

Cathal Maguire

Ph.D. Candidate in Astrophysics · Trinity College Dublin

✉ maguic10@tcd.ie | 🏠 cathal-maguire.github.io | 📞 0000-0002-9061-780X

EDUCATION

Ph.D., Astrophysics

Expected Graduation: September 2024

Trinity College Dublin, Dublin, Ireland

2020 – Present

B.A. (Mod), Physics & Astrophysics

Graduated with First Class Honours (75%)

Received a Gold Medal for “exceptional merit at degree examinations”

Trinity College Dublin, Dublin, Ireland

2016 – 2020

RESEARCH EXPERIENCE

Postgraduate Researcher | Supervisor: Prof. Neale Gibson

Trinity College Dublin, Dublin, Ireland

- High-resolution transmission spectroscopy observations of exoplanetary atmospheres with VLT/ESPRESSO 2020 – Present
- Applied advanced Bayesian inference techniques to large high-resolution data sets
- Monitored ultra-hot Jupiter atmospheres over months/years via novel and archival observations

SSDF Visitor | Supervisor: Dr. Elyar Sedaghati

European Southern Observatory, Santiago, Chile

- Compared efficacy of high-resolution telluric removal techniques from high-resolution observations Mar 2023 – May 2023
- Conducted multiple nights of observations at the Very Large Telescope (VLT), Paranal Observatory
- Utilised the ESPRESSO instrument for both scientific and calibration observations

Research Assistant | Supervisor: Prof. Salvatore Orlando

PRACE, Cineca, Bologna, Italy

- Worked remotely as part of the PRACE Summer of High-Performance Computing (SoHPC) Jun 2020 – Aug 2020
- Simulated highly-energetic supernova and investigated the interaction of their ejecta with their surrounding environments
- Focused on efficient data management and remote high-performance computing with the GALILEO supercomputer

Undergraduate Researcher | Supervisor: Prof. Aline Vidotto

Trinity College Dublin, Dublin, Ireland

- Modelled the 1D velocity and temperature profile of the stellar wind of the red supergiant Alpha Orionis Sep 2019 – Jan 2020
- Compared radiative transfer modelling of stellar wind with radio observations

PUBLICATIONS

PEER-REVIEWED PUBLICATIONS

- 4 Ramkumar, Swaetha et al. (4 co-authors, incl. **Maguire, Cathal**), 2023, High-resolution emission spectroscopy retrievals of MASCARA-1b with CRIRES+: strong detections of CO, H₂O, and Fe emission lines and a C/O consistent with solar, *MNRAS*, **525**, 2985.
- 3 Gandhi, Siddharth et al. (11 co-authors, incl. **Maguire, Cathal**), 2023, Retrieval Survey of Metals in Six Ultrahot Jupiters: Trends in Chemistry, Rain-out, Ionization, and Atmospheric Dynamics, *AJ*, **165**, 242.
- 2 **Maguire, Cathal** et al., 2023, High-resolution atmospheric retrievals of WASP-121b transmission spectroscopy with ESPRESSO: Consistent relative abundance constraints across multiple epochs and instruments, *MNRAS*, **519**, 1030.
- 1 Gibson, Neale P et al. (4 co-authors, incl. **Maguire, Cathal**), 2022, Relative abundance constraints from high-resolution optical transmission spectroscopy of WASP-121b, and a fast model-filtering technique for accelerating retrievals, *MNRAS*, **512**, 4161.

UNDER REVIEW

- 2 **Maguire, Cathal** et al., 2024, High-resolution atmospheric retrievals of WASP-76b transmission spectroscopy with ESPRESSO: Monitoring limb asymmetries across multiple transits, A&A.
- 1 Fortune, Mark; et al. (5 co-authors, incl. **Maguire, Cathal**), 2024, How do wavelength correlations affect your transmission spectrum? Application of a new fast and flexible 2D Gaussian process framework to transiting exoplanet spectroscopy, A&A.

CURRENT RESEARCH INTERESTS (SELECTED)

- Exoplanetary atmospheres (observations & modelling)
- High-resolution spectroscopy
- Bayesian inference methods
- High-performance computing
- Telluric correction of ground-based high-resolution spectra

CONFERENCE & SEMINAR TALKS

- Cathal Maguire**, August 2023. "Optimising the removal of telluric contamination from high-resolution transmission spectra." *Irish National Astronomy Meeting (INAM)*, University College Cork, Ireland[†]
- Cathal Maguire**, July 2023. "Optimising the removal of telluric contamination from high-resolution transmission spectra." *Exoplanets by the Lake*, Starnberg, Germany[†]
- Cathal Maguire**, May 2023. "Optimising the removal of telluric contamination from high-resolution transmission spectra." *European Southern Observatory*, Santiago, Chile*
- Cathal Maguire**, April 2023. "Transmission Spectroscopy of WASP-121b with ESPRESSO." *Universidad Adolfo Ibáñez*, Santiago, Chile*
- Cathal Maguire**, December 2022. "Transmission Spectroscopy of WASP-121b with ESPRESSO." *DUBLIN STar formation, DeBris disks and plaNets (DUSTBIN) Meeting*, Maynooth University, Ireland*
- Cathal Maguire**, September 2022. "Above the Clouds: Probing the atmosphere of the ultra-hot Jupiter WASP-121b with VLT/ESPRESSO." *AIP Thinkshop 2022: High-resolution spectroscopy for exoplanet atmospheres and biomarkers*, Leibniz Institute for Astrophysics, Potsdam, Germany[†]
- Cathal Maguire**, August 2022. "Above the Clouds: Probing the atmosphere of the ultra-hot Jupiter WASP-121b with VLT/ESPRESSO." *Irish National Astronomy Meeting (INAM)*, Dunsink Observatory, Ireland[†]

([†]Contributed, *Seminar)

TEACHING & OUTREACH

Teaching Assistant

Trinity College Dublin, Dublin, Ireland

- Undergraduate teaching assistant for Junior Sophister astrophysical labs 2020 – Present
- Facilitated laboratory exercises, providing hands-on support to students and ensuring a conducive learning environment
- Successfully completed a postgraduate course focusing on pedagogical methods and best practices

STEM Mentor

Innumeris Education, Dublin, Ireland

- Mentored final year secondary school students from underrepresented backgrounds 2020 – 2022
- Provided assistance with university admissions procedures, offering insights and support
- Delivered tailored tutoring sessions, addressing individual learning needs

PROFESSIONAL SKILLS

- **Programming / Markup Languages:** Python, IDL, C/C++, JavaScript, HTML/CSS, \LaTeX
- **Data Analysis Techniques:** Bayesian inference, Cross-correlation analysis, Astronomical image reduction, Radiative transfer, Open-source code management, Web development
- **Languages:** English (native), Irish (native), Spanish (intermediate)

INTERESTS & HOBBIES

I am passionate about sports, having participated in teams across a variety of sports, including soccer and [gaelic football](#).

I am also interested in science and advancing technologies, with my main interests coming in the physical and space sciences.