Andean Cosmology School 2015

Universidad de los Andes, Bogotá, Colombia

1. CCD reduction

In this problem we will work with two real life images taken in the r band with a CCD of the *Sloan Digital Sky Survey*, SDSS[1]. Your job is to do a very basic processing of these images by using `python`. The first file is called `object.fits` and contains the astronomical image of interest. The second file is called `twilight.fits`, and it is a twilight flat field image. The plate scale in both is 0.33 arcseconds per pixel.

Before staring, open the images in `DS9` and make a visual inspection of them. Play around with some of the parameters, such as scale, zoom, and brightness contrast.

(a) CCDs usually include regions along the image edge that are not exposed to light. These areas are called *overscan* regions. They are used to measure the bias due to electronic noise and any time variability. There are overscan regions on both left and right sides of the images. Find the bias level for each image from an appropriate section and subtract from each. What bias value did you find for each image?

(b) Rescale the twilight flat so its mean value is near 1, then divide the object image by the flat. Does the sky now look uniform?. Trim the resulting image to the pixels in range [55:2054, 90:4089] to get rid of the overscan. After flat-fielding and trimming, visually compare the two images in `DS9`

(c) Identify in one or two sentences the origin of each of the following features in your flattened image:

(i) The fat streak crossing the full image near row 2500

(ii) The negative "hole" in the sky at (516,2020)

(iii) The vertical line in column 1747

(iv) The vertical stripe near (434,1810)

(v) The small dot at (395,1022)

(vi) The fuzzy blob at (492,3914)

[1]Courtesy of Prof. M. Sako (Penn)