Emma L. Elley

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Research Interests

- Magnetohydrodynamic simulations of astrophysical jets.
- Impact of variability on morphological features of resolved radio observations of AGN jets.
- Particle acceleration mechanisms in jets from black holes across the mass range.
- Developing methods for comparison of magnetohydrodynamic simulations with radio survey data.

Education

2023 – · · · · **DPhil Astrophysics, University of Oxford**.
Thesis title: *Particle Acceleration in Outflows from Black Holes.*

2020 – 2021 **M.Sc. Particles, Strings and Cosmology, Durham University**
Thesis title: *Axion Production in the Early Universe*.

2019 – 2020 **PGDE Secondary Education, University of Edinburgh**. Physics and Mathematics

2015 – 2019 **B.Sc. Theoretical Physics, University of Edinburgh**

Research Publications

Journal Articles

1. **E. L. Elley**, J. H. Matthews, D. Mukherjee, and B. Vaidya, "Simulating radio emission from flickering AGN jets: travelling shocks and hotspot brightening,", vol. 546, no. 2, stag131, Feb. 2026, Art. no. stag131. DOI: 10.1093/mnras/stag131. arXiv: 2601.13138 [astro-ph.HE].

2. **E. L. Elley**, J. H. Matthews, H. Whitehead, and A. J. Cooper, "The impact of flickering variability and magnetisation on the dynamics, stability and morphology of radio-loud AGN jets," *arXiv e-prints*, arXiv:2605.13469, May 2026, Art. no. arXiv:2605.13469, Submitted to MNRAS. DOI: 10.48550/arXiv.2605.13469. arXiv: 2605.13469 [astro-ph.HE].

3. J. H. Matthews, A. J. Cooper, L. Rhodes, K. Savard, R. Fender, F. Carotenuto, F. J. Cowie, **E. L. Elley**, J. Bright, A. K. Hughes, and et al., "Blast waves and reverse shocks: from ultra-relativistic GRBs to moderately relativistic X-ray binaries,", vol. 539, no. 3, pp. 2665–2684, May 2025. DOI: 10.1093/mnras/staf609. arXiv: 2503.10802 [astro-ph.HE].

Datasets

1. **E. L. Elley**, J. H. Matthews, H. Whitehead, and A. J. Cooper, *Simulated radio images of magnetised flickering jets*, https://zenodo.org/records/20140021, May 2026. DOI: 10.5281/zenodo.20140021.

Conference and Seminar Presentations

Apr 2026 **Simulations of radio galaxy flickering jets,** Astronomy Journal Club, Open University (Invited Talk)

Mar 2026 **Simulations of flickering AGN jets: travelling shocks, hotspot brightening and large-scale asymmetries,** Blackholistic Conference, University of Oxford (Contributed Poster)

Feb 2026 **Simulations of radio galaxy flickering jets,** Galaxies Discussion Group, University of Cambridge (Invited Talk)

Conference and Seminar Presentations (continued)

Sept 2025 — **Energy dissipation and particle acceleration in XRB jets: the role of the kink instability,** Micro Quasar Workshop, Cefalù (Contributed Poster)

Aug 2025 — **The effects of variability and mixing on observable features of kpc-scale jets using radio emission maps from high resolution simulations,** Extragalactic Jets at all Scales, Crete (Contributed Talk)

Simulating radio emission from flickering AGN jets: morphology and luminosity, High Energy Phenomena in Relativistic Outflows IX (Contributed Talk)

Feb 2025 — **Accounting for mixing in synchrotron spectral modelling of flickering AGN jets using Lagrangian particles,** Workshop on Numerical Multi Messenger Modelling, DESY (Contributed Talk)

Sept 2024 — **Spectra as a probe of fuelling and flickering in AGN jets,** PLUTO Symposium, University of Turin (Contributed Poster)

Jul 2024 — **Spectra as a probe of fuelling and flickering in AGN jets,** European Astronomical Society Congress, Padova (Contributed Talk)

Grants and Funding

2025 — **Next generation simulations of particle acceleration and transport in black hole jets,** 10 million core hour computing allocation on Isambard 3, funded by UKRI and ESPRC (Core team: James Matthews (PI), Emma Elley).

Graduate Travel Award, St Peter's College .

2023-2027 — **Royal Society Studentship**.

Miscellaneous Experience

Teaching Experience

2024 – · · · · — **Nuclear and Particle Physics Tutor,** Oriel College, Oxford

2023 – 2025 — **Nuclear and Particle Physics Tutor,** St Peter's College, Oxford

Training delivered

2026 — **Introduction to Pandas – in preparation**. Research Software Engineering Group Training Courses for Researchers, University of Oxford.

Feb 2025 — **Introduction to git and github**. Astrophysics Computing Seminar, University of Oxford.

Outreach and Engagement

2025 – 2026 — **Marie Curious Workshop Leader**. 'Simulations in Research' at 4 events.

2026 — **Workshop leader**. 3 events, African Families in the UK.

May 2026 — **Do Jets from Supermassive Black Holes Flicker?**. Online talk, Chipping Norton Amateur Astronomy Group.

Do Jets from Supermassive Black Holes Flicker?. Online talk for COMPOS Comprehensive Oxford Maths and Physics Online School.

Feb 2026 — **Black holes and problem solving**. Talk at BPhO Physics Taster Day.

Jan 2026 — **Do jets from supermassive black holes flicker?**. Invited public talk at Cyprus Planetarium.

Mar 2024 — **St Peter's College Workshop Leader**. 'Simulations in Research' at 2 events.

Miscellaneous Experience (continued)

Courses and Certifications

Jul 2024 — **CUDA Programming on NVIDIA GPUs**. Mathematical Institute, University of Oxford.

Dec 2022 — **Azure Data Scientist Associate**. Microsoft.

May 2021 — **Data Science Professional Certificate**. IBM.

Employment History

2022 – 2023 — **Data Scientist,** Valtech

2018 – 2022 — **Private Tutor,** Self-employed

Skills

Coding — Python, C, SQL, LaTeX.

Technical skills — Detailed knowledge of the PLUTO code for hydrodynamic simulation including modelling of non-thermal electron spectra using the Lagrangian particle module. Extensive experience with high performance computing including Slurm scheduling, parallelisation and data management. Proven track record in planning and managing large computing projects, including scoping, successfully securing compute time allocations, and overseeing data processing and management. Skilled in managing databases and data pipelines, with consulting work focused on applying machine learning algorithms in production settings.

Languages — English (Native speaker), German (B2).

References

Available on Request