James Petley

Curriculum Vitae

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Qualifications

2020–Present **PhD - Expected Completion Summer 2024**, *Durham University*, Durham, UK, **Supervisor: Dr Leah Morabito**.
High resolution imaging and survey studies of quasars with outflows using the LOFAR International Telescope

2016–2020 **Physics and Astronomy, MPhys - 1st class with honours**, *Durham University*, Durham, UK, **Supervisors: Prof. Mark Swinbank & Prof. Ian Smail**.
Investigating the Most Luminous Starbursts in the Universe

Research Highlights

- Demonstrated that the absorption properties of BALQSOs are linked to their radio-emission
- Revealed a key link between quasars with outflows and their optical reddening due to dust
- Contributed crucial elements to the LOFAR-VLBI pipeline, enabling sub-arcsecond resolution at 150 MHz

Research Interests

I am interested in understanding the effect super-massive black holes have on their own growth and their larger surroundings. My work has focused on Broad Absorption Line Quasars (BALQSOs) which contain high-velocity winds which can sometimes reach across their whole galaxy. These sources contain enhanced radio emission which is currently without a determined physical origin. My main tool for studying these sources has been the LOFAR telescope, an SKA pathfinder instrument. Using LOFAR, I showed that radio-emission from BALQSOs may be originating from wind shocks. I have skills in VLBI imaging at low frequency and am working on future pipelines for this intensive data processing.

Programming Experience

Python Proficient in Python for Data Analysis and Physics Problem Solving. I also have some experience in web development with Django and Flask. I have previously won prizes at Durham Hackathon for a Flask MicroLending Service and a Fake News Detecting Whatsapp Bot each created in 24 hours. I also have my own Python package with documentation, CoSpecPy, for downloading, creating and plotting composite spectra.

HPC Experienced with bash scripting and using torque and slurm for job submission on multiple HPC resources.

git/GitHub Experienced with git and hosting repositories on GitHub. As well as my own projects I also regularly fork and make pull requests to other LOFAR repositories.

C++ I took a long online course on the language in 2018 but have not had the chance to use it in a practical or work setting since

Cloud Services I have worked with Google Cloud (NLP and AI) and AWS (EC2, S3, SageMaker) for hackathon projects and a previous internship

Machine Learning I have a small amount of machine learning experience mostly through experimentation with Google Keras and TensorFlow. This is an area I would like to learn a lot more about over the next few years.

Others I have been learning R and Julia over the past year, primarily in the context of data science and machine learning.

Telescope Experience

LOFAR Member of LOFAR Surveys Key Science Project, Evolution of AGN and Star-Forming Galaxies working group and Long Baseline Working Group

SKA Member of the Continuum Science Working Group

e-MERLIN PI for 120 hours observed in Cycle 13

Leadership

UK SKA ERC Committee Became a member in 2023, helping to organise an upcoming town hall meeting.

LOFAR-VLBI Led groups during VLBI busy weeks where large changes are made to the pipeline.

PhD Journal Club	Co-led the Durham Astronomy PhD journal club for 2022/23.
Conference in Iceland	On the LOC for the *What drives the growth of black holes?* conference in Reykjavik, Iceland Oct 2022.

Publications

First Author

1 **Petley** J. W., Morabito, L. K., Rankine, A. L. and 7 colleagues, *How does the radio enhancement of broad absorption line quasars relate to colour and accretion rate?*, Submitted to collaboration, **2023**

2 **Petley**, J. W., Morabito, L. K., Alexander, D. M. and 6 colleagues, *Connecting radio emission to AGN wind properties with Broad Absorption Line Quasars*, MNRAS, 525.4, 5159-5174, **2022**

Co-Author

1 Yue, B., Best, P., Duncan, K., and 6 other colleagues, *A novel Bayesian approach for decomposing the radio emission of quasars: I. Modelling the radio excess in red quasars*, MNRAS, submitted, **2023**

2 Hardcastle, M. J., Horton, M. A., Williams, W. L. and 48 colleagues, *The LOFAR Two-Metre Sky Survey (LoTSS) - VI. Optical identifications for the second data release*, A&A, submitted, **2023**

3 Andonie, C. A., Alexander, D. M., Rosario, D. J and 13 colleagues, *A panchromatic view of infrared quasars: excess star formation and radio emission in the most heavily obscured systems*, MNRAS, 517.2, 2577-2598, **2022**

Scientific Presentations

USA, Jun. 2023	**AGN Winds on the Chesapeake** - Contributed - *Does the radio enhancement of BALQSOs have a distinct origin?*
Scotland, Jan 2023	**DEX-XIX** - Contributed - *Disentangling the drivers of radio emission in quasars*
South Africa, Dec. 2022	**South African Radio Astronomy Observatory** - Invited Speaker - *Determining the origin of radio emission in quasars with outflows*
South Africa, Dec. 2022	**University of Cape Town** - Invited Lunchtime Speaker - *Determining the origin of radio emission in quasars with outflows*
Iceland, Oct. 2022	**What Drives the Growth of Black Holes? Conference** - Contributed - *How can we determine the source of the enhanced radio detection fraction of quasars with strong winds?*
Virtual, Oct. 2022	**LOFAR Early Careers Researcher Conference** - Contributed - *How can we determine the source of the enhanced radio detection fraction of quasars with strong winds?*
Virtual, May 2022	**Kapteyn Institute** - Invited Lunchtime Speaker - *How can we determine the source of the enhanced radio detection fraction of quasars with strong winds?*
Virtual, Nov. 2021	**Science at Low Frequencies** - Contributed Lightning Talk

Public Engagement/Outreach

Celebrate Science	Helped children ages 6-16 understand cosmology work in Durham through exploring a "Universe Maker" and virtual reality tours of our simulations.
Space Camp	Overnight camp for children aged 10 at a local school. Created model planets and moon dust before leading a stargazing session.
Public Talks	**Mexborough and Swinton Astronomical Society, Sep. 2022** - *How super-massive black holes control the galactic weather*

Other Experience

Teaching

2020-Present **Postgraduate Demonstrator**, *Durham University*.

I have been working as a postgraduate demonstrator each year since starting my PhD. At Durham this is optional but I took the initiative including through the pandemic. In particular, I have greatly enjoyed being one of two "drop-in" demonstrators for 3rd and 4th year undergraduates. In this role, I am there to help with any programming problems these students may face in their final-year projects.

2016–2020 **Tutor**, *Advantage 11+*, Birmingham.

I have tutored children between the ages of 8 and 11 for several years. This has allowed me to:

- As a leader, managed a class of 25 young students and two other tutors
- Planned series of lessons between 2 and 4 weeks long
- Delivered short lessons on key topics in a clear and effective manner
- Communicated well with parents, giving advice on what their children need to work on and how they should be studying

2014 **Teaching Assistant**, *Wilson Stuart School*, Birmingham.

I volunteered as a teaching assistant at this Special Academy for disabled students. I worked with a class of students with very different abilities and needs. I improved:

- My confidence in responding to stressful or unusual situations (e.g. student having a seizure)
- Communication skills with the students and also teachers. I even learnt some "Makaton" sign language
- Teaching skills. How to teach a 14-year-old student practical life skills when they struggle to count past 10.

Other

2019 **Summer Internship**, *Drone Industries Ltd.*, Gateshead, 7 weeks.

I won the chance to work for a company in the space or space technologies industry through a Santander scheme. I was mostly given tasks related to website design and structure but I managed to implement some extra features such as interactive maps combined with drone imagery using JavaScript. I also used Open-CV to help identify different types of moor plants and study their growth in drone images for the local council. I combined artificial intelligence AWS services with archive images from a local museum to pull out useful text and key aspects of their extensive collection.

2016-Present **Musician**, Durham.

I have played in several bands while at Durham University. I play clarinet (Grade 8 distinction), saxophones, piano (grade 7 merit) and I am learning the flute. I have been able to:

- Negotiate prices and payment with large university organisations for balls and other events
- Lead a big band of 18 people as president. Manage ∼£7000 a year as well as providing leadership and direction.
- Organise a tour for 16 people to travel to Amsterdam (2019) and Prague (2022). Liaise with transport and accommodation providers, set up venues to perform abroad and budget based on income for the year.
- Record three albums with a band in Durham and release them online.

Languages

English	Fluent	*Native Speaker*
French	Moderate	*B at AS Level*

Further Achievements

Duke of Edinburgh Award

I have completed my Gold Duke of Edinburgh award which involved many hours of volunteering, sporting activity and new experiences. Prince Edward presented me with the award in 2017.

Postgraduate Events Officer

During the COVID-19 pandemic, I was elected to the role of Events Officer for post-grads in my college. I ran successful online events both socially and for members to share their research with others across disciplines. By the end of the role I managed to run some in-person events, the highlight being a postgrad BBQ celebration.

Running Despite Adversity

I was diagnosed with Juvenile Arthritis, a genetic disease which affects my joints, when I was 15. Despite this, I have been able to continue sporting activity and, in particular, running where I have been able to run half marathons (starting in 2014) and the Budapest marathon (2018). I also play, and regularly captain teams in, Ultimate Frisbee for Durham University along with football for my college. Outside university, I have been a part of and captained a team that reached the UK national championships in Ultimate Frisbee.