'Early science from the Rubin LSST (EarlyRubin)' Abstracts

Talks

The anisotropy of satellite galaxy quiescence and morphology in galaxy clusters

Authors

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Abstract

We use data from the first preview of the legacy survey of space and time (LSST DP1) to investigate the anisotropic quenching phenomenon: the tendency of quenched satellite galaxies to align with the major axis of the brightest cluster galaxy (BCG) in galaxy clusters. For the first time, we also consider the anisotropy in satellite galaxy morphology, finding a strong anisotropic signal in both quenched and elliptical galaxies as expected, likely due to pre-processing and potentially the presence of backsplash galaxies. Further, we see tantalising results in the anisotropy of quiescent spiral and star forming elliptical galaxies.

The AMPEL alert broker for LSST: a how-to guide

Authors

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Abstract

The Legacy Survey of Space and Time (LSST) at the Vera C. Rubin Observatory will generate an unprecedented stream of transient alerts. Efficiently filtering and analysing this data in real time is essential to fully exploit LSST's scientific potential. In this talk, I will present AMPEL, a flexible, modular alert broker designed to support user-defined workflows for time-domain science. I will provide a practical introduction to AMPEL and demonstrate how users can query alert streams, construct custom filtering pipelines, and implement science units tailored to specific scientific goals. The tutorial will include examples of setting up workflows to select transient candidates of interest using catalogue matching and photometric classification tools. This enables efficient identification and prioritisation of candidates for follow-up in LSST alert streams.

Towards Reliable Galaxy Property Inference for the LSST Era

Authors

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Abstract

The Rubin Observatory's LSST will deliver ugrizy photometry for an unprecedented number of galaxies, enabling population-scale investigations of galaxy formation and evolution. Extracting robust physical parameters—such as stellar mass, star-formation rate, metallicity, dust content, and star-formation histories—from broad-band data remains challenging, not least because these quantities depend sensitively on modelling assumptions and on the limited wavelength coverage available in LSST alone. In this talk, I will present an assessment of these challenges using a cross-matched sample of approximately ten thousand galaxies from LSST Data Preview 1 and the MUSYC survey, which provides extended optical–near-infrared coverage. The two datasets show excellent photometric consistency, allowing a clean investigation of how far ugrizy photometry alone can constrain fundamental physical properties, and where additional bands or stronger priors become indispensable. I will discuss the stability of inferred quantities under different assumptions, the impact of filter completeness, and the practical limits imposed by broad-band SED fitting. Finally, I will introduce a browser-based interactive SED-grid tool designed for rapid exploration of high-dimensional model spaces, useful both for developing LSST-scale pipelines and for building intuition about parameter sensitivities.

The LSST Reliability Factor: Expert and Citizen Science Real/Bogus Classification

Authors

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Abstract

The Rubin Observatory's Legacy Survey of Space and Time (LSST) is expected to generate ten million transient alerts per night, every night, for the next ten years - the majority of which will not correspond to a genuine astrophysical source. Real/bogus classification is therefore a vital first step in any transient science pipeline, and in turn the construction of a high-quality labelled training set is essential to its accuracy. The Rubin Difference Detectives, a Zooniverse citizen science project launched in November 2025, tasked volunteers with the real/bogus classification of Rubin difference image stamps to assist in the development of the LSST `Reliability Factor'. In parallel, an expert labelling effort was conducted with astronomers who had comprehensive experience in image stamp classification/classifier development from prior transient surveys. We present an analysis of the 215,345 citizen science and 55,117 expert classifications used in the development of the LSST's Reliability Factor, establishing a gold standard label set and evaluating the degree to which citizen scientists can recover it. We discuss what behavioural differences emerge in the comparison of the two groups, the conditions under which citizen science can supplement expert judgement, and the implications for automated real/bogus classification in the LSST transient pipeline.

A novel approach to obtain unbiased galaxy clustering measurements with LSST

Authors

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Abstract

Galaxy clustering studies are important tools for constraining the connection between galaxies and their host dark matter halos, as well as the properties of the underlying cosmology of our Universe. With the anticipated increases in sensitivity and survey area afforded by LSST, these constraints will be more limited by our ability to mitigate systematic biases than by statistical uncertainties. These biases can arise from instrumental and observational effects that cause non-cosmological fluctuations in the observed galaxy density. I will present a novel tool for mitigating these systematics. This tool, presented in Cornish et al. (2026), builds upon a recently introduced formalism which allows one to compute angular power spectra directly from catalogue-based data, circumventing the need to first construct maps (e.g. of the galaxy overdensity field, in the case of galaxy clustering) and thus avoiding biases introduced by the pixelisation process. Our extension to this formalism combines these benefits with the ability to characterise and mitigate observationally- or instrumentally-driven systematic effects, facilitating unbiased clustering measurements across all angular scales. I will introduce this formalism and present its validation on both simulated and real data, and discuss its usefulness in helping to ensure LSST reaches its maximum potential for cosmology.

Introduction to LSST and LSST:UK (Invited)

Authors

Graham Smith (1), Bob Mann (2)

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(2) University of Edinburgh

Abstract

I will give a brief introduction to the Legacy Survey of Space and Time (LSST), and the LSST:UK consortium via which the UK community engages with the Vera C. Rubin Observatory and the Rubin/LSST Science Collaborations, and accesses LSST data. Summer 2026 is an exciting time, as early science is emerging from the first tranche of Rubin/LSST data (DP1), release of the second tranche (DP2) and the start of the LSST survey are imminent, and real-time alerts are already being served to the world-wide community. The talk will aim to help people who are new to Rubin/LSST, and to prepare the way for subsequent talks, demos, and discussions in this session.

Q+A and discussion: Accessing early data and alerts (Invited)

Authors

James Mullaney (1)

(1) The University of Sheffield

Abstract

During this session there will be experts on-hand to discuss and answer your questions about accessing Data Preview data and alerts.

Lessons learned from Data Preview 1 and what to expect from Data Preview 2 (Invited)

Authors

James Mullaney (1), Jamie Robinson (2), Garreth Martin (3)

(1) University of Sheffield
(2) University of Edinburgh
(3) University of Nottingham

Abstract

LSST DP 1 has given the community its first real opportunity to work with Rubin data and the tools that come with it. This talk and demo gives an overview of the Rubin Science Platform, walking through the main ways researchers can access and work with the data, from the Notebook and Portal aspects to querying catalogues and retrieving images via the Butler. With Data Preview 2 now on the horizon, we also look ahead to what the next release means for getting started with Rubin data.

Lasair and lessons learned from early alerts (Invited)

Authors

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Abstract

Lasair, developed by The University of Edinburgh, Queen's University Belfast and Oxford University, is the UK's Legacy Survey of Space and Time (LSST) alerts broker and primary access point for the wealth of transient event alerts expected from LSST. Lasair is developed with user functionality at the forefront, whilst also being engineered with sufficient scalability to handle the unprecedented volume of LSST data. Users can construct filters which enable them to preferentially select objects of interest to them and can use annotators to feed information related to objects to the Lasair database – which is particularly relevant and effective when paired with machine learning classifiers for the photometric identification of events.

We will demonstrate several scientific use cases from Lasair users. For example, the Time Domain Extragalactic Survey (TiDES) is utilising a Lasair filter comprised of a combination of photometric variability parameters present in the LSST alerts to reduce AGN contamination in their automated target selection algorithm. The NEural Engine for Discovering Luminous Events (NEEDLE), a photometric classifier for tidal disruption events and superluminous supernovae developed by Xinyue Sheng, has acted successfully as an annotator on Lasair, providing the scientific community with live classifier scores for incoming Zwicky Transient Facility alerts and is soon to be adapted for the incoming LSST data. The LSST TVS-TDE community aims to follow this route – with all photometric classifiers which pass a performance test hosting their classifier scores as a filter supplied by an annotator on Lasair.

These stated examples and many more illustrate the scientific utility of Lasair, and we hope that this presentation will supply users with the information and inspiration to employ Lasair for the enhancement of their science in the new golden age of time domain astronomy brought about by LSST.

Introduction to the LSST:UK Junior Associate Network (Invited)

Authors

Clara Marie Pennock (1), Tom J. Wilson (2), Thomas Cornish (3), Adrew Wilson (2), Garreth Martin (4), Andres Ponte Perez (5), James Robinson (1), Matthew J. Temple (6)

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(2) University of Exeter
(3) Imperial College London
(4) The University of Nottingham
(5) The University of Birmingham
(6) Durham University

Abstract

The LSST:UK Junior Associates Network was set up last year, run by junior associates for junior associates, with the aim to coordinate all Early Career Researcher activities related to the Vera C. Rubin Observatory, and its Legacy Survey of Space and Time (LSST), in the UK. A year on and as the start of the Vera Rubin LSST survey and the release of DP2 draws ever nearer, we'd like to introduce the network to the community, provide information on how to sign up, and to touch base with the LSST:UK community on the future they would like the Junior Associates Network to take.

Early Rubin/LSST science results in the Solar System (Invited)

Authors

Cyrielle Opitom (1)

(1) University of Edinburgh

Abstract

While astronomers around the world await the start of the Vera C. Rubin Observatory's Legacy Survey of Space and Time, and the release of Data Preview 2, the solar system community has been combing through Data Preview one and object discoveries released during the Science Validation surveys. This talk will go through some of the initial solar system results, from the thousands of newly discovered asteroids, to measurement of the rotation period of one of them, and observations of the third interstellar object.

Update from the Vera C. Rubin Observatory (Invited) (Online)

Authors

Bob Blum (1)

(1) NOIRlab

Abstract

I will update the community on the current performance of the Observatory as we look toward year 1 of the LSST. I will also provide an update on Data Preview 2 and the status of the nightly alert stream.

Posters

Calibration of Production Transient Alert Brokers: Preparing Decision Infrastructure for LSST

Authors

Pallavi (1)

(1) Independent Researcher

Abstract

The Vera C. Rubin Observatory is expected to generate approximately 10^7 transient alerts per night, while global spectroscopic follow-up capacity is limited to roughly 10^5 observations per year. Under these conditions, the usefulness of alert broker classifications depends not only on accuracy but also on the reliability of their reported confidence estimates. Well-calibrated probabilities are therefore important for prioritising spectroscopic follow-up. However, the calibration properties of production transient alert brokers have not yet been systematically evaluated.

We examine the calibration behaviour of two widely used brokers, ALeRCE and Fink, using spectroscopically confirmed objects from the ZTF Bright Transient Survey as ground truth. The dataset contains 1,576 confirmed transients spanning Type Ia supernovae, core-collapse supernovae, Type Ibc supernovae, and superluminous supernovae. Calibration is assessed using Expected Calibration Error (ECE) together with reliability diagrams that compare predicted probabilities with observed classification accuracy.

For the ALeRCE light-curve classifier we observe systematic underconfidence, with $\mathrm{ECE}=0.259$. Objects assigned probabilities near 0.5 are observed to be correctly classified about 76% of the time. This behaviour is consistent with the Balanced Random Forest architecture used by the classifier, where class rebalancing during training can compress probability estimates toward intermediate values. Per-class analysis shows that Type Ia supernovae, which achieve the highest classification accuracy ($\sim94\%$), also exhibit the largest calibration deviation with $\mathrm{ECE}_{\mathrm{Ia}}=0.376$. We also note a taxonomy limitation in the production API: tidal disruption events return null predictions despite being an expected component of LSST transient populations.

For Fink we analyse the \texttt{rf_snia_vs_nonia} classifier and find that its probability scores behave primarily as an early Type Ia detection statistic rather than as a calibrated probability over a broader transient taxonomy.

Applying post-hoc temperature scaling using stratified five-fold cross-validation reduces the ALeRCE calibration error from $\mathrm{ECE}=0.259$ to $\mathrm{ECE}=0.015$, with a stable temperature parameter $T=0.361\pm0.011$.

These results provide a calibration baseline for ZTF-era brokers and demonstrate a methodology that can be applied to LSST alert streams as they become available.

Extended Structure in E+A Galaxies via Image Stacking

Authors

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Abstract

Small-scale galaxy interactions, such as minor mergers, flybys, and gravitational harassment, are thought to play a pivotal role in the triggering and quenching of star formation in post-starburst (PSB) galaxies. In this work, we investigate the faint imprint of these processes in E+A galaxies by applying image stacking techniques to enhance low surface-brightness features that are otherwise difficult to detect.

We construct stacked images from a sample of 55 E+A galaxies drawn from SDSS and derive their averaged radial surface brightness profiles and Sérsic profiles. Our results reveal that E+A galaxies exhibit systematically brighter extended outskirts compared to matched non-PSB systems, suggesting the presence of diffuse tidal features consistent with past small-scale interactions.

To probe these features in greater detail, we apply our stacking pipeline to deeper imaging for DES DR1. The resulting stacks reveal significantly enhance extended light, reinforcing the presence of faint tidal structures and demonstrating the sensitivity of stacking methods to low surface brightness features.

Looking ahead, the next generation of deep-wide surveys, particularly Rubin LSST, will provide imaging that surpasses current depths by a substantial margin. Applying our stacking pipeline to Rubin LSST data will enable us to detect even fainter and more extended tidal features, offering an unprecedented view of the role of small-scale interactions in PSB evolution. These future applications will provide anew window into how small-scale interactions shape PSB galaxies, particularly in the low surface brightness regime.

How Well Can We Constrain Cosmology with Double-source-plane Lenses from LSST

Authors

Duncan Bowden (1), Aprajita Verma (1)

(1) University of Oxford

Abstract

Double-source-plane lenses (DSPLs) are a unique and rare type of strong lens consisting of two source galaxies at different redshifts. They are particularly valuable for many applications due to the additional constraining power the second source provides on the mass of the deflector and the dependence of the ratio of Einstein radii on cosmology. With Rubin now operational and DP2 on the horizon, we will soon have ~ O(10) new DSPLs discovered in LSST, doubling the number currently known and many of which will have complementary Euclid data. We must be prepared to model many systems in a consistent and computationally efficient manner. By exploring the systematic error introduced by mass model assumptions for the intermediate source using simulated lenses, we seek to determine how well we can recover the underlying truth and what biases we must consider. This will directly impact our ability to infer cosmological parameters and how our inferred cosmology will evolve as LSST progresses, discovering more DSPLs up to O(100) over the 10-year survey.