INAF e LSST

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Divisione opt-IR

- Why this meeting
- How is LSST organized
- How can we join LSST
- Next steps

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The Large Synoptic Survey Telescope

The LSST is a new kind of telescope. Currently under construction in Chile, the LSST is designed to conduct a ten-year survey of the dynamic universe. LSST can map the entire visible sky in just a few nights; each panoramic snapshot with the 3200-megapixel camera covers an area 40 times the size of the full moon.

Images will be immediately analyzed to identify objects that have change or moved: from exploding supernovae on the other side of the Universe to asteroids that might impact the Earth.

In the ten-year survey lifetime, LSST will map tens of billions of stars and galaxies. With this map, scientists will explore the structure of the Milky Way, determine the properties of dark energy and dark matter, and make discoveries that we have not yet imagined.

Scientists in the US and Chile, LSST's International Affiliates, and the general public are invited to share in this voyage of discovery. What will you find?

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LSST: a digital color movie of the Universe...

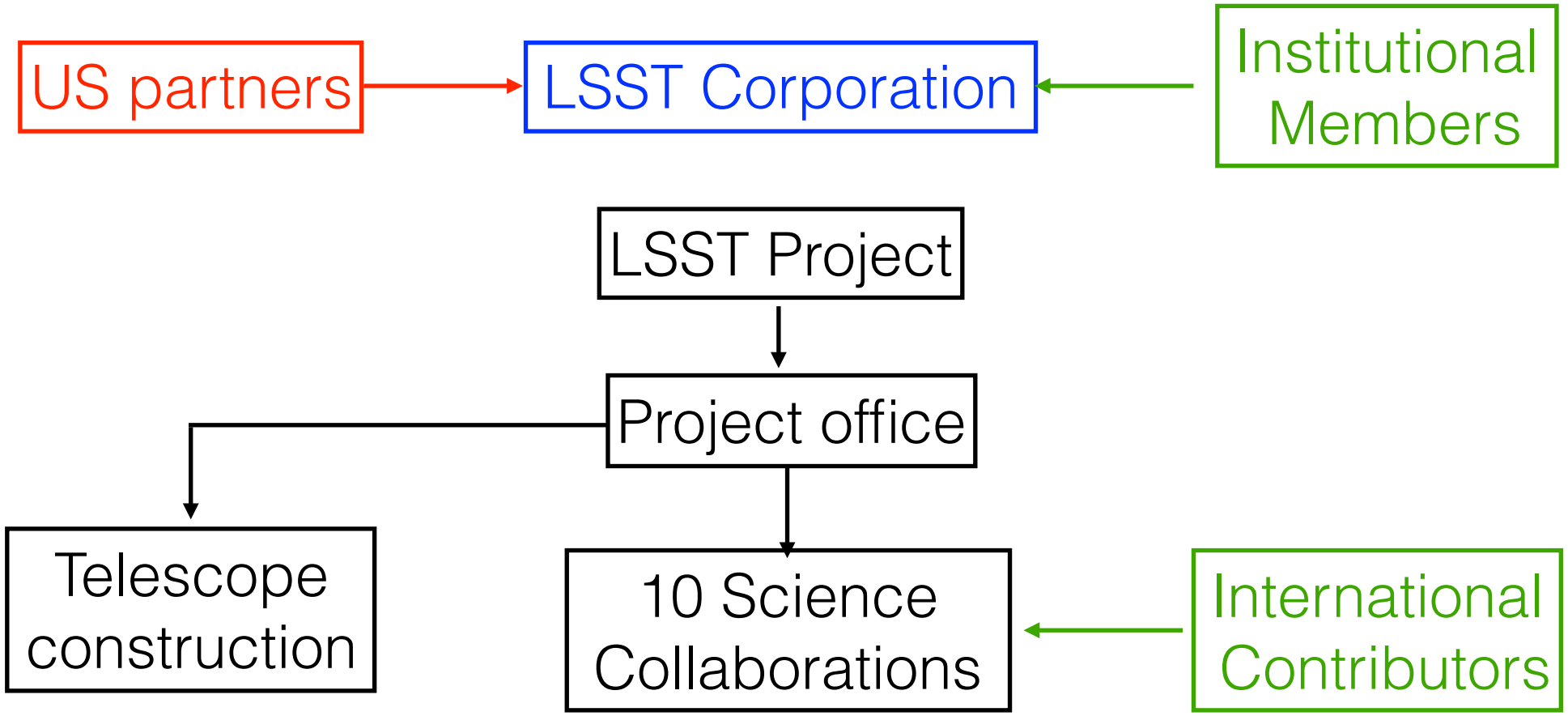
LSST in one sentence:

An optical/near-IR survey of half the sky in ugrizy bands to r~27.5 based on ~1000 visits over a 10-year period:

More information at www.lsst.org and arXiv:0805.2366

A catalog of 20 billion stars and 20 billion galaxies with exquisite photometry, astrometry and image quality!

How is LSST organized?



LSST Science Collaborations

There are currently ten LSST Science Collaborations. Additional information about their work and membership can be found at the links below or by contacting the individual chairs, or the LSSTC Science Collaborations Coordinator (LSSTCSCC), Lucianne Walkowicz.

Galaxies

Michael Cooper (UC Irvine); Brant Robertson (University of California, Santa Cruz);

Stars, Milky Way, and Local Volume

John Bochanski (Rider University); John Gizis (University of Delaware); Nitya Jacob Kallivayalil (University of Virginia);

Solar System

Lynne Jones (University of Washington); David Trilling (Northern Arizona University);

Dark Energy

Rachel Bean (Cornell University); Jeffrey Newman (University of Pittsburgh);

Active Galactic Nuclei

Niel Brandt (Pennsylvania State University);

Transients/variable stars

Federica Bianco (New York University); Ashish Mahabal (Caltech);

Large-scale structure/baryon oscillations

Eric Gawiser (Rutgers The State University of New Jersey); Shirley Ho (Carnegie Mellon University);

Strong Lensing

Phil Marshall (KIPAC);

Informatics and Statistics

Tom Loredo (Cornell University); Chad Schafer (Carnegie Mellon University);

International Contributors

Australia

- The University of Sydney - ARC Centre of Excellence for All-sky Astrophysics (CA
- The University of Western Australia (UWA)

Brazil

- Laboratorio Interinstitucional de e-Astronomia (LIneA)
- Laboratorio Nacional de Astrofisica (LNA)
- Rede Nacional de Ensino e Pesquisa (RNP)
- Academic Network at Sao Paulo (ANSP)
- Americas Pathways (AMPATH)

Canada

- University of Toronto (UofT)

Canary Islands

- Instituto de Astrofisica de Canarias (IAC)

China

- LSST-China Consortium

Croatia

- Ruđer Bošković Institute (RBI)

France

- Institut National de Physique Nucleaire et de Physique des Particules (IN2P3)

Germany

- Ludwig-Maximilians-Universität (LMU)
- Max Planck Institute for Astrophysics (MPA)
- Max Planck Institute for Astronomy (MPIA)

Hungary

- Eotvos Lorand University (ELTE)
- Konkoly Observatory

India

- Inter-University Centre for Astronomy and Astrophysics (IUCAA)

Korea

- Korea Astronomy and Space Science Institute (KASI)

New Zealand

- University of Auckland (UOA)

Serbia

- Nano Center

South Africa

- The National Research Foundation (NRF)

Switzerland

- Eidgenoessische Technische Hochschule Zuerich (Eth Zuerich), Institute for Astronomy

Taiwan

- Academia Sinica Institute of Astronomy & Astrophysics (ASIAA)

International Contributors

In all cases the access is institutional, not individual.
BUT
Each institute pays for *N* individual PIs.

PI = "(senior) staff"

"Paghi 1 prendi 4"

Each PI can bring up to 4 young researchers:
max 3PhD, max 3 Postdoc

Designed for US-like Departments; unclear what a young researcher is in the case of INAF.

1PI = 200 k$ spread over 10 years (=20k$/year)

"Compra oggi paghi domani"

Payment due from 2019.

Number of PIs can increase, not decrease.

Institutional members: Members of the LSST Corporation attend Board meting etc. Cost: +25k$/yr

LSSTC INSTITUTIONAL MEMBER

Adler Planetarium

Argonne National Laboratory

Brookhaven National Laboratory (BNL)

California Institute of Technology

Carnegie Mellon University

Chile

Columbia University

Cornell University

Drexel University

Fermi National Accelerator Laboratory

Google, Inc.

Institut de Physique Nucleaire et de Physique des Particules (IN2P3)

Johns Hopkins University

Kavli Institute for Particle Astrophysics and Cosmology (KIPAC) - Stanford University

Las Cumbres Observatory Global Telescope Network, Inc.

Lawrence Livermore National Laboratory (LLNL)

Los Alamos National Laboratory (LANL)

National Optical Astronomy Observatory*

Northwestern University

Princeton University

Purdue University

Research Corporation for Science Advancement*

Rutgers University

SLAC National Accelerator Laboratory

Space Telescope Science Institute

Texas A & M University

The Institute of Physics of the Academy of the Czech Republic

The Pennsylvania State University

The University of Arizona*

The University of Chicago

University of California at Davis

University of Illinois at Urbana-Champaign

University of Michigan

University of Oxford

University of Pennsylvania

University of Pittsburgh

University of Portsmouth, Institute of Cosmology & Gravitation

University of Washington*

What do you get from LSST?

Public:

- Transient in real time (60s): position, magnitude. No time series.
- Raw data (20Tb/night, good luck)
- Catalogs and coadded images, 2 years after proprietary (consortium) time.

Contributors:

- All data available to the consortium:
  - Reduced images; incremental stacks; catalogs; time series. At delivery (once a year)
  - Access to Level 3 data and sw, i.e. special sw and data developed within the Scientific collaborations;
  - Possibility to develop and install specific software
  - Computing time (10% of all CPU power) on the LSST computing centre.

Data Description & Processing:

There are three types of processed data that will be generated for LSST:

Level 1: These result from difference imaging performed real-time as the data are acquired. Level 1 data products include a stream of ~ 10 million time-domain events per night, detected and transmitted to event distribution networks within 60 s of observation. The Level 1 pipeline will also flag moving objects in the data stream, and determine their orbits. This is expected to result in a catalog of orbits for ~ 6 million small bodies in the solar system.

Level 2: These utilize both the raw images and accompanying housekeeping and calibration data to derive calibrated photometry, astrometry, shape information, and lightcurves for all detected sources. The Level 2 catalogs will eventually contain ~ 37 billion sources, 20 billion galaxies and 17 billion stars. In addition, forced photometry will be performed at the positions of transient sources, yielding ~ 30 trillion individual measurements. These will be accompanied by deep co-added images of every part of the southern sky. The Level 2 data products are released annually, except for the first two, which will be released 6 months apart.

Level 3: Individual collaborations and scientific users will construct additional Level 3 software to reduce the processed data for particular scientific analyses. The LSST Data Access Centers will offer services and computing resources to enable such user-specified custom processing and analysis to be performed, as well as software and APIs to enable development of the requisite codes within the LSST data management framework.

Data Products and Releases:

The LSST Project is responsible for processing the raw LSST images and producing the Level 1 and Level 2 data products. These are made available to the community through the Data Access Centers, which are located in Urbana, Illinois and La Serena, Chile. All raw and processed data are archived at both NCSA in Urbana and La Serena, as well as at CC-IN2P3 in Lyon.

All data acquired by LSST to date are reprocessed annually to produce the Level 2 data products. At any given time, both the current and the prior data release are stored on spinning disks, available for use by the community.

For two years after they are produced, LSST Level 2 data projects are held proprietary for use by the U.S. and Chilean communities, and those of selected other international partners who are contributing to operations. After this two year period, Level 2 data products will be made available to the world, although the Project reserves the right to charge requestors for the costs of distributing the data and/or making them accessible for analysis.

Level 1 data products (time-domain alerts) will be made available to a limited number of event distribution services, as they are generated. These event "brokers" will filter the events to identify particular classes of variable stars and transients, for subsequent release to the community at large. The time-domain event streams are not proprietary, however it will be up to the event distribution services to determine who gets access to their filtered lists.

Publication policy

-SDSS like: not very strict. Papers must be announced in order to allow anyone to enter and contribute. Must include people who contributed to data or software etc;
- Competing/overlapping papers may exist, provided information is given about paper preparation.
- Papers can be open to external (non-LSST) contributors if they do contribute to data analysis and interpretation;
- Follow-up of LSST sources is allowed with external (non-LSST) contributors
The use of LSST for external sources (sources not detected by LSST) is also allowed, provided that general rules for data access are satisfied.

What are the chances that we enter LSST?

1) Timing: need to sign MoA by Oct1.

2) Funds: payment starts from 2019.
   The budget plan for 2019 is unknown, but there are several instrumental project that end in 2019-2020, so sustaining 10 (or more) PIs is not impossible.

3) We need to present to INAF a combination of:
   1) top level science cases;
   2) PIs or group committed to dedicate a significant part of their effort to LSST science in the next years.

Achieving 3) is the goal of this initiative.

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2016 Sep 1-7 — Deadline for submission of proposals to INAF

DS (feasibility) +CS (scientific c[illegible]

CdA approve[illegible] association to LSST

Not granted!

2016 Sep 30 — If all goes well, signature of MoA