

Xinyue Sheng

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Introduction

I am an early-career postdoctoral researcher in Astrophysics specializing in the development of data-driven tools using machine learning to analyse and interpret large-scale astronomical datasets and astronomical software development. My current research focuses on identifying rare, young astronomical transients in real-time alert streams from next-generation sky surveys such as the Rubin Observatory's Legacy Survey of Space and Time. I am also experienced in optimizing high-performance computing workflows through parallel programming to improve the efficiency and scalability of astronomical discovery and data analysis.

Work

Sept. 2025 – Present **Postdoctoral researcher in Astrophysics**
at Queen's University, Belfast, UK.

Education

Sept. 2021 – Sept. 2025 **Ph.D in Astrophysics**
Funded by European Research Council; Supervised by Dr. Matt Nicholl (main) and Prof. Stephen Smartt (2nd) at Queen's University Belfast (transferred) & University of Birmingham, UK

Sept. 2019 – Aug. 2020 **Master of Science in High Performance Computing with Data Science**, with Distinction. Supervised by Dr. Nicholas Ross and Dr. Darren White at University of Edinburgh, UK

Sept. 2015 – Aug. 2019 **Bachelor of Digital Publishing**.
Wuhan University, China

Teaching and Student Supervision

Sept. 2023 – Dec. 2023 **Teaching assistant** for Y3 Computing Physics, Queen's University, Belfast.

Oct. 2021 – Apr. 2023 **Teaching assistant** for Y2 Computing Physics and Y1 Scientific Computing, University of Birmingham.

May 2023 – Nov. 2023 **Non-profit personal tutor (remote)** of a Chinese high school student Kexin Wu, working on *Unsupervised Clustering and Feature Extraction of Supernovae Light Curves using RNN AutoEncoder*. This project won National Award of Excellence in China.

Professional Responsibilities

Survey Operations and Transient Discovery

- **NEEDLE collaboration**: Lead weekly candidate scanning meetings and publish *AstroNotes* for newly identified transients.
- **ATLAS survey**: Screen transient alerts, identify nearby events (< 100 Mpc), publish *AstroNotes*, and flag promising follow-up targets while removing bogus alerts.
- **Lasair user group (UK LSST broker)**: Provide user feedback to developers and contribute NEEDLE annotations to the Lasair platform.

Observing and Instrumentation

- PESSTO/ePESSTO+: Target scheduling, observing, and data reduction with the ESO New Technology Telescope (EFOSC2 optical spectrograph and SOFI NIR instrument), both remotely

and in person.

- Dark Energy Camera Alliance for Transients (DECAT): Remote observing.
- Liverpool Telescope: Follow-up triggering, observation coordination, and data reduction.

Professional Service

- Member of LSST TVS, LSST ISSC, and ENGRAVE collaborations; contributor to ATLAS, Pan-STARRS, ePESSTO+, and LS4 surveys.
- Member of the ZTF AGN–TDE Science Working Group.
- Referee for *Astronomy and Computing* and *Publications of the Astronomical Society of the Pacific*; reviewer for *Liverpool Telescope* observing proposals.
- Co-chair of the transient session at the UK National Astronomy Meeting 2025.

Outreach and Mentoring

- Live supernova candidate screening demonstrations for public school education events in Belfast.
- Volunteer speaker for *Astronomy in the City* and *Astronomy on Tap* events in Birmingham and Belfast.
- Supervisor for the *Yanxing Plan*, mentoring high-school female students conducting astronomy and machine-learning research.

Observing Proposals

Liverpool Telescope

- PI: 2026A – From Disruption to Detonation: Identifying Infant TDEs and SLSN-I with the NEE-DLE collaboration (26.5 hours awarded with rank A.)

Swift ToO Triggering

- PI: Photometric follow-up of TDE 2025ccg (1500 s × 10).

ESO Programmes

- Delegated PI: VLT/MUSE P117 – Confirming the origins of a wandering supermassive black hole via observations of the off-nuclear TDE candidate AT2024qkw.
- Co-I: NTT/EFOSC2 P115 – Unveiling the Emission Mechanisms in Tidal Disruption Events Through Resolved Spectral Line Studies.

Gemini Observatory & SOAR

- Co-I: Observations of infant TDE 2025A.

Skills

Programming	Python, C, Java, MySQL, XML, R
High Performance Computing	Parallel programming (MPI, Multi-threading)
Machine Learning	Experienced in Sklearn, TensorFlow, Keras, PyTorch; data analysis with Pandas, Numpy, Astropy
Software Development	Data crawling, Docker, Git (version control), Make
Operating Systems	Linux, Windows, macOS (terminal operations)
Astronomical Data Processing	Liverpool Telescope photometric data reduction; New Technology Telescope spectrum classification using Iraf and SNID
Languages	Chinese (Native), English (Professional)

Completed Projects and Data Products

NEEDLE: Neural Engine for Discovering Luminous Events

Lead developer of a multi-modal machine-learning pipeline designed for LSST-era alert streams to identify rare transients such as Superluminous Supernovae and Tidal Disruption Events from real-time survey data. Predictions are publicly distributed through the *Lasair* UK alert broker and have contributed to 29 confirmed discoveries since Aug. 2024.

Reference: [Sheng et al. \(2024\)](#), *MNRAS*.

NEEDLE Data Augmentation and Image Processing Framework

Machine-learning preprocessing framework for rare-transient classification, including artefact removal, host-galaxy source masking, rotational image augmentation, and synthetic training sample generation via Gaussian Process light-curve modelling. Integrated within the NEEDLE pipeline to improve classification purity and completeness for SLSNe-I and TDEs.

Reference: [Sheng et al. \(2026\)](#), *ApJS*.

SRNN Framework for LSST AGN Time-Series Analysis

Implementation of a Stochastic Recurrent Neural Network (SRNN) for modelling simulated AGN light curves under LSST Wide-Fast-Deep cadences using CARMA variability models, demonstrating recovery of variability structure functions while highlighting cadence limitations.

Reference: [Sheng et al. \(2022\)](#), *MNRAS*.

NEEDLE-TRACK – PyPI package providing a local system for managing transient alerts from *Lasair-ZTF*, enabling structured data storage, update tracking, and search functionality for transient monitoring workflows.

Astro-Refine – PyPI package for detection-image restoration and artefact masking that removes unrelated foreground/background sources to improve machine-learning focus on host-galaxy morphology. Originally developed to enhance NEEDLE training data.

Conferences and Talks

2026, Apr. 12–15	LSST+Euclid meeting & Lasair User Workshop, Manchester, UK
2026, Mar. 9–11	Talk, TDA Bench2026 Workshop, Chicago, USA/Virtual
2025, Nov. 13	Invited Seminar, Armagh Observatory, Armagh, NI, UK
2025, Aug. 18–22	E-Poster, Supernovae 100, Stockholm, Sweden
2025, Jul. 7–11	Co-chaired Transient Session, UK National Astronomy Meeting 2025, Durham, UK
2025, May 20–22	Talk, Superluminous 2025, Center for Astrophysics Harvard & Smithsonian, Cambridge, MA, USA
2025, Apr. 14	Talk, Leverhulme Interdisciplinary Network on Algorithmic Solutions (LINAS) Conference, Queen's University Belfast, UK
2024, Oct. 25	Talk, Graduate School Conference, Queen's University Belfast, UK
2024, Sep. 26	Talk, ENGRAVE Monthly Meeting, Virtual
2024, Sep. 16–20	Talk , LSST@Europe6, La Palma, Canary Islands, Spain
2024, Jul. 3	Invited Talk and Panel Discussion, STFC Astronomy and AI, Virtual
2023, Dec. 11–15	Talk, Cosmic Streams Conference, Puerto Varas, Chile
2023, Nov. 23	Invited Talk, Pakistan ML Astronomy Workshop, Virtual
2023, Nov. 6–10	Talk, SuperVirtual 2023 Meeting, Virtual
2023, Oct. 17	Invited Talk , ML Astronomy Webinar, Virtual
2023, Sep. 13–14	Invited Talk, Lasair LSST Review Users Meeting, Oxford, UK
2023, Jul. 10–14	E-Poster, European Astronomical Society Annual Meeting, Krakow, Poland
2022, Oct. 26	Invited Talk, ML Meeting, Tsinghua University, Virtual
2022, Jul. 11–15	Poster, UK National Astronomy Meeting, University of Warwick, UK
2022, Jun. 27–Jul. 1	Talk, European Astronomical Society Annual Meeting, Valencia, Spain
2021, May 14	Talk, Machine Learning and AI Applied to Astronomy (hosted by RAS), Virtual

Publications

3 first-author journal articles; 1 first-author conference proceeding (Total citation: 50); 10 co-authored papers (Total citation: 389).

- [1] Xinyue Sheng et al. “Attention-Based Preprocessing Framework for Improving Rare Transient Classification”. In: *The Astrophysical Journal Supplement Series* (2026). url: <https://arxiv.org/abs/2512.14644>.
- [2] Xinyue Sheng et al. “NEural Engine for Discovering Luminous Events (NEEDLE): identifying rare transient candidates in real time from host galaxy images”. In: *Monthly Notices of the Royal Astronomical Society* 531.2 (May 2024), pp. 2474–2492. doi: [10.1093/mnras/stae1253](https://doi.org/10.1093/mnras/stae1253).
- [3] Xinyue Sheng, Nicholas Ross, and Matt Nicholl. “Legacy Survey of Space and Time cadence strategy evaluations for active galactic nucleus time-series data in Wide-Fast-Deep field”. In: *Monthly Notices of the Royal Astronomical Society* 512.4 (Mar. 2022), pp. 5580–5600. doi: [10.1093/mnras/stac803](https://doi.org/10.1093/mnras/stac803).
- [4] Xinyue Sheng, Matt Nicholl, and Nicholas Ross. “Stochastic Recurrent Neural Networks for Modelling Astronomical Time Series: Advantages and Limitations”. In: *EAS 2022 S11 conference proceedings* (Mar. 2023). arXiv: [2303.13197](https://arxiv.org/abs/2303.13197) [[astro-ph.IM](#)].
- [5] Dylan Magill et al. “MALLORN: Many Artificial LSST Lightcurves based on Observations of Real Nuclear transients”. In: *RAS Techniques and Instruments* (Mar. 2026), rzag019. issn: 2752-8200. doi: [10.1093/rasti/rzag019](https://doi.org/10.1093/rasti/rzag019).
- [6] Shubham Srivastav et al. *ATLAS100 – I. A volume-limited sample of supernovae and related transients within 100 Mpc*. 2026. arXiv: [2603.03069](https://arxiv.org/abs/2603.03069) [[astro-ph.HE](#)]. url: <https://arxiv.org/abs/2603.03069>.
- [7] Dheeraj R. Pasham et al. “The Birth of a Relativistic Jet Following the Disruption of a Star by a Cosmological Black Hole”. In: *Nature Astronomy* 7 (Jan. 2023), pp. 88–104. doi: [10.1038/s41550-022-01820-x](https://doi.org/10.1038/s41550-022-01820-x).
- [8] Shubham Srivastav et al. “Unprecedented Early Flux Excess in the Hybrid O2es-like Type Ia Supernova 2022ywc Indicates Interaction with Circumstellar Material”. In: *The Astrophysical Journal Letters* 956.2 (Oct. 2023), p. L34. doi: [10.3847/2041-8213/acffaf](https://doi.org/10.3847/2041-8213/acffaf).
- [9] M. Nicholl et al. “AT 2022aedm and a New Class of Luminous, Fast-cooling Transients in Elliptical Galaxies”. In: *The Astrophysical Journal Letters* 954.1 (Sept. 2023), p. L28. doi: [10.3847/2041-8213/acf0ba](https://doi.org/10.3847/2041-8213/acf0ba).
- [10] T. Moore et al. “SN 2022jli: A Type Ic Supernova with Periodic Modulation of Its Light Curve and an Unusually Long Rise”. In: *The Astrophysical Journal Letters* 956.1 (Oct. 2023), p. L31. doi: [10.3847/2041-8213/acfc25](https://doi.org/10.3847/2041-8213/acfc25).
- [11] M. Nicholl et al. “Quasi-periodic X-ray eruptions years after a nearby tidal disruption event”. In: *Nature* (Oct. 2024). doi: [10.1038/s41586-024-08023-6](https://doi.org/10.1038/s41586-024-08023-6).
- [12] T. Moore et al. “SN 2023zaw: The Low-energy Explosion of an Ultrastripped Star”. In: *The Astrophysical Journal Letters* 980.2 (Feb. 2025), p. L44. doi: [10.3847/2041-8213/adade6](https://doi.org/10.3847/2041-8213/adade6).
- [13] J. H. Gillanders et al. “Discovery of the Optical and Radio Counterpart to the Fast X-Ray Transient EP 240315a”. In: *The Astrophysical Journal Letters* 969.1, L14 (July 2024), p. L14. doi: [10.3847/2041-8213/ad55cd](https://doi.org/10.3847/2041-8213/ad55cd).
- [14] Yuhan Yao et al. *AT2024lhc and AT2024kmq in the landscape of featureless tidal disruption events*. 2026. arXiv: [2602.21624](https://arxiv.org/abs/2602.21624) [[astro-ph.HE](#)]. url: <https://arxiv.org/abs/2602.21624>.