# LSST:UK Newsletter 31 (March 2023)

Introduction

March has been a busy month, both for the Rubin Observatory and for LSST:UK. On the summit, the StarTracker cameras continue their work to reduce the uncertainty in the Telescope Mount Assembly's pointing, while the latest video release from Rubin (see right) shows Wil O'Mullane and Ranpal Gill being lifted onto the top of the dome.

The operations team has had its annual NSF/DOE Joint Operations Review, which was formally passed and which yielded a crop of constructive feedback from the review panel.

Rubin have issued a *Save the date* announcement for the 2023 Project and Community Workshop, which will take place at the Marriott University Park in Tucson, in the week of 7-11 August. As last year, it is intended that some sessions - plenaries and general-interest sessions - will be made virtually accessible.

March has also seen a pair of workshops concerning the Rubin Independent Data Access Centres (IDACs), of which the UK will be hosting one. The first - Supporting Computational Science with Rubin LSST - was a user-focussed event, gathering use cases for the analysis of LSST data and mapping then onto requirements for the IDACs, while the second was a technical meeting involving staff from the IDACs, plus the Rubin Data Management and Operations staff with whom they will be interacting.

Closer to home, we have published the latest update to our UK Data Rights Holders list of Affiliate PIs and Junior Associates. There is also a significant update to the two Rubin project documents that layout the path to early data access and early science. With the start of survey operations now scheduled for January 2025, check out the latest news on our regularly updated wiki page.
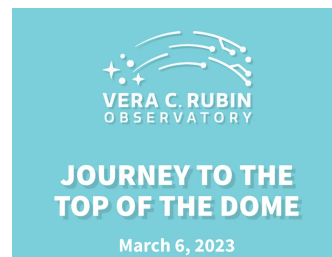
Those with ideas for future newsletter items should contact the LSST:UK Project Managers (@ George Beckett and @ Terry Sloan lusc_pm @mlist.is.ed.ac.uk), while everyone is encouraged to subscribe to the Rubin Observatory Digest for more general news from the US observatory team.

@ Bob Mann

Forthcoming LSST:UK Elections

The next few months will see the end of the current terms of @ Mike Watson as LSST:UK Consortium Board Chair and of @ Catherine Heymans and @ Aprajita Verma on the Executive Group. So, we shall be holding elections for two Exec Group slots and a Board Chair, although, in both cases the incumbents can stand for re-election.

The Board Chair must be a member of the Board at the time of their election, and is elected by the other Board members, so this process is really internal to the Board.

The Exec Group members are also elected by the Board, but anyone in the LSST:UK Consortium is eligible to stand for election (with the exception of Work Package Leaders in the STFC-funded LSST:UK Science Centre programme). A separate email will be sent out on the *lusc-announce* list after the Easter break to solicit (self-)nominations for the Exec Group posts and to give the timescale for the election process, but this is an informal heads-up to all Consortium members to think about whether they would consider standing for the Exec or suggesting to others that they should; **the Consortium Board is particularly keen to see candidates who would increase the diversity of the LSST:UK leadership**. A formal description of the role of the Exec Group in contained in the Consortium's governance document, while informal enquires as to what the role entails in practice can be directed to either of us.

@ Bob Mann and @ Terry Sloan

Changes to access to the Data Previews

The Data Preview programme is operated by the (recently renamed) Rubin Community Science Team and is aimed at helping the Rubin community gain experience with the LSST data products and analysis tools (principally, the Rubin Science Platform) prior to Data Release 1, through use of data from simulations (Data Preview 0) and, later, commissioning (Data Previews 1 and 2). Until recently, access to the Data Previews was provided to "DP Delegates" via a periodic application process. The Community Science Team has announced that, from now on, any Data Rights Holder may sign up for the current Data Preview 0, simply by following a registration checklist. This change of procedure follows the adoption of a new identity management system, which makes the registration of new delegates a less manual process, and which also simplifies things for users, as they can now login using existing credentials from a trusted provider (e.g. their university). The new system also enables registered users to link multiple identities to their account, so that they can use credentials from a fallback provider, should their main one not be working.

@ Bob Mann

LSST:UK at NAM2023

We have been allocated three 90-minute sessions at NAM2023, which will be taking place in Cardiff during the week of 3-7 July 2023. A more detailed session plan will be circulated once the NAM schedule has been released, but these sessions will be used to present a mixed programme of material, including project updates, reports from some of the staff of the STFC-funded LSST:UK Science Centre programme and contributed science talks from the wider LSST:UK Consortium.

All members of the Consortium are encouraged to consider applying for a contributed talk slot in which to talk about their work within the LSST Science Collaborations or other plans for LSST science - and **we particularly encourage applications from Early Career Researchers**. With the start of science survey operations now set for January 2025 and commissioning data due to appear in 2024, this is an ideal opportunity to learn about LSST data and data access. It offers an opportunity to early career researchers (as well as those more senior) to present and discuss ideas and areas for synergy and UK coordination. We very much encourage wide participation from the community and welcome feedback from the expected wide LSST user based on UK data access issues and science opportunities.

The abstract submission form can be found at https://nam2023.org/science/abstract-submission and abstracts are due by **1300hrs (UTC) on Monday 24th April 2023**.

@ Bob Mann and @ Stephen Smartt

New Interface for the Lasair Alert Broker
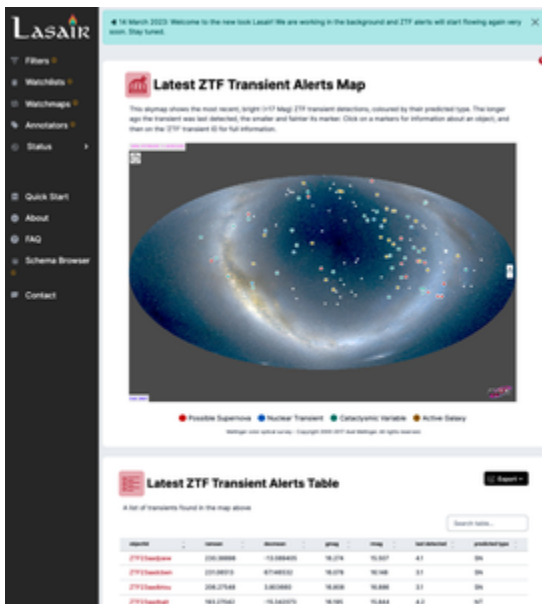
The Lasair team is very pleased to announce our latest release - Lasair version 4.2. This has a dramatically improved user interface, and full documentation. It is the final version using the ZTF alert stream as a prototype - from here on in we will be adapting Lasair for the Rubin/LSST data stream. However, the technology stack, the functionality delivered, and the user interface - including both web pages and an API for notebooks - is pretty much as we plan for Rubin. So take a look! It's worth taking stock and explaining what Lasair does, and how it differs from other brokers.

Lasair is the UK community broker for LSST alerts -- the immediate notifications of changes in the night sky. Often these sources are the result of energetic processes, and the science knowledge from such sources is greatly improved by early follow-up -- with spectroscopy for example. Therefore the alert broker is designed so that end-users get data as soon as possible after the photons hit the Rubin telescope. Lasair can send emails to users -- the 20th century rapid alert -- or it can push messages via Kafka, a streaming protocol made for machine-to-machine communication. A Lasair user builds filters -- from fragments of SQL -- that pass through only what that user wants: perhaps a kilonova lightcurve, or an alert coincident with the user's personal catalogue.

There will be a lot of alerts from LSST, perhaps 10 million on an average night, each about 60 kilobytes, so up to a terabyte to be processed. The LSST alerts will have not just the latest detection of the lightcurve, but a year-long lightcurve. The Lasair architecture splits the firehose into substreams, each to its own processor, which can evaluate each alert against the user's stored filters.

Lasair adds value to the alerts before the filters run. "Sherlock" is a collection of catalogues of galaxies, AGN, variable stars, etc, and an intelligent algorithm to associate an alert with a known astrophysical object. There is also a crossmatch with the Transient Name Service to see if the alert has already been discovered and registered. Users can upload "watchlists" of their favourite objects, and "watchmaps" with regions of the sky, and include these as part of their filter.

Most of the other six LSST alert brokers are classification engines, so that alerts are labelled by, for example, supernova type. But the Lasair approach is to provide a kit of parts for users to make their own filters and classifications, based on lightcurve "features", for example periodicity and rate of increase of flux. The filter can also include the Sherlock information, for example redshift and colour of the host galaxy, and association with watchmap sources. Lasair users are encouraged to create "annotations" of objects in the database, where their classifications and derived features can be added to those produced by Lasair itself, and so available for other users.

Lasair has been prototyped for four years on the Palomar-ZTF survey, a preview in many ways to LSST. The Lasair team has been working on a new web interface for this final ZTF version of Lasair, which was put into production March 14, before starting seriously on the LSST alerts that are soon to come. Please look through the new web pages and documentation.

@ Gareth Francis   @ Andy Lawrence   @ Terry Sloan   @ Stephen Smartt   @ Ken Smith   @ Roy Williams   @ Dave Young

Updates on the status of 4MOST

LSST is set to transform our understanding of the Time-Domain Universe through time-series imaging of the southern sky. This revolution should not be news to anyone reading this newsletter, regardless of whether your astrophysical interests explode or not. Many of us will have worked on previous generations of surveys that have performed wide-area but shallow searches of local transients, or pencil-beam surveys that observe type Ia supernovae out to high redshifts. With the advent of LSST, we are able to combine both area and depth to search an unprecedented volume of the Universe and discover an order of magnitude more transient events than the current best surveys. The photometric discovery of transients, however, is not where the story ends, as spectroscopic follow up enables us to get a much more detailed look at the astrophysical nature of the events. The spectroscopic resources at our fingertips haven't quite grown as rapidly as our photometric discovery capabilities – until now.

The 4m Multi-Object Spectroscopic Telescope (4MOST) will become the dominant follow-up mechanism of supernovae and their host galaxies in the LSST-era. 4MOST will be mounted on the current VISTA telescope at the Paranal Observatory in Chile. Within 4MOST's field-of-view sit ~2,400 fibres, each on an individually controllable actuated arm, to simultaneously capture light across a variety of target types. During its initial 5-years of operations, 4MOST will cover the entire southern sky at least twice and obtain more than 25 million spectra. The 4MOST science team consists of 18 different surveys, and assembled uniquely among them is the Time-Domain Extragalactic Survey (TiDES). The LSST:UK WP3.3 efforts are focused on creating software products to seamlessly bridge the discovery and follow-up of transients between the two complementary surveys of LSST and TiDES.

Much like the Rubin Observatory itself, 4MOST is still under construction but showing good progress even in the face of covid-related delays. Within the past year, the first of three spectrographs arrived in Potsdam, Germany, for integration and testing. The system will consist of 2 low-resolution spectrographs, R>4000, and a high resolution spectrograph, R>18,000. Other components of the optical system taking shape include the Wide-Field Corrector (WFC), which has recently been installed on the Cassegrain test stand. The WFC consists of 6 large lenses, each about 1m in diameter, and will sit in front of the fibre positioner to provide a suitable focal-plane for the fibres.

Speaking of fibres, probably the most challenging task for 4MOST will be individually positioning each of the ~2,400 optical cables, to a fraction of an arcsecond precision, for each of the many pointings the telescope will slew to each night! Late last year, the fibre positioning system, AESOP, was tested for the first time at the AIP integration hall. The fibres were backlit and four highly precise cameras measured the position of each fibre. The system then measured the deviation from the desired position and iterated the process until all fibres were at the desired coordinates. An example of the backlit fibres before and after positioning is shown in the Figure. The current setup performs 7 iteration steps for a total fibre reconfiguration time of 3 minutes. This is promising progress towards a requirement of 2 minutes and a goal of 1 minute for a total system reconfiguration.

The hardware and software development efforts within 4MOST are continuing at an impressive pace with the collaboration working towards the start of commissioning in the second quarter of 2024. As full survey operations are scheduled to begin in Autumn 2024, the timing with Rubin's start will ensure that the TiDES team is ready from the moment LSST discovers its first supernova. Thanks to the efforts of LSST:UK WP3.3, tens-of-thousands of those transients will flow seamlessly across two different telescope systems and straight onto the computers of the time-domain astronomical community.
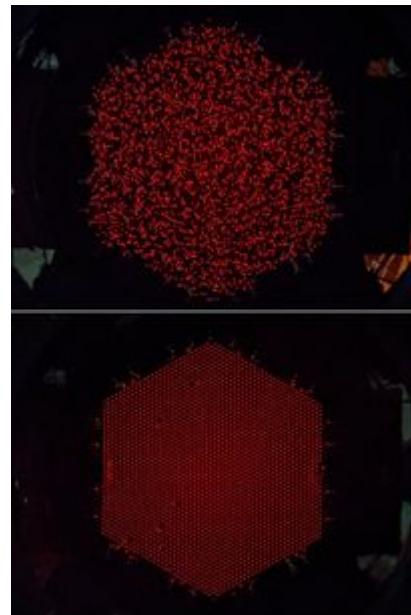
@ Christopher Frohmaier   @ Mark Sullivan

Forthcoming meetings of interest

A reminder of a date for your diary for the **LSST@Europe 5** meeting, which will be held in Pore, Croatia, during 25th--29th September 2023. Registration information is expected to be published in the next couple of weeks. The dates have also been confirmed for the **Rubin Project and Community Workshop 2023**: it will be held on 7th--11th August in Tucson, Arizona.

Other meetings of potential interest for the coming months include:

- 20th–22nd June: The Transient and Variable Universe, held at University of Urbana Champaign, Illinois, USA
- 3rd-7th July: The National Astronomy Meeting 2023, held in Cardiff, with a three-part session on "UK involvement in the Vera C. Rubin Observatory: Legacy Survey of Space and Time"
- 24th–28th July: DESC Collaboration Meeting (SLAC), California, USA

Members of the Consortium (not in receipt of travel funding through one of the Science Centre grants) may apply for travel support for meetings of this kind via the the LSST:UK Pool Travel Fund. Details are available at Forthcoming LSST-related Meetings .

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.

@ 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.