**Detector characterization macro set**

This set contains macros for the calculation of system gain, dark current, and read noise of a detector. It can be used for various detectors, for example different type of cameras and PMTs. This macro set is inspired by Craig Stark’s web page about camera characterization in the astronomy: http://www.cloudynights.com/item.php?item\_id=2001. Big thanks to Kota Miura for helpful suggestions regarding the macro programming.

**Detector gain macro** calculates a detector system gain, conversion coefficient between signal in grey values (adu) and electrons. The input for macro is a bias image and two consecutively acquired stacks of images with different intensities. If the intensity is not uniform across the image, one should select an area with approximately equal intensities.

**Dark current macro** calculates the dark current of a camera. The input for macro is bias and dark images, exposure time of the dark image, and camera system gain.

**Read noise macro** calculates read noise of a camera. The input for macro is a sequence of bias images and value of a camera system gain.

How to get input data

**Detector system gain** can be either measured with “Detector gain” macro or estimated based on the camera specs. The gain is roughly equal to the ratio of the camera pixel full well capacity in electrons to the full camera range in grey values.

**Bias image** is acquired with no light going to the detector. Exposure time should be set to the minimum possible value.

**Dark image** is acquired in the same light condition as the bias image, but with relatively long exposure time (if possible a minute or longer).

**Sequence of bias images** is acquired in the same light condition as the bias image with smallest possible delay between the images. The number of images in a sequence should be sufficient to get a reliable statistics in every pixel. Normally several tens of images are enough.

**Stacks of images** for detector gain macro should be taken consecutively twice by either varying intensity of illumination or exposure time at a given gain of the detector. The best result is obtained when the intensity of the images in the stack covers the whole detector range and the number of the images is large enough for a reliable fit (normally more than five). Images of fluorescence slide from Chroma or bright field images with properly set up Koehler illumination can be used.