Unique LSST Information

This page contains information that may be helpful when designing investigations or interpreting data.

Telescope location and sky coverage

The telescope is located at a latitude of 30.2˚ S and an elevation of 8736 feet.
The field of view of each image is 9.6 square degrees. About 10,000 square degrees of sky will be covered every night using pairs of 15-second exposures called *snaps*, with a typical magnitude limit for point sources to +24.5 (AB magnitude system). The total survey area will include ~30,000 square degrees with coverage from declinations of -90° to +34.5°.

Brightness and magnitude limits

Brightness of sources is recorded in several ways:
The official LSST unit of flux is the nanomaggy. It was adopted from the SDSS unit of flux called "maggies". One maggy (Mgy) has an AB magnitude of zero.

The conversion between maggies and AB magnitudes is: $m_{AB} = -2.5\log_{10}(\text{maggie})$

A nanomaggy (nMgy) is 1×10^{-9} of a maggy. One nanomaggie is also equal to 3.631 µJy (microjanskys).

To relate these quantities to standard magnitudes, an object with flux (f) given in nMgy can be converted to a Pogson magnitude:
$m = [22.5 \text{ mag}] - 2.5 \log_{10}(f)$

Magnitude limits
Since the CCD camera is so sensitive to light, LSST will saturate at about magnitude 17. What that means is that objects brighter than magnitude 17 (which accounts for all naked eye objects and those within the reach of most amateur telescopes) will be eliminated from the data products catalog and will be processed in images to reduce or obliterate their light.
Typical exposures will extend to +24.5 (AB magnitude system). Deep drilling fields will extend to +26. Co-added images, by the end of the ten-year survey, will have a magnitude lower limit of better than 27.5.

Filters

The LSST camera uses 6 filters. The filters are designated u g r I z y and cover the wavelength range from 320–1050 nm.

The u filter extends from ultraviolet into the visible violet. This filter is extremely important for separating low redshift quasars from hot stars, and for estimating the metallicities of F/G main sequence stars.

LSST has no B "blue" filter. Instead, the v filter transmits light of traditional blue through green wavelengths; the r filter transmits from mid green to mid red, and the i filter passes light from long red wavelengths into the infrared. The z and y filters represent deeper infrared wavelengths.

The r and i filters are important because of their dominant role in star/galaxy separation and weak lensing measurements.

The y filter will enable studies of substellar objects, high-redshift quasars (to redshifts of ∼7.5), and regions of the Galaxy that are obscured by interstellar dust.

Comparison to visual color ranges with LSST filters

color	traditional	LSST	filter
violet	380–450 nm	330- 400 nm	u
blue	450–495 nm	402- 552 nm	v
green	495–570 nm		
yellow	570–590 nm		
orange	590–620 nm	552- 691 nm	r
red	620–750 nm	691- 818 nm	i
		818- 922 nm	z
		970- 1060 nm	y

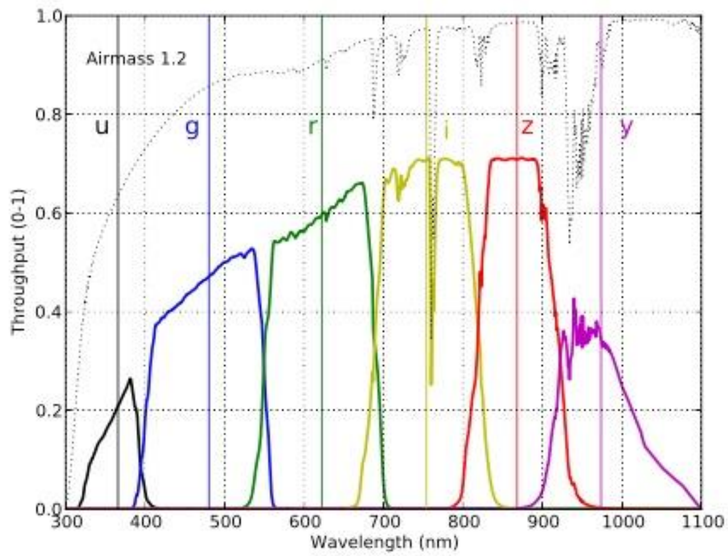

FIG. 4.— The LSST bandpasses. The vertical axis shows the total throughput. The computation includes the atmospheric transmission (assuming an airmass of 1.2, dotted line), optics, and the detector sensitivity.

For more filter comparisons, see http://speclite.readthedocs.io/en/latest/filters.html

The filters will not all be used uniformly.
Estimated mean number of visits are: u : 70, g : 100, r : 230, i : 230, z : 200, y : 200

The limiting magnitude for each image is dependent on the filter used:
Single visit depths: u : 23.9, g : 25.0, r : 24.7, i : 24.0, z : 23.3, y : 22.1
Final (coadded) depths: u : 26.3, g : 27.5, r : 27.7, i : 27.0, z : 26.2, y : 24.9

Images

Co-adds

There are several classes of co-added images. A color co-add can be produced by stacking together a set of images taken through all 6 filters. Another type of co-add is made by stacking multiple sets of an image in a certain filter. Over time, these co-added images will achieve greater depth as more and more images are stacked together.

Tracks and tracklets

These terms describe the data record of a moving solar system object. Here is how it is detected: LSST will revisit observed fields twice each night, with approximately 20–45 minutes between these observations. If an object shows motion between the two detections, it is linked and identified as a tracklet. During the next repeat visit (3-4 nights later), the object will be searched for and if detected again, the two tracklets will be combined into a track. These data should be enough to generate an approximate orbit.

Visits

A "visit" is defined as a pair of 15-second exposures, performed back-to-back in a given filter. As often as possible, each field will be observed twice on a given night, with visits separated by 15-60 minutes. This strategy will provide motion vectors to link detections of moving objects, and fine-time sampling for measuring short-period variability. Visits to the same field will be repeated approximately every three nights.

Deep drills (also known as mini-surveys)

One hour of observing time per night is devoted to the observation of a single field to substantially greater depth. About 50 consecutive 15-second exposures may be obtained in each of four filters in an hour. This would allow for measurement of light curves of objects on hour-long timescales, and detection of faint supernovae and asteroids. The typical magnitude limit for deep drill images is +26.