Emma L. Alexander

MPhys(Hons) · PhD · FRAS · AFHEA

emma.alexander@gmail.com | emmaalexander.github.io | EmmaAlexander | emmaalexander

Summary

Astrophysicist with research interests in radio astronomy, polarimetry, and machine learning, with a focus on the Galactic plane, radio galaxies, and citizen science. Communicating science, particularly astronomy, through a variety of outreach and media.

Experience

University of Leeds — *Leeds, UK*

Research Fellow — *Nov 2024 -*

- Data analysis and interpretation of non-thermal radio filaments in the Galactic plane (PI: Prof. Mark Thompson).
- Observation planning and scheduling with the MeerKAT telescope; reduction and imaging of JVLA data.

Government Statistical Service (GSS) — *Salford, UK*

Ad hoc Statistical Officer in HM Revenue & Customs (HMRC) — *Jan - Nov 2024*

- Provided statistical insights to improve HMRC processes, using a variety of software including SQL and R. Aided in development of an evidence-based proposal to HM Treasury for investment in HMRC's Data and Analysis capabilities. Work recognised by internal award for collaboration.

University of Manchester — *Manchester, UK*

Postdoctoral Research Associate — *Oct 2021 - Dec 2023*

- Applied various machine learning techniques to solve complex astronomical problems, including stellar classification. Built datasets for machine learning and citizen science from ASKAP images, using specialist data selection, extraction and formatting. Key communication point between a team of astronomers and AI experts at external industry partner.
- Data reduction and analysis of well-resolved radio galaxies in POSSUM (Polarisation Sky Survey of the Universe's Magnetism).

PhD student (Supervisors: Dr. Patrick Leahy & Prof. Anna Scaife) — *Sept 2017 - Sept 2021*

- Thesis title: Magnetic Fields around Radio Galaxies. Analysis of large polarisation data cubes from the Australian Square Kilometre Array Pathfinder telescope (ASKAP) via extensive use of programming languages (e.g. Python) and astronomical software (e.g. CASA) in both Linux and MacOSX environments. Observing with the Australia Telescope Compact Array (ATCA): proposal writing (as PI & Co-I), observation planning and supervising, reduction and analysis of data in Miriad.

Undergraduate research — *Various, 2015 - 2017*

- Calibration and imaging of C, L, and X-band JVLA data in CASA of NGC 628; analysis of Faraday rotation maps with Python scripts.
- Reduction and analysis of ATCA data of the magnetically chemically peculiar star CU Virginis in Miriad; imaging of radio pulses from the star in CASA, and spectrographic analysis of the results via Python.
- Solar sidelobe analysis for the C-Band All Sky Survey (C-BASS); improved existing models of sidelobes and solar variability using IDL, Python and MATLAB.

Netherlands Institute for Radio Astronomy (ASTRON) — *Dwingeloo, Netherlands*

Summer Student (Supervisor: Dr. Jess Broderick) — *June - Sept 2017*

- Normalisation and stacking of uncalibrated data from an exploratory scan by the Engineering Development Array (EDA), to obtain detections of carbon and hydrogen Radio Recombination Lines (RRLs) towards the Galactic Centre.

Education

University of Manchester — *Manchester, UK*

PhD Astronomy & Astrophysics — *2022*

MPhys Physics with Astrophysics (first class honours) — *2017*

Awards & Funding

2025 **UKRI Public Engagement Spark Award (£20,000),** Co-lead on Moonsighter's Academy (MoonBack)

2023 **Winton Poster Prize (Postdoc),** National Astronomy Meeting, Cardiff

2020 **Associate Fellowship of Advance HE (AFHEA)**

2017 **George Rigg Studentship,** Jodrell Bank Centre for Astrophysics

2017 **President's Doctoral Scholarship,** University of Manchester

2016 **Fellowship of the Royal Astronomical Society (FRAS)**

Publications

Refereed

12. A. M. Hopkins et al. (inc. **E. L. Alexander**), **The Evolutionary Map of the Universe: A new radio atlas for the southern hemisphere sky**, PASA (2025).
11. B. M. Gaensler et al. (inc. **E. L. Alexander**), **The Polarisation Sky Survey of the Universe's Magnetism (POSSUM). I. Science Goals and Survey Description** PASA (2025).
10. L. Rudnick et al. (inc. **E. L. Alexander**), **Pseudo-3D visualization of Faraday structure in polarized radio sources: methods, science use cases, and development priorities** MNRAS 535, 3, 2115–2128 (2024).
9. I. McDonald et al. (inc. **E. L. Alexander**), **PySSED: an automated method of collating and fitting stellar spectral energy distributions.** RAS Techniques and Instruments (2024): rzae005.
8. S. E. Cody et al. (inc. **E. L. Alexander**), **Machine learning based stellar classification with highly sparse photometry data.**. Open Research Europe 4 (2024): 29.
7. M. M. Boyce et al. (inc. **E. L. Alexander**), **Hydra II: Characterisation of Aegean, Caesar, ProFound, PyBDSF, and Selavy source finders.** PASA 1-28 (2023).
6. M. M. Boyce et al. (inc. **E. L. Alexander**), **Hydra I: An extensible multi-source-finder comparison and cataloguing tool.** PASA 1-27 (2023).
5. M. Bowles, H. Tang, E. Vardoulaki, **E. L. Alexander** et al., **Radio Galaxy Zoo EMU: Towards a Semantic Radio Galaxy Morphology Taxonomy**. MNRAS 522, 2, 2584–2600 (2023).
4. G. Segal et al. (inc. **E. L. Alexander**, **Identifying anomalous sources in the EMU Pilot Survey data using a complexity-based approach.**. MNRAS 521, 1, 1429-1447 (2023).
3. M. Cárcamo, A. M. M. Scaife, **E. L. Alexander** and J. P. Leahy, **CS-ROMER: A novel compressed sensing framework for Faraday depth reconstruction.** MNRAS 518, 2, 1955-1974. (2023).
2. T. D. Joseph, M. D. Filipović, E. J. Crawford, I. Bojičić, **E. L. Alexander** et al., **The ASKAP-EMU Early Science Project: Radio Continuum Survey of the Small Magellanic Cloud**. MNRAS 490, 1, 1202-1219 (2019).
1. J. B. R. Oonk, **E. L. Alexander**, J. Broderick, M. Sokolowski, and R. Wayth, **Spectroscopy with the Engineering Development Array: cold H+ at 63 MHz towards the Galactic center**. MNRAS 487, 4, 4737–4750 (2019).

Conference papers

2. E. Vardoulaki et al. (inc. **E. L. Alexander**), **Radio Galaxy Zoo EMU: Harnessing Citizen Science and AI to Advance Open Science Catalogues**. Proceedings IAU397 Symposium UniversAI Exploring the Universe with Artificial Intelligence.
1. M. Bowles, H. Tang, E. Vardoulaki, **E. L. Alexander** et al., **A New Task: Deriving Semantic Class Targets for the Physical Sciences**. Fifth Workshop on Machine Learning and the Physical Sciences (NeurIPS 2022). `https://arxiv.org/abs/2210.14760`

Presentations

Non-thermal Radio Filaments in the Galactic Plane

- National Astronomy Meeting (contributed talk, Durham, 2025)
- *A new era in astrophysics: Preparing for early science with the SKAO (poster & sparkler, Görlitz, 2025)*

Talks about PhD research: Magnetic fields around radio galaxies with POSSUM

- 2023: *National Astronomy Meeting (poster & sparkler, Cardiff)*; 'New Eyes on the Universe' conference (poster, remote)
- 2022: SKA Magnetism SWG meeting (**invited talk**, remote); SPARCS XI conference (contributed talk, remote)
- 2021: Curtin University colloquium (**invited talk**, remote); SPARCS X conference (contributed talk, remote); 'A precursor view of the SKA Sky' conference (contributed talk, remote); Jodrell Bank Centre for Astrophysics (internal seminar)
- 2019: *'New Science enabled by New Technologies in the SKA Era (poster)*

Overview talks: Radio Astronomy & Astrophysical Magnetism

- North American Foundation Awards for Postgraduate Study at the University of Manchester (NAFUM) board meeting (**invited**, remote, 2020).
- PhD discussion sessions and work experience weeks (various contributions, 2018-2020)

Other academic talks

- The New Crescent Moon and its role in the Islamic calendar, National Astronomy Meeting (contributed talk, Cardiff, 2023)
- Recombination line science with SKA precursor technology (Astrolunch, ASTRON, Netherlands, 2017)

Teaching & Supervising

Demonstrator, PHYS3002 Advanced Techniques in Astrophysics, University of Leeds, UK	2025 –
Supervisor, MPhys student research project, 'Predicting the visibility of the New Crescent Moon with Machine Learning', University of Manchester, UK	2023
Academic Tutor, 2nd Year Undergraduates, University of Manchester, UK	2022 – 2023
Presentation: Intro to Linux, JBCA Autumn Computing Sessions	2022
Demonstrator, 2nd Year Undergraduate Laboratory, University of Manchester, UK	2018 – 2021
Examination Invigilator, University of Manchester, UK	2018
Demonstrator, 1st Year Undergraduate Laboratory, University of Manchester, UK	2017
Peer Assisted Study Sessions (PASS) Leader & Peer Mentor, University of Manchester, UK	2014 – 2016

Observing

Co-I: Non-thermal radio filaments 20241103-MT-01, MeerKAT S-band. Lead on scheduling.
PI: A polarised look at extended DRAGNs in Ophiuchus, Australia Telescope Compact Array, 2019APRS (C3315, 40 hours).
Co-I: The QUOCKA Survey Australia Telescope Compact Array, 2018APRS/2018OCTS/2019APRS/2020APRS, (PI: G. Heald, C3244, 830 hours total). Personal observing contribution: 10 sessions totalling 65 hours, on-site & remote.
Co-I: e-MERLIN ToO Request, Supernova SN 2013ej (PI: H. Rampadarath, 13 hours, 2017).

Service

Institute of Physics Careers Panel, Dept. of Physics & Astronomy, University of Manchester, UK	2024
Laboratory teaching committee, Dept. of Physics & Astronomy, University of Manchester, UK	2020 – 2021
Postgraduate representative, Dept. of Physics & Astronomy, University of Manchester, UK	2018 – 2020
PhD interviews support team, Jodrell Bank Centre for Astrophysics, University of Manchester	2020
Local Organising Committee: Internal Symposium, Jodrell Bank Centre for Astrophysics, University of Manchester	2019
Local Organising Committee: A Centenary of Astrophysical Jets conference, SKAO HQ, Cheshire, UK	2019
Laboratory open day tour guide, University of Manchester, UK	2019
Internal Seminar organiser, Jodrell Bank Centre for Astrophysics, University of Manchester, UK	2017 – 2018
Postgraduate committee, Jodrell Bank Centre for Astrophysics, University of Manchester, UK	2017 – 2018
Astronomy Society Committee, (Science Officer; then Chair; then Secretary), University of Manchester, UK	2014 – 2017

Selected Media & Outreach

Television

***Breakfast*, BBC One**, Multiple live apperances (in-studio and remote) to discuss astronomy news. Topics included 'Oumuamua, New Horizons, Chang'e 4, and the Perseid meteor shower.	2018 – 2020
***Newsround*, CBBC**, Pre-recorded segment on astronomy. `https://www.bbc.co.uk/newsround/49911516`	2019
BBC News & BBC World News, Multiple remote live apperance; topics included lunar eclipse and New Horizons probe.	2019

Radio & podcasting

The Jodcast, Producing, presenting, interviewing, and audio editing of a popular astronomy podcast.	2017 - 2020.
BBC Radio 5 Live, Monthly (Jan – Sept 2018) discussion of recent astrophysical news and the night sky. One-off features on a range of topics, including: Jupiter opposition, Jodrell Bank UNESCO award, and Betelgeuse dimming.	2018 – 2020
BBC World Service OS, Explaining the physics of the "broom challenge".	2020
BBC Radio 5 Live, Discussion panel: this year & next in space.	2018

Press Releases & articles

The Conversation, "A 4G network on the Moon is bad news for radio astronomy"	2020
ASTRON press release, "Star formation may be halted by cold ionised hydrogen"	2019

Consulting

CBBC Newsround, Various articles and features including `https://www.bbc.co.uk/newsround/59559445`	2020 – 2021
Netflix: *Night on Earth*, Consultant for astronomy content (episode: *Moonlit Plains*).	2019 – 2020
BBC News, Feature on how Wi-Fi works.	2019

Talks & workshops

A Tour through the Radio Universe, York Astronomical Society; Derby & District Astronomical Society; Leeds Astronomical Society; Doncaster Astronomical Society (Invited talks).	2019-2025
The Science of the New Crescent Moon, New Crescent Society online workshop.	2020
Cosmic Magnetism, York Astronomical Society (Invited talk).	2018

Events

Bluedot Festival, Jodrell Bank Observatory, Cheshire, UK. Science explanations and talk introductions.	2016 - 2019
ScienceX, Trafford Centre, Manchester, UK. Science busking.	2018
***Stargazing Live* event: public astronomy demonstrations**, York, UK.	2011 - 2013

Schools

Moon Palace, John Smeaton Academy, Leeds	2025
Solar System workshop, IntoUniversity, Leeds East	2025
INFUSE, University of Manchester, UK. Physics workshops for Year 10 and Year 12.	2018 - 2019