

LSST:UK Newsletter 41

February 2024



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Introduction

[Bob Mann](#)

This month's gratuitous picture from the summit shows (at right) the M1M3 mass surrogate being washed. This took place on the maintenance level of the summit facility, as a prelude to it receiving a full-surface coating, using the same procedure, under vacuum and in the mirror coating enclosure, that will be applied to the M1M3 mirror itself in due course.



Credit: RubinObs/NSF/AURA

LSST:UK has operated a Pool Travel Fund since the start of Phase A in 2015, enabling those without travel funding from LSST:UK Science Centre (LUSC) grants to apply for support to attend LSST-related scientific and technical meetings. These awards are made by >>>

the Executive Group, primarily on the basis of anticipated scientific return, and have proven to be an effective way to help UK researchers engage with the international Science Collaborations. The Exec has decided that this scheme should be broadened slightly, to allow a fraction (<25%) of the Pool Travel Fund to be used to help support LSST-related scientific and technical meetings held in the UK, where, for example, hosting a meeting here would be more beneficial scientifically, and better value-for-money, than sending multiple attendees to a meeting that would otherwise take place in the US. The page on the LSST:UK wiki providing [information about the Pool Travel Fund](#) has been updated to include this updated policy, plus links to new application forms to apply for travel and meeting support.

March sees the return of online events run by the Rubin Community Science Team for Data Preview 0 Delegates. A series of these [Rubin Science Assemblies](#) will run through to early May, while the annual Rubin Data Academy will take place on 17, 18, 20 and 21 June.

Finally, we are delighted to announce that our very own [Stephen Smartt](#) (right), the LSST:UK Project Scientist, has been [awarded a Royal Society Research Professorship](#).

These are very prestigious awards – Stephen’s was one of only two awarded across the whole of science for 2024 – intended both to recognise past achievements and to support future successes.



Analysis, and follow-up, of LSST transients is a major element of the research programme that Stephen intends to undertake with support from this award, and we look forward to hearing about the fruits of this success in the coming years.

A UK perspective on the Joint Technical Meeting

[George Beckett](#)

Annually (typically), the Rubin Data Management (DM) Team holds a Joint Technical Meeting (JTM) to review progress of the whole DM programme. It covers everything from commissioning and data processing to science validation and end-user tooling.

The most recent meeting was held in SLAC (home of the US Data Facility) from 6-8 February. Several LSST:UK team members – including me – attended; I was able to attend in person.

This was my first in-person experience of the JTM and it was a very positive experience. It was really good to be face-to-face with most of the key people in DM, these are people we work with day-in, day-out but usually via online meetings and Slack. What was pleasantly surprising was how familiar everyone felt:

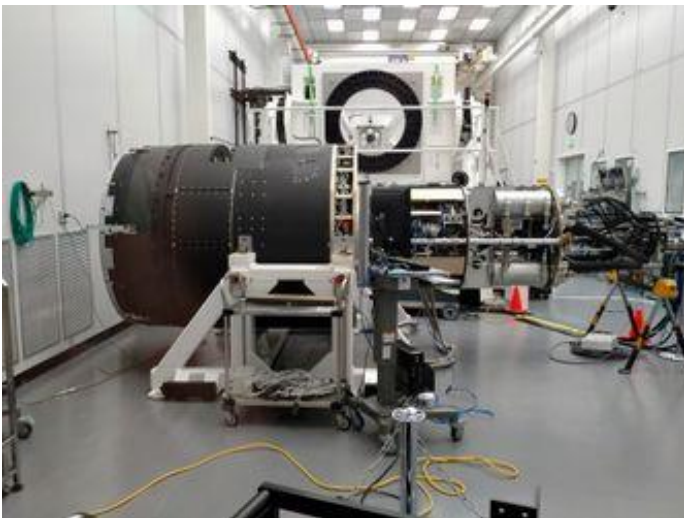


it certainly didn't feel like the first time I had met many of the team members in person.

The JTM programme is definitely a packed one, with three or four parallel sessions at times, plus satellite meetings happening alongside the main programme. There was a very positive feel to the meeting, with lots of energy as the beginning of Operations feels almost imminent.

My focus was on three aspects of UK involvement in DM: contributing to Data Release Processing, running a Data Access Centre, and supporting UK science priority experiments. I also had a number of tasks/ questions from colleagues in the LSST:UK team to follow up on. I feel things are in good shape, and DM is working very well as a unit. There are still some challenges to the timeline to the start of Operations, with some details of Commissioning and Early Science still being finalise, but what is clear is that the telescope is going to be an amazing facility and the survey will keep astronomers busy for many years to come.

Being face-to-face also gave me a rare opportunity for some more sociable aspects of workshop participation. I particularly enjoyed my first experience of a board games evening and found a fellow retro-computing fan in the US-based team.



It was also good to finally visit SLAC and learn more about the set-up of the US Data Facility. A particular highlight was a chance to see LSSTCam up close (left), as it is currently on site completing final testing, before being shipped to the summit in spring.

From the UK, SLAC is easier to reach than Tucson, so I shall hope to have a few more opportunities to visit as we move into Operations and Early Science support.

Connections forged at the ESO-LSST workshop

[Colin Snodgrass](#)



Some of the 100+ attendees of the recent ESO-LSST workshop

The workshop *What Was That? – Planning ESO Follow up for Transients, Variables, and Solar System Objects In the Era of LSST* was hosted by The European Southern Observatory (ESO) at its headquarters in Garching, Germany, from 23-26 January 2024. The meeting was well attended, with around 100 in-person attendees and many more joining online from across the diverse research fields that will use LSST as a discovery machine.

The purposes of the meeting were:

- to bring together the communities of ESO observers and the LSST project, broker teams, and science collaborations
- to highlight available ESO facilities for LSST follow up observations
- to demonstrate to ESO management the need for significant support for follow up in the LSST era, and
- to begin to plan and build consortia who will make and use these follow up observations.

The meeting was seen as very successful by participants, with useful connections made between groups who do not normally work together. Senior ESO staff were present throughout and reported at the end of the meeting that the message of what the LSST community needs, and the urgency of figuring out next steps (for example, whether or not ESO should issue a call for relevant large public surveys), were well received. Broker teams reported that the meeting was a useful opportunity to get feedback on their plans for their tools from the user community, and there were good discussions in break-out sessions on topics, ranging from >>>

how we communicate with each other to planning for specific follow up campaigns for particular science cases.

See more details on the [meeting website](#) – including links to presentations shared via Zenodo

Videos of most of the talks are available on the [ESO-LSST YouTube Channel](#)

LSST:UK in the media: The Guardian highlights UK contribution to Rubin

[Eleanor O’Kane](#)

A feature on the Rubin Observatory in *The Guardian* published earlier this month highlights how Rubin will expand our knowledge of the Universe.

[Aprajita Verma](#) was interviewed for the feature, which underscores the UK’s role in processing around one quarter of the 60 petabytes of data set to be captured during the 10-year survey.



The article notes that with Rubin’s completion, Chile will become the leading destination of astronomical observation, generating about 70% of data seen from Earth by 2025.

Read the full article:

<https://www.theguardian.com/science/2024/feb/05/astronomy-telescope-chile-vera-c-rubin-observatory>

New paper: The merits and pitfalls of sky subtraction techniques

[Aaron Watkins](#)

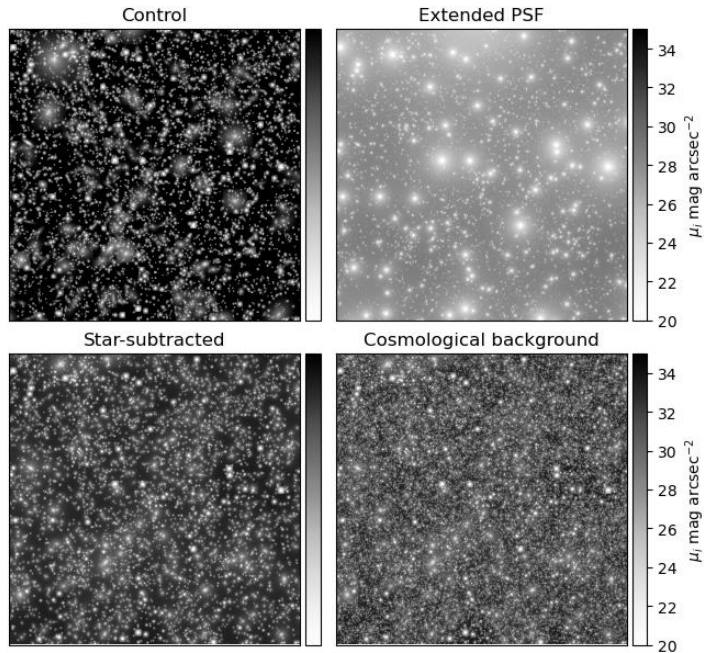
MNRAS has recently published an article by [aaron.watkins](#) and collaborators (including [Sugata Kaviraj](#) and [Chris Collins](#)) discussing the merits and pitfalls of different kinds of sky subtraction techniques. The paper, [Strategies for optimal sky subtraction in the low surface brightness regime](#), describes experiments using fully synthetic images to investigate three different techniques, two commonly used in low surface brightness surveys, another experimental.

The study's results quantify the impact of undetected flux on sky models, which tends to bias estimated sky brightnesses high, risking over-subtraction of flux. If the sky is modelled with a complex function (for example, a high-order polynomial, or a spline interpolation), that over-subtraction can occur locally, leading to artificial divots surrounding extended objects like galaxies, or even objects which are simply located close together on the sky. However, the results demonstrate that when a simple model is used, and when proper care is taken to mask detected astronomical objects to low surface brightness levels, this bias can be reduced to negligible amounts.

Even for a survey as deep as LSST, any sky subtraction technique traditionally used in low surface brightness surveys can still be applied safely, so long as empirical corrections are made for scattered light and undetected faint sources.

The paper justifies the recommendations Watkins and collaborators have proposed to LSST's data management (DM) team regarding the survey's pipeline sky subtraction. Working alongside DM, Watkins et al. found that the existing algorithm suffers from two problems: insufficient masking of low surface brightness flux, and too complex a sky model. Following the paper's results, the team found that adjusting the algorithm to use a much simpler model, even without an improvement to the masking, proves very successful at minimising the impact of the sky subtraction on the flux of extended or clustered objects.

In fact, a preliminary investigation suggests that the proposed revised algorithm might benefit more than just low surface brightness science: a number of DM's photometric quality metrics appear to improve slightly when the revised algorithm is used, compared to the default pipeline. However, the full impact of the proposed change is still being investigated. >>>



Examples of the synthetic images used to conduct the tests on sky subtraction routines, showcasing the kinds of model sources injected for four different experiment types.

- Top-left panel shows a sparsely populated control field.
- Top-right panel shows that same image, but convolved with an extended scattered light model derived from the Subaru Telescope's Hyper Suprime-Cam imager, to investigate the impact of that scattered light on sky models.
- Bottom-left panel shows an image simulating data processed through a typical low surface brightness optimised data reduction routine, in which that scattered light is subtracted from the stars (but not the galaxies).
- The bottom-right panel shows an image which includes models of many faint, high-redshift sources drawn from the New Horizon simulation, to investigate the impact of undetected faint objects on sky models (also known as extragalactic background light).

[Read the paper \(open access\)](#)

[Available on GitHub:](#)

- the code used to generate and process synthetic images
- a tutorial Jupyter Notebook demonstrating two of the sky subtraction algorithms tested

Cosmic streams in the era of Rubin – conference report

[Chris Frohmaier](#)

As the northern hemisphere braced itself for the cold wet winter of 2023, astronomers gathered in the early summer sunshine of Puerto Varas in Chile to discuss data brokers and the follow up of transients in the LSST-era. The week-long meeting, *Unveiling the dynamic universe: cosmic streams in the era of Rubin*, commenced on 11 December 2023 with an update on the status of the Rubin Observatory and the opportunities for both early and time-domain science. This was followed by several talks on the progress of current surveys, such as ZTF, and future surveys that will complement LSST operations. Of particular interest to those of us in explosive transients was the La Silla Schmidt Southern Survey – LS4 for short – introduced by the survey PI Peter Nugent (Berkeley). LS4 will conduct a multiyear survey of the southern sky to a depth comparable to ZTF, discovering thousands of supernovae each year. This survey is designed to monitor the local Universe and observe nearby and bright supernovae that would otherwise saturate the LSST CCD. The synergistic surveys sessions were rounded out by my 4MOST/TIDES presentation and the efforts within LSST:UK to dominate the spectroscopic follow up resource of LSST discovered supernovae and their hosts.

Broker pitches

The first day of the conference also saw the participating data brokers pitching their products to the participants to convince us to use their platform once LSST overwhelms us with alerts. Of course, there was no single best broker, and it was clear that they all play a vital role for the community. Each broker offers something unique, such that the science you want to perform will naturally find a home on one (or several!) platforms. The takeaway message was to play around with each of them and have fun!

It was the role of Mark Sullivan to remind the audience why we were all here during his overview talk of explosive transients. Drawing on his many years of experience in supernova surveys, Mark presented the progress of our understanding of supernova astrophysics and cosmology. He provided recent examples of exciting results to set the stage for how LSST will completely revolutionise our understanding of the time-domain Universe.

The second day of the conference was filled with tutorials to provide hands-on experience with current tools and in-development broker services. Both ALeRCE and Fink took centre stage with live broker demos reminiscent of a Silicon Valley Keynote address, reflecting the impressiveness of their development efforts. >>>



Summer skies for the attendees of conference on cosmic streams, December 2023

The middle of the week was reserved for scientific discussion and collaboration between the participants. The structure of the preceding days made way for a more relaxed environment where we pooled our ideas, searching for the next hot topic in transient astronomy, and discussions on how we can use LSST to spring these projects forward.

The final few days were dedicated to science talks. There was strong representation from the LSST:UK contingent, with [Philip Wiseman](#) presenting his Ambiguous Nuclear Transients research, and Xinyue Sheng presenting her machine learning code, NEEDLE, and its deployment within the Lasair broker.

On the flight home, I reflected on what I learned during the past week. In isolation, the prospect of the full data stream from LSST is terrifying, however, the development efforts from the community were truly impressive. Now is the time to get involved, get ready, and to get excited about the start of LSST.

Visit the [conference website](#)

Gain the skills to engage others in LSST:UK

[EO](#)

Many of you are probably already talking to people outside the LSST:UK sphere about the project. Maybe you're blogging or posting about the project on social media – or would like to. We want to give researchers interested in telling new audiences about LSST:UK: the skills to spread the word.

We're looking to develop science communication skills in team members. This is an opportunity to gain useful skills while helping others – especially non-specialist audiences – understand the value of LSST:UK. The aim is to create a network of researchers who have the know-how to communicate the complexity and significance of LSST:UK and ignite interest in science and research.

The communications training schedule will be light touch, flexible and ongoing, guided by the skills and interests within the team. We're looking for researchers with no experience to those who already engaged in science communication at any level.

The Communications Officer, [Eleanor O'Kane](#) (email eokane@roe.ac.uk), will coordinate the training. We also have the considerable expertise of our Education and Public Engagement Officer [Chris Lintott](#) within the project. Skills will include working with the media, communicating complex messages and understanding how to connect with different audiences.

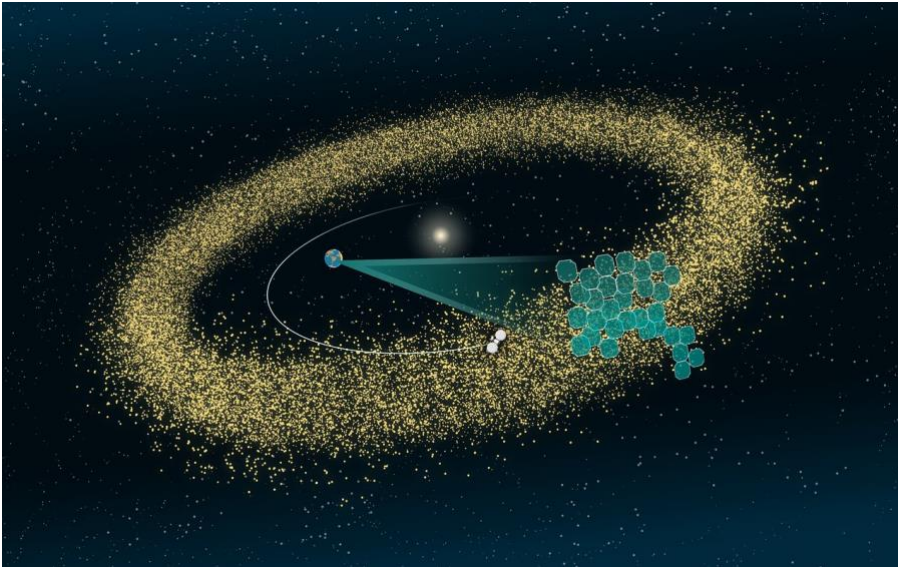
Training may be online and where possible we will work with institutional marketing and communication teams to deliver sessions. Sign up below if you'd like to learn more.

If you're interested in knowing more, [add your name here](#).

(Consortium Board members who have previously responded to my requests about communications training do not need to respond.)

Inspiring a new era in space missions – latest Rubin science release

[EO](#)



As well as inspiring new missions, Rubin could also identify flyby opportunities for missions such as NASA's Lucy, whose shape and orbit are represented in this image, left.

Credit: RubinObs/NOIRLab/NSF/AURA/J. Pinto

The latest science release from Rubin outlines how a discovery could trigger a space mission to a fast moving target.

The first space mission to launch before a primary target has been identified is already in development: the [ESA/JAXA Comet Interceptor](#) mission is due to launch with the ESA ARIEL spacecraft in 2029. A Rubin discovery could see the multi-element spacecraft directed to a long-period solar system comet or interstellar object passing by the sun for the first time.

[Colin Snodgrass](#), Mission Deputy Principal Investigator for the ESA/JAXA Comet Interceptor, comments: "LSST is expected to discover vast numbers of Solar System objects, but what is really exciting for me is that we expect to discover new comets approaching the Sun for the first time at much larger distances than we currently do. This will help us answer questions about how cometary activity works far from the Sun, where it is too cold for water ice to sublimate, and is also a key enabling technology that allowed us to propose Comet Interceptor.

"We expect to have years to react to a discovery instead of months, and while this is still too short a time to plan and build a space mission from scratch, it is enough to get the spacecraft into the right place at the right time from a parking orbit in space. LSST:UK will make an >>> important contribution to this through the Adler system that we are developing in Edinburgh and Belfast, that will – along with other goals – flag comets that could be potential mission targets amongst the LSST discoveries."

[Read the full story on the Rubin website](#)

Forthcoming meetings of interest

Dates, locations and links... 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](#).

Dates	Meeting Title / Event	Meeting Website/ Contact	Meeting location / venue
12/Mar/24-15/Mar/24	Preparing for the Statistical Age of Strong Gravitational Lens Science with the Rubin Observatory Legacy Survey of Space and Time (LSST)	https://sites.google.com/view/rubinslens24/	UK Oxford
18/Mar/24-20/Mar/24	Rubin ToO 2024: Envisioning the Vera C. Rubin Observatory LSST Target of Opportunity program	https://lssttooworkshop.github.io/	USA Berkeley, California (or virtual). Registration for virtual attendance closes 29/Feb/24

15/Apr/24-19/Apr/24	KAVLI-IAU (IAUS 387) Symposium, <i>(Toward) Discovery of Life Beyond Earth and its Impact</i>	https://kavli-iau-2024.durham.ac.uk/wordpress/	UK Durham University
17/Apr/24-19/Apr/24	Time Domain Needles in Rubin's Haystack	https://rubin-anomalies-workshop.github.io/index.html	USA Harvard Center for Astrophysics, Cambridge, MA
20/May/24-23/May/24	Rare Gems in Big Data. The discovery potential of large astrophysical surveys: science opportunities, tools, and techniques	https://mailchi.mp/d8d4daa3ed0a/first-announcement-rare-gems-in-big-data?e=5176cbbd93	USA Tucson, AZ
08/Jul/24-12/Jul/24	DESC Collaboration Meeting	https://lsstdesc.org/	Switzerland ETZ Zurich
22/Jul/24-26/Jul/24	Rubin Community Workshop	More details about the meeting will be available once the meeting website is set up and registration opens. The call for session suggestions and talk/poster abstracts is now open. Email questions about the meeting to pmo.rubin@noirlab.edu .	USA SLAC, California (hybrid)

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 LSST:UK Pool Travel Fund. Details are available at [Forthcoming LSST-related Meetings](#)

Announcements

The [Challenging the Standard Cosmological Model](#) workshop takes place at the Royal Society in London on 15 and 16 April 2024. Both in person and online attendance are available but advance registration is essential. The deadline for applying to present in a poster is 5 March. (Requested by [Subir Sarkar](#))

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 [Eleanor O'Kane](#) (email eokane@roe.ac.uk)