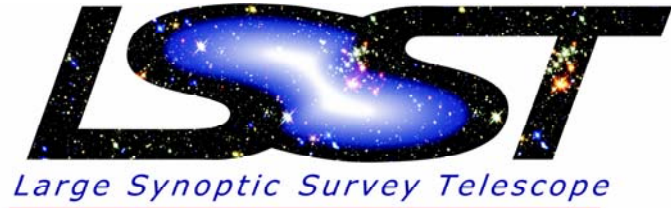


# Science Opportunities with LSST

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The LSST will be a community collaboration and resource, with broad access to the data and no proprietary data withholding period. We encourage scientists to think about how they might exploit the LSST data, and in particular how frequent multi-band imaging to 24.5 AB magnitudes every 15 sec could enable innovative new science.

The 8.4-meter telescope and 3 billion pixel camera covering ten square degrees will be sky noise limited in less than 10 seconds in each of 6 optical bands (*ugrizy*). This wide-fast-deep capability is enabled by advances in microelectronics, software, and large optics fabrication. The LSST system will have three main components: the *telescope and optics*, the *wide field imager*, and the *system software*. Significant developments have taken place in all three areas, as highlighted in the companion posters. Final site selection will occur this Spring. First light is scheduled for 2012, science operations for 2013. Our observing simulations show ~2000 exposures per each 10 square degree field, with total 20,000 square degree sky coverage reaching 27 AB mag in a 10-year survey.

Key science drivers all utilize the same data and are representative of LSST's system capabilities:

- Precision characterization of Dark Energy
- Mapping the Milky Way
- Taking an inventory of the Solar System
- Exploring the Transient Optical Sky

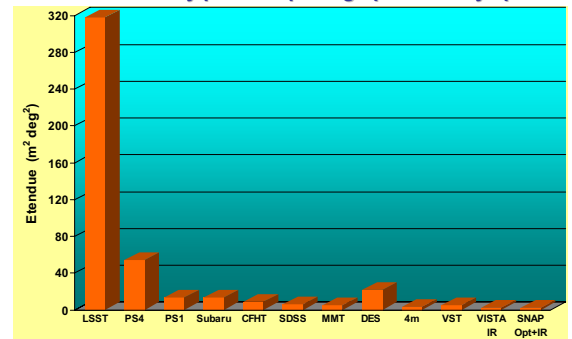
- 8.4m diameter primary, 6.5m dia. effective collecting area
- 9.6 square degree field of view
- 0.2 arcsec per pixel, < 2 sec readout of 3 Gpixel camera
- Dual 10-15 sec exposures at each visit
- Point source sensitivity of  $r > 24$  AB mag ( $5\sigma$ ) in 15 sec
- Time domain survey in g,r,i,z,y
- 30 sec latency for real-time image analysis

In addition to enabling all four of these major scientific initiatives, LSST will make it possible to pursue many other research programs. The community has suggested a number of exciting programs using these data, and the long-lived data archives of the LSST will have the astrometric and photometric precision needed to support entirely new research directions which will inevitably develop during the next several decades. Scientists are encouraged to join one of the Science Working Groups. The LSST will produce the largest non-proprietary data set in the world.

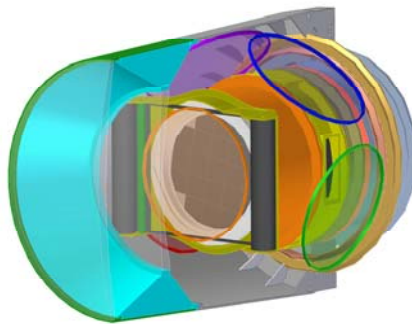
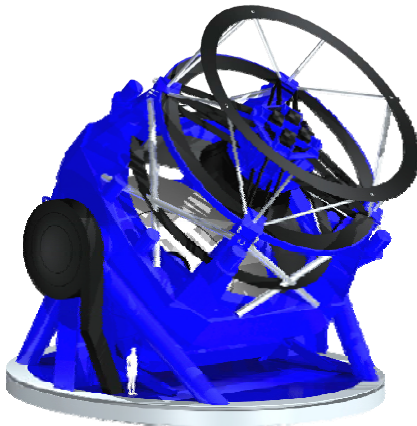
## Full system simulations

We have developed an end-to-end simulation of the LSST system, including the effects of atmospheric propagation, optical transfer function, detector properties, and science signals of interest (in particular weak gravitational lensing).

## Relative survey power: opening up discovery space



Survey power is proportional to the étendue (the  $A\Omega$  product) of the telescope aperture and camera field in  $m^2 \text{ deg}^2$ . This plot compares various imaging projects, assuming 100% of nights are spent in survey mode. Only LSST, PS, and VST will operate 100% in survey mode. The LSST will open up a qualitatively new regime in survey science. A unique result of a very high optical étendue is that many science programs can proceed in *parallel* with the same high quality data.



LSST 3 Gpixel Camera

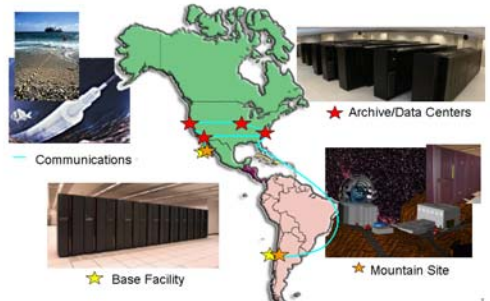
## 6-band Survey: *ugrizy* 320–1050 nm

- Sky area covered: 20,000 deg<sup>2</sup> 0.2 arcsec / pixel
- Each 9.6 sq.deg FOV revisited >300 times/band
- Time resolution: >20 sec
- Limiting magnitude: 26.5 AB magnitude @10 $\sigma$  (24.5 in *u*)  
24 AB mag in 15 seconds
- Photometry precision: 0.01 mag requirement, 0.005 mag goal
- Galaxy density: 50 galaxies/sq.arcmin
- 3 billion galaxies with color redshifts
- Time domain: Log sampling, seconds – years

## Data on Disk:

- Processed images: 30 PB / yr
- Raw images: 5 PB / yr
- Time-Photometry Catalog: 300 TB / yr

<http://www.lsst.org>



## LSST Data Management

Fusion of astronomical algorithm and high performance computing communities

**Data access: The LSST is open-source open-data. The LSST project has begun supplying source code to others. LSST is a community collaboration and data will be promptly provided to the community, with no proprietary data period.**

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