Feng-Yuan "Frey" Liu

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Research Interests

• My scientific interests lie in the formation and evolution of galaxies across cosmic history, particularly star formation and interstellar medium in massive and dusty galaxies at high redshifts.

• My broader interests include active galactic nucleus (AGN) evolution, large-scale structure, gravitational lensing, and ultracool brown dwarfs in extragalactic fields.

• My technical interests encompass multi-wavelength imaging and spectroscopy, spanning ultraviolet to radio wavelengths, as well as developing pipelines and software for survey data analysis.

Education

Ph.D. in Astronomy *Sep. 2023 – present (expected Summer 2027)*
Institute for Astronomy (IfA), University of Edinburgh (UoE) Edinburgh, UK
- Mary Brück scholarship. Supervisors: Prof. **James Dunlop**, Prof. **Ross McLure**, Dr. **Derek McLeod**
- Thesis: *Galaxy Evolution Across Cosmic Time Through Multi-Wavelength Observations*

M.Sc. in Astrophysics *Sep. 2020 – Jun. 2023*
National Astronomical Observatories, Chinese Academy of Sciences (NAOC) Beijing, China
- Class Valedictorian. Supervisor: Prof. **Yu Sophia Dai**
- Thesis: *Cold gas and Dust Properties of Infrared Luminous Quasars*

B.Sc. in Astronomy *Sep. 2016 – Jun. 2020*
School of Astronomy and Space Science, Nanjing University (NJU) Nanjing, China
- Astronomy Elite Class (summa cum laude equivalent). Supervisor: Prof. **Yi Xie**
- Thesis: *Gravitational Lensing of a Regular Non-Minimal Einstein-Yang-Mills Black Hole*

Observing Programs

My research spans multi-wavelength observations, and I have a successful proposal track record with major IR and (sub)mm/radio facilities, totalling ***> 200 hr*** *as PI or first author. I currently lead an ongoing (three-year) VLA Large Program, serve as a core member of an ongoing ALMA Large Program, and have secured NOEMA time as PI in all three most recent cycles.*

JWST:

1. **Co-I** (GO 11171, PI: D. McLeod; co-PI: N. Garuda) Cycle 5, 2026, **12.3h**
   Is the quest for Cosmic Dawn beyond all H0pe?

VLA:

1. **First author** (26B-312, U.S. PI: M. Dickinson, **Large Program**, **Priority A**) 2026B, **157.43h**
   THISTLE: A Deep VLA Legacy Survey Around the Abell 370 Cluster (expected $\times 3$ semesters in 2026–2028 $\approx$ 475h)

ALMA:

1. **Co-I** (2026.1.00514.L, **Large Program**, **Priority A**) Cycle 13, **200.6h**
   A complete census of star formation in the best-studied extra-galactic deep field: a public 1mm survey

NOEMA (total: **266h**):

5. **PI** (S26CO, co-PI: P. Cox, Grade B) 2026S, **64.0h**
   NOSEGAY: The Northern-Sky Submillimeter Galaxy Census at the Final CANDELS Frontier
4. **PI** (S26DE, co-PI: P. Cox, Grade B) 2026S, **43.5h**
   NACRE-UDS: A Cosmic-Variance-Mitigated View of Dusty Star-Forming Galaxy Emergence at the EoR
3. **PI** (W25EC, co-PI: P. Cox, **Grade A**) 2025W, **86.4h**
   NACRE: Tracing the early emergence of dusty star-forming galaxies with continuum and [CII] emission
2. **PI** (S25CK, co-PI: P. Pérez-González, Grade B) 2025S, **65.0h**
   Tracing the early emergence of dusty star-forming galaxies at the Epoch of Reionization
1. **Co-I** (S22CH, PI: Y. S. Dai, Grade B) 2022S, **7.3h**
   Confirmation of rare starburst HyLIRGs in high-z QSOs

GMRT:

1. **Co-I** (No. 42-012, PI: C. He) Cycle 42, 2022, **20.0h**
   Spatially Resolved HI Kinematics of Spiral+Elliptical and Spiral+Spiral Major-merger Galaxy Pairs

Selected Grants, Scholarships & Honors

Summer project bursary grant (£1,500), Royal Astronomical Society (RAS) *May 2026*
Best Poster Prize, PhD Highlands Conference, School of Physics and Astronomy (SoPA), UoE *Feb. 2026*
Travelling Grant for Telescope Service (£2,065), IfA, UoE *Jan. 2026*
Best Talk Prize, DEX-XXII *Jan. 2026*
Travelling Grant (£3,298), IfA, UoE *Sep. 2025*
CSE Vacation Funding (£1,709, co-applied as supervisor), UoE *Jun. 2025*
Fellow of the Royal Astronomical Society *May 2025*
Mary Brück Scholarship (£20,780 per annum for 4 years), UoE *Sep. 2023– Aug. 2027*
Research Training Support Grant (£4,800), UoE *Sep. 2023*
Valedictorian of Class 2023, NAOC *Jun. 2023*
National Graduate Student Award (20,000 CNY), Ministry of Education of PRC *Oct. 2022*
First Class Scholarship for Master's Students (43,200 CNY per annum for 3 years), NAOC *2020–2023*
First Award of Lin-bridge Scholarship (3,000 CNY), Kavli Institute for Astrophysics, Peking University *Sep. 2020*
First Award for Best Undergraduate Thesis, NJU *Jun. 2020*
Selected member for National Top Notch honors track, Ministry of Education of PRC *Sep. 2017 – Jun. 2020*

Research Skills

I have extensive experience across the full observational workflow, from preparing proposals for major astronomical facilities and conducting observations to reducing and analysing data, particularly from JWST and various (sub)mm/radio telescopes. I am experienced in high-performance computing for large-scale astronomical data analysis and enthusiastic about developing and improving scientific pipelines and software packages.

Observations:

- ESO visiting astronomer, Danish 1.54m telescope at La Silla, Chile; 20-night service (Jun. & Sep. 2025) for Milky Way + solar system targets & main author of a new focusing strategy
- Teaching assistant, the 40-cm telescope at Turkana Basin Institute (TBI)-Ileret, Kenya; 10-night service (Sep. & Oct. 2025) for Milky Way + solar system targets
- Teaching assistant, the PIRATE telescope at OpenScience Observatory/Observatorio del Teide, Spain; 8-night operation (Sep. & Oct. 2026) for Milky Way + solar system targets

Schools & trainings:

- Tenth European Radio Interferometry School, IAA-CSIC — Granada, Spain, *Sep.–Oct. 2024*
- European ALMA School, Jodrell Bank Centre for Astrophysics — Manchester, UK, *Jun. 2024*
- 10th IRAM 30-meter School on Millimetre Astronomy, IRAM — Online, *Nov. 2021*
- International Summer School on the Interstellar Medium of Galaxies, CNRS/INSU — Online, *Jul. 2021*

Proposal writing: VLT (X-SHOOTER + ERIS + KMOS), Keck (MOSFIRE), JWST (NIRCam + NIRSpec/MOS + NIRISS + MIRI), ALMA, NOEMA, VLA (pointed + mosaic), GMRT

Data reduction/analysis: SDSS, DK154, VLT (MUSE), HST, JWST (NIRCam + MIRI + NIRSpec), VISTA, Herschel, JCMT/SCUBA-2, ALMA, NOEMA, IRAM-30m, GMRT, VLA

Scientific software/packages:

- Radio interferometer + single-dish data calibration + reduction: `CASA, GILDAS, CARTA`
- JWST NIRCam data reduction: `Pencil`
- Galaxy SED fitting: `CIGALE, Bagpipes, MAGPHYS, Prospector, LePHARE`
- Brown-dwarf/exoplanet SED modelling: `Sonora, ATMO2020, Exo-REM, species`

Programming & software development: Python (proficient), C, Bash scripting, Git, LaTeX

Software projects:

- `APRICOT`: ALMA stacking and faint-source analysis software; planned public release in 2027–2028.
- `AsterAtlas`: Star-chart generation software for astronomy education (currently in closed beta testing)

High-performance computing: Linux/Unix, Bash scripting, Slurm job scheduling, parallel computing, batch processing, and large-scale data analysis; experience with the `Cuillin` and `Slurm Compute Cluster` at UoE

Languages: English (fluent), Chinese Mandarin (native)

Teaching, Supervising & Academic Service

I am passionate about teaching and mentoring, including both lecturing and research supervision. Over the past two years, I have taken a leading role in supervising undergraduate summer research projects and actively explored innovative approaches to astronomy education, including founding and organising Edinburgh's first astronomy summer school run entirely by early-career researchers.

Chair of Organising Committee & lecturer, ESEA-I — Online + Edinburgh, UK, *Jun. 2025*
- First Edinburgh School of Extragalactic Astronomy: five days, ∼ 30 lectures, ∼120 UK & international attendees
- Gave four lectures on: *Far-infrared, (sub)millimeter & radio emissions of distant galaxies*; *Basic radiation transfer*; *Observation and telescope proposal writing*; *Paper reading and management*

Supervisor, Summer Research Program — Edinburgh, UK, *Jun. – Jul. 2026*
- Student: Eyja A. Óskarsdóttir
- Project: *Molecular Line Emission from Typical High-Redshift Galaxies Revealed by VLA and ALMA*
- Funded (£1,500) by RAS Undergraduate Bursary

Primary supervisor, Summer Research Program — Edinburgh, UK, *Jul. – Aug. 2026*
- Student: Lewis McNeil
- Project: *Probing the star-formation fuels of massive galaxies in lensing fields with VLT, JWST, and ALMA* (secondary supervisor: Prof. J. Dunlop)
- Funded (£2,152) by Carnegie Undergraduate Vacation Scholarship

Primary supervisor, Summer Research Program — Edinburgh, UK, *Jul. – Aug. 2025*
- Student: Chang Sui (now MPhil student at the University of Cambridge)
- Project: *A stacking analysis to probe faint (sub)mm galaxies with archival ALMA and JWST data* (secondary supervisor: Prof. J. Dunlop)
- Funded (£1,709) by College of Science and Engineering (CSE), UoE

Teaching assistant, *Observational Astronomy Theory & Experiment* — Turkana Basin Institute, Kenya, *Sep. & Oct. 2024*
- Tutoring postgraduate-level training for two weeks (voluntary service for the DARA program)
- Duties incl. operating a 40 cm telescope, writing pipelines & hosting data reduction workshops

Teaching assistant, University of Edinburgh — Edinburgh, UK, *academic year 2026/27*
- Four undergraduate courses: *Telescope Group Project; Observational Astronomy Lab; Dark Universe; Discover Astronomy.*

Distributed peer reviewer for Call for Proposals: ALMA (2024, 2026), ESO VLT (2024)

Selected Conference Presentations

Invited talks:

3. **NASA Goddard / STScI JWST Weekly Briefing**, Baltimore (remote), USA — *Sep. 2026*
   Ultra-distant or Ultra-cool? The Cold Brown Dwarf Frontier in JWST Extragalactic Fields
2. **Edinburgh-Sevilla-Tsukuba (EST) Galaxy Formation Workshop**, Edinburgh, UK — *Jul. 2026*
   Dusty Massive Galaxies and Their Early Cosmic History in the Era of Giant Observatories
1. **Royal Observatory Colloquium**, Edinburgh, UK — *May 2026*
   The Dark Side of the Universe: Dusty Star-Forming Galaxies in the Era of JWST and Radio Interferometers

Contributed talks:

10. **Scottish Exoplanet & Brown Dwarf Meeting**, St. Andrews, UK — *Sep. 2026*
    The Astrometric Dances at High Galactic Latitudes: Mapping the Most Distant Y-Dwarf Frontier with Deep JWST Extragalactic Fields
9. **Tokyo JWST Conference 2026**, Tokyo, Japan — *Mar. 2026*
    Uncovering the Dust-Obscured Cosmic Star Formation History back to $z \sim 7$ with JWST PRIMER and ALMA in COSMOS
8. **DEX-XXII (best-talk prize)**, Edinburgh, UK — *Jan. 2026*
    Uncovering the Dust-Obscured Cosmic Star Formation History back to $z \sim 7$ with JWST PRIMER and ALMA in COSMOS

7. **NAM2025**, Durham, UK *Jul. 2025*
   Dust-obscured Cosmic Star-Formation History Back to $z = 7$ Revealed by ALMA and JWST PRIMER
6. **CFC2025**, Austin, US *May 2025*
   Revealing the Obscured Cosmic Star Formation History at $z = 1 - 7$ with JWST PRIMER and ALMA
5. **DEX-XXI**, Newcastle, UK *Jan. 2025*
   Unveiling Dusty Star Formation Across Cosmic Time with JWST PRIMER and ALMA
4. **The 2nd Edinburgh-Copenhagen Joint Workshop**, Copenhagen, Denmark *Oct. 2024*
   Dust-Obscured Star Formation in the Young Universe Revealed by Combining JWST PRIMER and ALMA
3. **DEEP2024**, Sintra, Portugal *Oct. 2024*
   Dust-Obscured Star Formation in the Young Universe Revealed by Combining JWST PRIMER and ALMA
2. **NAM2024 (two talks)**, Hull, UK *Jul. 2024*
   Dust-Obscured Star Formation in the Young Universe Revealed by Combining JWST PRIMER and ALMA
   Quasars Co-existing with Dusty Starburst HyLIRGs at the Cosmic Noon
1. **DEX-XX**, Durham, UK *Jan. 2024*
   Cold Gas and Dust Properties of Infrared-Luminous QSOs

Contributed posters:

2. **The 40th IAP Symposium**, Paris, France *Dec. 2024*
   Revealing the Obscured Star Formation History of the Universe with JWST PRIMER and ALMA
1. **The XXXII IAU GA**, Cape Town, South Africa *Aug. 2024*
   Dust and cold gas properties of starburst infrared luminous quasars at $0.5 < z < 3$

Outreach Highlights

I actively engage in science communication, reaching local communities through in-person outreach and wider audiences through digital media. My efforts focus on bridging gaps in access to science, particularly for those from underserved regions and underrepresented communities, while making science more accessible and culturally vibrant.

Science writer & translator: 50+ astronomy-related published articles & 5 translated books by Oct. 2026

Digital science communicator (writing + photography + filming): 10M+ views & 33k+ online followers by Oct. 2026

Public talks: 7 popular-astronomy talks in English & Chinese as invited speaker by Oct. 2026

Podcasts: 6 episodes as invited speaker, total listens 10k+ by Oct. 2026

Publications

I have **18** published, accepted or submitted papers and **8** first-author papers (including manuscripts nearing submission), with $>$ **550** citations and an h-index of **9** as of Oct. 2026. See my **ADS library** for my full publication record.

First-author papers to be submitted: 2

2. **Liu, F.-Y.**; Sui, C.; Dunlop, J. S.; et al., under internal review of PRIMER collaboration 2026 (expected)
   APRICOT I. Revealing Previously Undetected Very Faint Dust Emission from Individual Galaxies with Archival ALMA Data across JWST/PRIMER COSMOS
1. **Liu, F.-Y.**; McLeod, D. J.; Chen, X.; et al., under internal review 2026 (expected)
   Parallax Detection of a Y Dwarf in the UDS Field at ~ 250 pc

First-author accepted/submitted papers: 6

6. **Liu, F.-Y.**; McLeod, D. J.; Chen, X.; et al., submitted to MNRAS 2026
   The Ultracool Galactic Frontier in JWST Extragalactic Surveys: Distant Parallax of an Extremely Cold Y Dwarf
5. **Liu, F.-Y.**; McLeod, D. J.; Sutlieff, B. J.; et al., accepted by MNRAS. arXiv: 2608.07461 2026
   A clear detection of proper motion confirms that the claimed $z \simeq 32$ galaxy candidate, "Capotauro", is a very cold brown dwarf
4. **Liu, F.-Y.**; Dunlop, J. S.; McLure, R. J.; et al., MNRAS, 545, 1961 2026
   JWST PRIMER: A deep JWST study of all ALMA-detected galaxies in PRIMER COSMOS – dust-obscured star-formation history back to $z \simeq 7$

3. **Liu, F.-Y.**; Dai, Y. S.; Omont, A.; et al., ApJ, 964, 136 2024
Dust and Cold Gas Properties of Starburst HyLIRG Quasars at $z \sim 2.5$
2. **Liu, F.-Y.**; Dai, Y.; Wu, J.-W.; et al., PrA, 41, 529 2023
CO Emission of Dust-Rich Broad-Emission-Line Quasars
1. **Liu, F.-Y.**; Mai, Y.-F.; Wu, W.-Y.; et al., PhLB, 795, 475 2019
Probing a regular non-minimal Einstein-Yang-Mills black hole with gravitational lensings

Co-authored accepted/submitted papers: 12

12. Kruszynska, K.; Bachelet, E.; Street, R. A.; et al. (50th author), under review of AJ 2026
OGLE-2024-BLG-0034 – a planetary system on the outskirts of the Galactic bulge
11. McLeod, D. J.; McLure, R. J.; Dunlop, J. S.; et al. (21st author), under review of MNRAS, arXiv: 2604.16666 2026
A search for the first galaxies across $\simeq 0.6$ sq. degrees of JWST imaging: Evidence for a rapid decline in star-formation at $z > 13$
10. Fraser Gillan, A.; Wyrzykowski, L.; et al. (51st author), accepted by A&A, arXiv:2603.01383 2026
Time-Domain Photometry and Activity Evolution of Interstellar Comet 3I/ATLAS with BHTOM
9. Taylor, E.; Carnall, A. C.; Maltby, D.; et al. (21st author), MNRAS, 549, 918 2026
The JWST EXCELS survey: Outflows in $1.5 < z < 5$ quiescent galaxies are likely relics from episodic AGN activity
8. Eales, S.; Smith, M.; Bakx, T.; et al. (5th author), MNRAS, 550, 1000 2026
COSMOS-Web: star formation along the early Hubble sequence and the evolution of dust over the redshift range $0 < z < 12$
7. Leung, H.-H.; Carnall, A. C.; Taylor, E.; et al. (18th author), MNRAS, 549, 827 2026
The JWST EXCELS survey: The ages and abundances of $3 < z < 5$ massive quiescent galaxies show that downsizing was already in place by $z \simeq 4$
6. Donnan, C. T.; McLeod, D. J.; McLure, R. J.; et al. (10th author), ApJ, 1002, 134 2026
Spectroscopic confirmation of a large and luminous galaxy with weak emission lines at $z = 13.53$
5. Barrufet, L.; Dunlop, J.; Begley, R.; et al. (10th author), MNRAS, 548, 770 2026
Strength in Numbers: Red Galaxies Bolster the Cosmic Star Formation Rate Density at $z > 3$
4. Stevenson, S. D.; Carnall, A. C.; Leung, H.-H.; et al. (17st author), MNRAS, 545, 2087 2025
PRIMER & JADES reveal an abundance of massive quiescent galaxies at $2 < z < 5$
3. Donnan, C. T.; McLure, R. J.; Dunlop, J. S.; et al. (18th author), MNRAS, 533, 3222 2024
JWST PRIMER: a new multifield determination of the evolving galaxy UV luminosity function at redshifts $z \simeq 9 - 15$
2. Stanton, T.; Cullen, F.; McLure, R. J.; et al. (15th author), MNRAS, 532, 3102 2024
The NIRVANDELS survey: the stellar and gas-phase mass-metallicity relations of star-forming galaxies at $z = 3.5$
1. Xu, H.; Dai, Y. S.; Huang, J.-S.; et al. (11th author), ApJ, 905, 103 2020
A Large Massive Quiescent Galaxy Sample at $z \sim 1.2$

References

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