VERA C. RUBIN OBSERVATORY

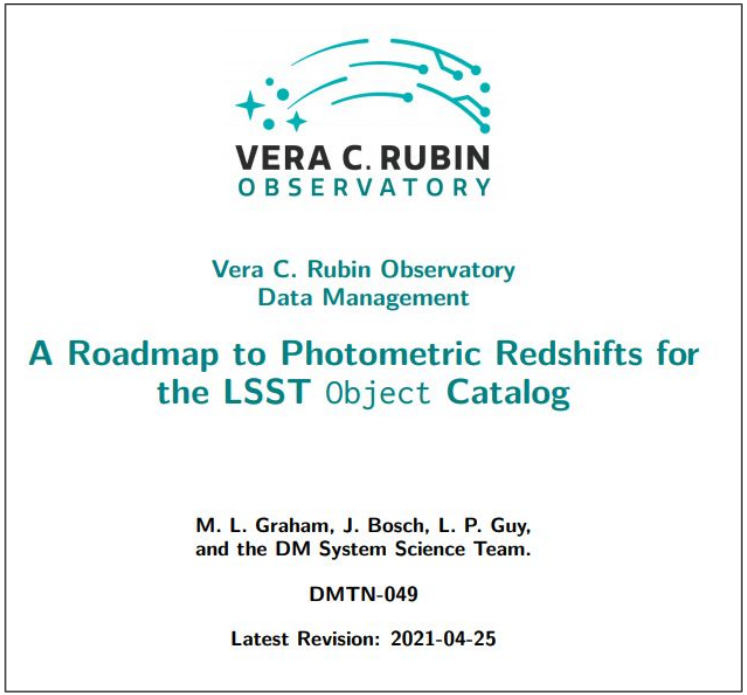
LSST Photo-z Virtual Forum Series 2

May, June, July 2021
Data Management System Science Team

Monthly drop-in seminars for everyone.

NSF AURA U.S. DEPARTMENT OF ENERGY SLAC CHARLES AND LISA SIMONYI FUND FOR ARTS AND SCIENCES LSST CORPORATION

Welcome.



full: ls.st/dmtn-049
summary: ls.st/clo4682

Introduction to Data Management (DM) Hosts

Leanne Guy, DM System Science Team (SST) Lead
Melissa Graham, DM-SST Science Analyst
Jim Bosch, DM Data Release Pipelines (DRP) Scientist
[+ any other DM staff helping out]

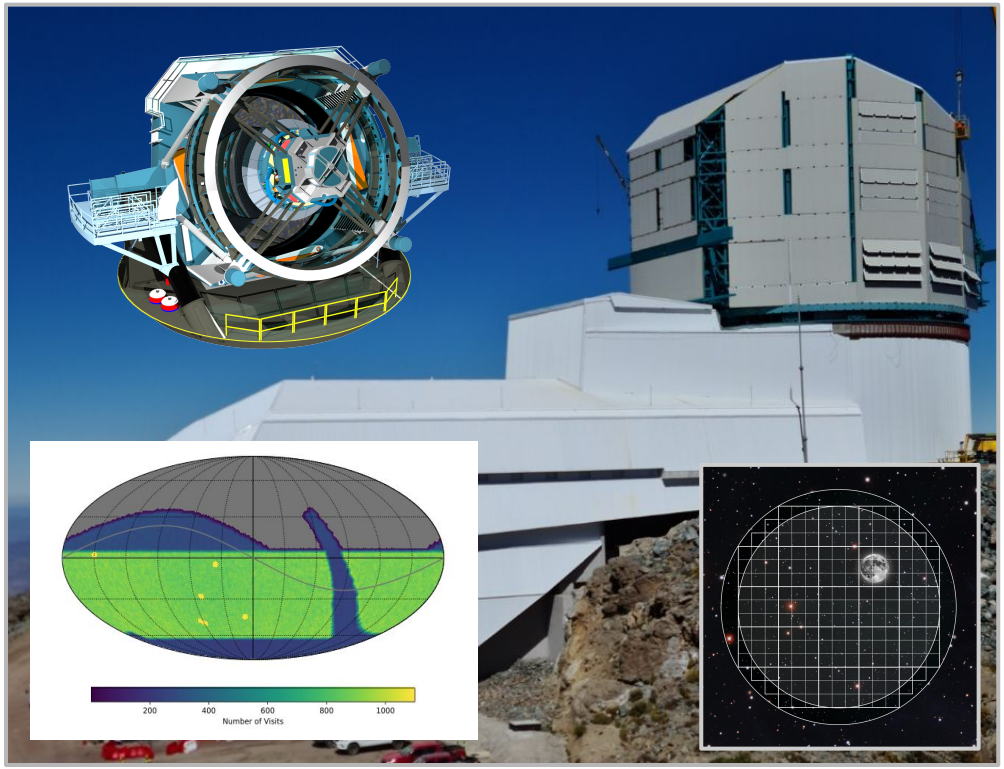
Reminder of Future PZ Virtual Forum Sessions

Monthly drop-in sessions; find schedule at ls.st/clo4683.

Today's Agenda

10 minutes -- presentation about the LSST PZ Roadmap
15 minutes -- Q&A about the roadmap
15 minutes -- Q&A about Letters of Recommendation
10 minutes -- open discussion time

The Vera C. Rubin Observatory



The Rubin Observatory, located in Chile, has an 8.4 meter diameter primary mirror and a 9.6 deg^2 field-of-view camera with six filters, *ugrizy*.

Once complete, Rubin Observatory will execute the **Legacy Survey of Space and Time (LSST)**.

The 10-year southern sky survey will make major advances in four core science areas:

1. Probing dark energy and dark matter
2. Taking an inventory of the solar system
3. Exploring the transient optical sky
4. Mapping the Milky Way

The LSST will cover ~⅓ of the sky each night, detect billions of stars and galaxies, and millions of transients, variables, and moving objects -- a data set of unprecedented volume and complexity.

LSST Data Release (DR) Data Products

Data Release Contents

Images: processed visit images, coadded images

Catalogs: Sources/Objects, DIASources/DIAObjects, ForcedSources.
Source measurements such as PSF, shape, size, flux
Object characterization such as color, model fits, variability, photo-z

Data Release Timescale

DR1 includes data from the first 0.5 years.
DR2 includes data from the first year.
DR3 includes data from the first two years.
…
DR11 include data from the full 10-year survey.

Definitions

Source = A detection in an image
Object = Sources associated by their location/coordinates
DIA = Difference Image Analysis
ForcedSource = Photometric measurements regardless of whether Source detected
PSF = point spread function

Roadmap Overview.

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Roadmap Contents (*DMTN = Data Management Tech Note*)
This is a living document that will be updated over time.

Section 1 - Introduction
Section 2 - Roadmap Timeline
Section 3 - Technical Considerations from the DMS
Section 4 - Evaluation Criteria
Section 5 - Letters of Recommendation
Section 6 - Photo-z Validation Cooperative *(draft)*

Appendix A - Examples of implementation/validation
Appendix B - Data Products Related to LSST PZ
Appendix C - Example Use-Cases for LSST PZ

full: ls.st/dmtn-049
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S.1. Why do we need a Roadmap?

The Data Management System (DMS) is required to compute a photometric redshift for all detected Objects (ls.st/lse-61).

The science community* has a wealth of expertise in generating photo-z and will be the primary users of this data product.

Thus, DM will involve the science community in selecting, implementing, and validating one (or more) PZ estimator(s).

This is a complicated process that requires a lot of communication and coordination; the roadmap will be our framework.

*The science community is everyone interested in LSST photo-z, including members of the Science Collaborations and members of International Programs proposing in-kind contributions related to LSST photo-z.

S.2. Timeline of Milestones (DM Actions)

2021-02/04: Host LSST PZ Virtual Forum Set 1. (Done!)

2021-05-01: Ingest community input about evaluation criteria for PZ estimators, update Section 4 of DMTN-049, and issue a formal call for “Letters of Recommendation”. (Done!)

2021-05/08: Host LSST PZ Virtual Forum Set 2.

2021-09-30: Accept “Letters of Recommendation” describing PZ-related science needs or advocating for certain estimators.

Before commissioning: generate a shortlist of community-vetted estimators and update Section 5 of DMTN-049.

During commissioning: facilitate community* participation in a “Photo-z Validation Cooperative” to validate shortlisted estimators.

*data rights are needed to participate in commissioning

S.3. Technical Considerations

Scalability -- must be able to scale to ~37B Objects (i.e., millisec/object)

Inputs/Outputs -- catalog-level inputs only; outputs made consistent with DPDD (ls.st/lse-163)

Language -- C++/Python easy to adapt; others should be adaptable to run from a Python harness

External Data Sets -- must exist by commissioning; must be public and formatted for the estimator

Estimator Training -- requires domain-specific knowledge beyond the scope of DM; training must be provided by community teams prior to data release (who will be supported by DM)

Storage - volume of input/output must conform to budget

Compute -- should have a low-memory-footprint; compute budget to be revised as dev. progresses

S.4. Evaluation Criteria

1. **Scientific Utility**
   - meet at least basic science needs
   - serve a wide diversity of science use-cases
   - have demonstrated success
2. **Outputs**
   - a posterior distribution function from which point estimates can be derived
   - reliable uncertainties and flag parameters to inform users
   - bonus: other object properties such as galaxy mass, SFR
3. **Scientific Performance**
   - provide, at least initially, the minimum quality needed for basic science needs
   - *(quantitative assessments and optimization to be done during the Photo-z Validation Cooperative)*
4. **Technical Considerations**
   - meet the specifications in Section 3 of DMTN-049

S.5. Letters of Recommendation

Send to mlg3k@uw.edu by Sep 30 2021, with subject beginning “LSST Object PZ LOR”.

Purpose: A formal opportunity for the community to state their scientific needs for LSST Object PZ.

Writers: Anyone who would use the Object PZ, and/or developers of PZ algorithms.

Scope: Describe science to be done with Object PZ; define minimum science-driven requirements for the Objec PZ; and/or recommend certain PZ estimators (or types of estimators).

Outcome: DM will create a shortlist of community-vetted PZ estimators to use as a starting point for the joint DM-community “Photo-z Validation Cooperative” during commissioning.

Guidelines: Keep scope in mind, follow the template, make it short and qualitative.

Official call and template for letters: ls.st/clo4936

LOR Template (1-3 pages)

0. Summary Statement

1. Scientific Utility -- *Describe your PZ-related LSST science, or how the estimator you are recommending would enable LSST science.*

2. Outputs -- *If possible, describe the minimum set of PZ outputs that are required for your science, or the outputs generated by the PZ estimator(s) you are recommending.*

3. Performance -- *If possible, describe the minimum PZ quality that would enable your LSST science, or the minimum quality of the PZ estimator(s) you are recommending.*

4. Technical Aspects -- *If possible, briefly address the technical considerations (e.g., "will meet", "will probably meet", "probably will not meet", "will not meet").*

S.6. Photo-z Validation Cooperative *(draft)*

The science community has a considerable wealth of expertise in generating photo-z catalogs, and are best suited to scientifically validate the LSST Object catalog photo-z.

DM will facilitate a “Photo-z Validation Cooperative” by providing infrastructure and technical support for community teams to collaboratively assemble training sets and validation metrics, apply them to commissioning data, and document and share the results.

Exactly how this will work and on what timescale remains TBD.

See Section 6.1 of DMTN-049 for a brief overview of the potential commissioning data that will be relevant to photo-z validation.

How do we communicate and work together?

Many teams within the Science Collaborations and International Programs proposing in-kind contributions are already working on LSST photometric redshifts.

The goal of this roadmap is to *let all that development progress* and at the same time *provide a transparent process for DM's activities* and a *consistent means of communication for everyone.*

Communication Modes

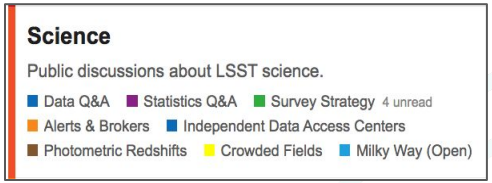
Attend these forums and participate in the discussions.

Photo-z Coordination Group in Community.lsst.org →

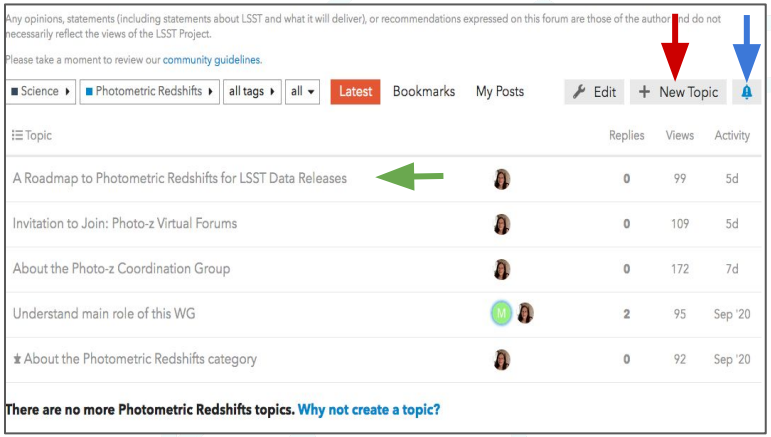
Emails to Melissa are OK too (mlg3k@uw.edu).

Community.lsst.org

"Photo-z Coordination Group" is the **Photometric Redshifts** category.



- **reply** in topic threads
- post **new topics**
- "**watch**" category to get email notifications



Discussion Session

~15 minutes: questions about the roadmap
~15 minutes: questions about letters of recommendation
~10 minutes: open Q&A or discussion

Type in the Zoom chat, or unmute to speak (please introduce yourself!).

Questions later? Raise it as a new topic in Community.lsst.org
“Photometric Redshifts” category (https://community.lsst.org/c/sci/photoz/42).

VERA C. RUBIN
OBSERVATORY

Thank you for joining us today.