LSST is an Observatory System

8.4m Telescope + 3.2Gpix Camera

Peta-scale Data Management

Science and Public user Interfaces

Data Release Production to date

302p-scale Data

Management

Raw Amp Images

Reference Catalogs

CR Split

Image Char.

Single Frame Meas.

Source Assn.

ISR

CCD Assembly

Calib Ref Images

Combined Image

Calibrated Visit Image

Source Catalog

Object Catalog

SAACC April 17, 2019 Cerro Calán
Primary Science Drivers

**Cosmology**
- Dark energy
- Dark matter

**Milky Way**
- Stellar populations
- Stellar Streams, Dwarf Galaxies

**Solar System**
- Near-Earth Objects
- Trans-Neptunian Objects
- Comets

**Dynamic Universe**
- Explosive transients
- Multi-messenger counterparts
- Variable stars, quasars
- Lensing events
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100x deeper than SDSS, >10x deeper than DES

Comparable depth to *Hubble* COSMOS, but over an area $10^4$ larger (in 6 filters)
LSST will image the entire Southern sky (18k sq deg) every few nights, taking an image every ~40 seconds, for 10 years.

The result: an 825-frame movie in 6-filter technicolor of every object present
Data Products

• A stream of ~10 million time-domain events per night, detected and transmitted to event distribution networks within 60 seconds of observation.
• A catalog of orbits for ~6 million bodies in the Solar System.

• A catalog of ~37 billion objects (20B galaxies, 17B stars), ~7 trillion observations (“sources”), and ~30 trillion measurements (“forced sources”), produced annually, accessible through online databases.
• Deep co-added images.

The production of data products will be transparent: All software is developed open-source and will be available to the community.

For more details, see the “Data Products Definition Document”, http://ls.st/ls-163
Data Products

LSST will catalog more stars and galaxies than all previous astronomical surveys combined

...but perhaps even more important is the anticipated *quality* and *richness* of the data, as well as *homogeneous* processing.

These data will be made available to all US and Chilean scientists, and named International Contributors with no proprietary period.

For more details, see the “Data Products Definition Document”, [http://ls.st/ls-163](http://ls.st/ls-163)
LSST Science Platform Vision

High-level vision for a collaborative environment for LSST Science

- Enable analysis of peta-scale LSST data
- Exploratory analysis through browsing and visualisation
- Enable science discovery by ‘bringing the analysis to the data’
- Supports User-Generated product creation
- Integration with extant archives via IVOA protocols
- Collaborative working environment
- Provision of backend computation and analysis resources

https://lsa.stsci
LSST Data Management System

Raw Data: 20TB/night
- Sequential 30s images covering the entire visible sky every few days

Prompt Data Products
- Alerts: up to 10 million per night
  - Raw, calibrated, and difference images and their source and object catalogs
  - Solar System Objects: ~6 million

Data Release Data Products
- Final 10yr Data Release:
  - Images: 5.5 million x 3.2 Gpx
  - Catalog: 15 PB, 37 billion objects

LSST Science Platform
- Provides access to LSST Data Products and services for all science users and project staff
The LSST Science Platform - Current Snapshot

- **Portal Aspect**: exploratory analysis and visualization of the LSST archive
- **JupyterLab Notebook Aspect**: in-depth 'next-to-the-data' analysis & creation of added-value data products
- **Web API Aspect**: remote access to the LSST archive via industry-standard APIs
Summit Facility Progress
Five Operational Departments

Observatory Operations
Data Facility Operations
Science Operations
System Performance
Education and Public Outreach

Data
Information about the LSST system
Science Community
Public
Staffing for Operations

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