Analysing exposures of the LSST camera

Supervisor

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Summary

The Legacy Survey of Space and Time (LSST) is an astromomical survey of large étendue (more than 20000 deg^2) produced from the Vera Rubin Observatory (VRO) currently in construction on Cerro Pachon (2680 m) in north Chile. From 2025, for ten years, the VRO will realize a systematic scan of the sky and will deliver the most extensive catalog ever (83 pB) with 17 billion stars and 20 billion galaxies. LSST will also collect a large number of Type Ia supernovae (SNe Ia) (more than 900000 after ten years). A large fraction of this SNe Ia sample (more than 220000) could be used to achieve accurate measurements for cosmology (dark energy equation of state parameters).

Astronomical catalogs are built from raw exposures of the telescope. Images are processed (cleaning, calibration, astrometric and photometric corrections) and lead to exposures with high astrometry and photometry accuracy. These images could then be used to extract e.g. SNe Ia light curves. Distances are measured from the parameters of these light curves. The accuracy of the distance measurement is thus dependent on the ligh curve quality extracted from the calibrated exposures. It is critical to understand and correct for the telescope images to achieve accurate cosmological distance measurement.

The LSST camera is currently being tested at the SLAC Accelerator Laboratory in Stanford (California, USA). A lot of tests are being performed to study exposure « low-level » effects, such as bias runs (images with no light on the image sensor – to correct the base level of readout noise) or the flat runs (fully illuminated images in a uniform way - to correct for pixel-to-pixel response). These two first calibration stages are critical for the following steps (astrometry and photometry).

The goal of the internship is to measure pixel-to-pixel response variation by using flat runs and to perform linearity and uniformity studies. Data taken recently will be available as well as data from previous test campaigns. During this internship, the student will have to automate the measurements so as to process the focal plane of the camera (21 rafts of 9 ccds=189 ccds, 3.3 Gpixels) in its entirety.

This work is also one of the items for further investigation of a phD thesis that will be proposed in 2024.