

Ay 122 – Homework #2

Posted on Friday, Nov. 9 * * * Due by 5 pm on Friday, Nov. 16 (directly to the TA)

1. Stellar photometry in practice. Take the images provided in the package linked at the class webpage. These are not quite in the true SDSS *gri* system, but they are close. Using *iraf*, measure the stellar magnitudes for the stars listed in the documentation provided. You will need to first derive the magnitude curves of growth, using a set of bright, but unsaturated stars, then do aperture photometry, choosing apertures that seem reasonably matched to the visible size of the stellar images, and correct them to the “total” magnitudes using your curves of growth. Use the “calibration” set of stars to convert your instrumental magnitudes to the SDSS system, i.e., derive the color transformations like:

$$g_{\text{sdss}} = g_{\text{inst}} + c_1 (g-r)_{\text{inst}} + c_2$$

... and the equivalent for the *r* and *i* images. Use these transformations to calibrate the “target” set of stars. Evaluate the scatter of your calibrations as a function of magnitude.

2. Color transformations. From Landolt (2009, AJ, 137, 4186), select from Table 2 a set of stars fainter than $V \sim 14$ mag (why?), spanning as broad a range of colors as you can (why?). Get the SDSS *ugriz* magnitudes for those that are in the SDSS covered area (that should be most of them), using the SDSS server. You should have a set of at least $\sim 20 - 30$ stars.

Derive the color transformations from SDSS *ugriz* system to Landolt’s UBVRI, of the form:

$$m_{\text{Landolt}} = m_{\text{SDSS}} + c_1 (\text{color})_{\text{SDSS}} + c_2$$

Hint: pick the bandpasses and colors that are close in wavelength, e.g., *V* as a function of *g* and $(g-r)$, *R* as a function of *r* and $(g-r)$ or $(r-i)$, etc.

Plot the residuals against the magnitude and color. Are there any systematic effects, and if so, what could be their cause? What is the residual scatter of your transformations?

After you’ve done all that, compare your results with those listed at <http://www.sdss.org/dr5/algorithms/sdssUBVRITransform.html> and in particular those by Lupton (2005).