LSST:UK Newsletter 19 (February 2022)

Introduction

Save the date: the Rubin Observatory has announced that the 2022 Rubin Project and Community Workshop (PCW) will be held from August 8-12 at the Ritz-Carlton Dove Mountain Resort in Tucson. They are currently planning a fully in-person meeting, and further information will be circulated in due course.

The Rubin Data Management team has published its summary of the Letters of Recommendation that it received in response to its consultation on photo-z estimation. The LoRs included submissions advocating use of specific photo-z estimation codes, as well as descriptions of a variety of scientific use cases that rely on the availability of accurate photo-zs; the Rubin document "*Roadmap to Photometric Redshifts for the LSST Object Catalog*" (DMTN-049) has been updated in the light of the information contained in the LoRs.

Those with ideas for future newsletter items should contact the LSST:UK Project Managers (@ George Beckett and @ Terry Sloan lusc_pm @mlist.is.ed.ac.uk), while everyone is encouraged to subscribe to the Rubin Observatory Digest for more general news from the US observatory team.

@ Bob Mann

Unlocking LSST's discovery space: sky subtraction algorithms optimised for low-surface-brightness science

Most of the baryonic matter in the Universe (both gaseous and stellar) exists in faint or diffuse 'low-surface-brightness' (LSB) structures. Examples of stellar LSB structures are dwarf galaxies at cosmological distances (which dominate the galaxy number density at all epochs and in all environments), intra-group and intra-cluster light (which contain significant fractions of the baryon budgets in dense regions of the Universe) and faint merger-induced stellar streams and tidal features (which encode the assembly histories of galaxies). As a direct consequence of this, most astrophysical objects are, in fact, fainter than the surface-brightness limits of past large surveys like the SDSS.

Given its unparalleled combination of depth and area LSST's niche will be to enable, for the first time, statistical studies of such LSB objects and structures, that are invisible in past wide surveys. While this promises a step change in our understanding of the Universe, accessing the discovery space of LSST will require new data-processing techniques. LSB structures are acutely susceptible to sky over-subtraction, which removes astrophysical LSB flux (which then propagates into related issues like shredding by de-blenders). A comprehensive exploration of the performance of the current LSST pipeline, which is optimised for well-separated objects with small angular size, indicates significant over-subtraction faintward of $\mu(r) \sim 26$ mag arcsec^{-2}. As LSST will reach at least ~4 mags deeper that past wide surveys like the SDSS, this puts much of its LSB science in doubt and the potential game-changing discoveries that will result from them out of reach.

To address this problem, we are developing sky-subtraction strategies that preserve LSB flux in LSST images. We are comparing the most common LSB-preserving sky subtraction methods, to be supplemented by a promising novel algorithm. Using existing methods as a starting point, it creates model-free sky maps in individual exposures, by subtracting, from each image, a preliminary sky-subtracted coadd, so as to remove all astrophysical flux. Since it involves no modelling and works at the cadence of individual exposures, this algorithm can produce this algorithm can produce more accurate sky maps, resulting in significantly cleaner final coadds, with flux potentially preserved down to LSST's theoretical depth ((r)~30.3 mag/arcsec^2). We are currently testing the algorithm on fully-synthetic images, to quantify sky-subtraction accuracy from each method using a known solution. We will then test on individual tracts from Hyper Suprime-Cam (HSC) surveys so as to converge on a sky-subtraction algorithm that can be employed by the LSST pipeline.

@ aaron.watkins @ Chris Collins @ Sugata Kaviraj

Galaxy Clustering & Lensing on Rubin Simulations

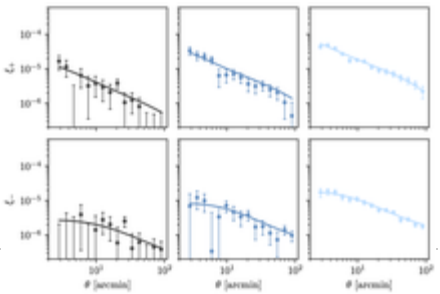
The first paper from the TXPipe project, a key output of LSST:UK Work Package 3.10, is now nearly complete.

TXPipe is the DESC package that analyzes the catalog outputs of the Rubin Science Pipelines and generates the two-point measurements for galaxy clustering and weak lensing, which is one of the primary cosmology science cases for Rubin. It connects together dozens of packages from across the collaboration and beyond, and is designed to make re-running every step in the complete analysis pipeline as simple as possible.

The paper, led by Judit Prat at UChicago, demonstrates the code on the CosmoDC2 simulations, and finds that the wider pipeline can recover these auto- and cross-correlations accurately enough for early LSST science. The project also highlighted a number of bugs and problems with the project, especially how it estimates noise levels in our catalog data.

CosmoDC2 was generated to test DESC pipelines, but is now being released by the Project as Data Preview 0.1 to the wider Rubin community.

@ Joe Zuntz



Recent LSST:UK Science Centre outputs

The LSST:UK Science Centre has recently produced the following technical report.

Title	Author	Description
D1.4.1 Plan for UK involvement in Commissioning	Graham Smith	This deliverable comprises the document titled “LSST:UK Directable In-kind Contribution to Commissioning the Vera Rubin Observatory” presented to the Rubin System Integration Test and Commissioning (SITCom) team. It describes the directable expertise available to the SITCom team from the LSST:UK Consortium. This expertise includes on-summit support for telescope and active optics commissioning, and remote data analysis expertise that is integrated with ongoing effort within the Science Collaborations and the LSST:UK software development teams.

@ Terry Sloan

Forthcoming meetings of interest

Several meetings of potential interest have been scheduled for the coming months.

Note that the current list of forthcoming meeting is always available on the Relevant Meetings page. You may also wish to check information held on the LSST organisation website LSST-organised events and the LSST Corporation website

- 28-30 March 2022. From Data to Software to Science. An in-person event at the Flatiron Institute in New York City, with remote participation supported on a best-efforts basis. (Applications must have been made by **January 26th** and successful applicants will have been informed by February 7th.)
- 8-12 August 2022. 2022 Project and Community Workshop, Ritz-Carlton Dove Mountain Resort, Tucson.

@ George Beckett

Announcements

If you have significant announcements that are directly relevant to LSST:UK and would like to share the announcement in a future newsletter, please contact the LSST:UK project managers.