

# Cathal Maguire

Ph.D. Candidate in Astrophysics · Trinity College Dublin

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## EDUCATION

### Ph.D., Astrophysics

Expected Graduation: September 2024

Trinity College Dublin, Dublin, Ireland

2020 – Present

### B.A., 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

2020 – Present

• Applied advanced Bayesian inference techniques to constrain the atmospheric composition and dynamics of ultra-hot Jupiters

### 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

### 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

• Radiative transfer modelling of stellar wind were compared with radio observations

## CURRENT RESEARCH INTERESTS (SELECTED)

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

## PUBLICATIONS

### REFEREED PUBLICATIONS

- <sup>4</sup> Ramkumar, Swaetha *et al.* (4 co-authors, incl. **Maguire, Cathal**), 2023, High-resolution emission spectroscopy retrievals of MASCARA-1b with CRILES+: strong detections of CO, H<sub>2</sub>O, and Fe emission lines and a C/O consistent with solar, *MNRAS*, **525**, 2985.
- <sup>3</sup> 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.
- <sup>2</sup> **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.
- <sup>1</sup> 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.

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## UNDER REVIEW

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

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## CONTRIBUTED & INVITED TALKS

- <sup>7</sup> **Cathal Maguire**, 2023. "Optimising the removal of telluric contamination from high-resolution transmission spectra." *Irish National Astronomy Meeting (INAM)*, University College Cork, Ireland.
- <sup>6</sup> **Cathal Maguire**, 2023. "Optimising the removal of telluric contamination from high-resolution transmission spectra." *Exoplanets by the Lake*, Starnberg, Germany.
- <sup>5</sup> **Cathal Maguire**, 2023. "Optimising the removal of telluric contamination from high-resolution transmission spectra." *European Southern Observatory*, Santiago, Chile.
- <sup>4</sup> **Cathal Maguire**, 2023. "Transmission Spectroscopy of WASP-121b with ESPRESSO." *Universidad Adolfo Ibáñez*, Santiago, Chile.
- <sup>3</sup> **Cathal Maguire**, 2022. "Transmission Spectroscopy of WASP-121b with ESPRESSO." *DUBLIN STar formation, DeBris dIsks and plaNets (DUSTBIN) Meeting*, Maynooth University, Ireland.
- <sup>2</sup> **Cathal Maguire**, 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.
- <sup>1</sup> **Cathal Maguire**, 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.

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## TEACHING & OUTREACH

### Teaching Assistant

Trinity College Dublin, Dublin, Ireland

- Undergraduate teaching assistant for Junior Sophister astrophysical labs
- 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

2020 – Present

### STEM Mentor

Innumeris Education, Dublin, Ireland

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

2020 – 2022

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## PROFESSIONAL SKILLS

- **Programming / Markup Languages:** Python, IDL, C/C++, HTML/CSS, JavaScript,  $\LaTeX$
- **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)

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## MISCELLANEOUS

### Sales Consultant

Next Retail Plc., Dublin, Ireland

2015 – 2020

### Rides Operator

Canada's Wonderland, Vaughan, Canada

Jun 2018 – Aug 2018

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## 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.