B, and U images. Measured counts (similarly corrected for sky background, and normalized to a one-second exposure time) for the three program stars appear in Table 2.

Table 1 - Standard Stars

HD	X	V	B-V	U-B	C _v	C _b	C _u
22049	1.785	3.73	+0.89	+0.57	3535	2027	262
30652	1.445	3.19	+0.45	- 0.01	6486	5582	1380
32630	1.002	3.17	- 0.18	- 0.67	7475	12001	6680
33111	2.002	2.80	+0.13	+0.10	8158	8472	1508
47105	1.122	1.93	0.00	+0.03	22511	30172	8226
58946	1.015	4.16	+0.32	- 0.03	2990	3042	882
62345	1.046	3.57	+0.93	+0.68	4957	301	452
69267	1.684	3.52	+1.48	+1.78	4422	1528	65
91316	1.465	3.85	- 0.14	- 0.95	3558	5138	3110
106625	2.543	2.60	- 0.11	- 0.35	8333	10214	2392
114710	1.029	4.28	+0.57	+0.07	2687	2158	575
140573	1.784	2.65	+1.17	+1.24	9692	4313	293

Table 2 - Program Stars

HD	X	C _v	C _b	C _u
21120	1.262	4673	2811	410
35497	1.034	30116	45962	21067
106591	1.074	6486	8046	2989

- a) Convert the raw counts to instrumental magnitudes and colors (v, b-v, and u-b) for each standard star and each program star.
- b) Use the standard stars to graphically determine the first-order extinction coefficients. The second-order coefficients are assumed to be known; their values are:

$$k_v'' = 0.000 \quad k_{bv}'' = -0.035 \quad k_{ub}'' = -0.015$$

- c) Finally, use the extinction coefficients to determine v_o , $(b-v)_o$, and $(u-b)_o$ for each standard star and each program star.
- 2) In the previous section you used the photometric data provided for twelve standard stars to determine correct the instrumental magnitudes of the program stars for the effects of atmospheric extinction. Now complete the task: use the standard stars to determine the constants in the transformation equations which convert instrumental magnitudes to Johnson magnitudes and color indices (V, B-V, and U-B).
- a) Use these transformation equations to determine V, B-V, and U-B for each program star.
- b) Use these same transformation equations to calculate (based on your instrumental magnitudes) V, B-V, and U-B for each of the twelve standard stars. Compare your results with the given values provided in Table 1 to determine the typical errors in V, B-V, and U-B you can expect for the program stars.