Swaetha Ramkumar

PhD Candidate in Astrophysics at Trinity College Dublin

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https://swaetharamkumar.github.io/

Education

2021 – Present **Ph.D. in Physics, Trinity College Dublin**
Supervisor: *Prof. Neale P. Gibson*

2019 – 2020 **M.Sc. in Astrophysics, University College London (UCL)**
Thesis title: *Assessing the stability of nuclear disc orbits against migrating resonances.*
Supervisor: *Dr. Ralph Schoenrich*
Distinction

2016 – 2019 **B.Sc. in Physics, Amrita Vishwa Vidyapeetham**
Project title: *Basic properties of Solar and Interstellar Plasma.*
Supervisor: *Dr. Bharat Kishore Sharma*
First Class with Distinction (CGPA: 9.10 out of 10)

Research Experience

2021-Present **Postgraduate Researcher (PhD)**, *Trinity College Dublin*

- Working on characterising the atmospheres of exoplanets using high-resolution spectroscopy, primarily phase curve observations of hot- and ultra-hot Jupiters.
- Developing the Gibson et al. (2020) retrieval framework to incorporate the 3D nature of atmospheres.

Mar 2020-Sep 2020 **Master's Research Project**, *University College London (UCL)*

- Studied the non-axisymmetric bar of the Milky Way and performed simulations using an orbit integrator (written in C++).
- Investigated the behaviour of x_2 orbits and their interactions with the bar.
- Explored the behaviour of orbital resonances and x_2 orbits when introducing a nuclear disk.

Feb 2019-May 2019 **Undergraduate Research Project**, *Amrita Vishwa Vidyapeetham*

- Investigated the basic properties of Solar and Interstellar Plasma.
- The simulation output was investigated in Python, to determine the plasma parameters (such as Debye length, and Debye number) as a function of temperature. These results were then compared with observed values in the Solar wind and Interstellar medium.

Research Publications

First-Authored

1. **S. Ramkumar**, N. P. Gibson, S. K. Nugroho, C. Maguire, and M. Fortune, "High-resolution emission spectroscopy retrievals of MASCARA-1b with CRIRES+: strong detections of CO, H_2O, and Fe emission lines and a C/O consistent with solar," *MNRAS*, 2023. DOI: 10.1093/mnras/stad2476.

Co-Authored

1. M. Fortune, N. P. Gibson, D. Foreman-Mackey, T. M. Evans-Soma, C. Maguire, and **S. Ramkumar**, "How do wavelength correlations affect transmission spectra? Application of a new fast and flexible 2D Gaussian process framework to transiting exoplanet spectroscopy," *A&A*, 2024. DOI: 10.1051/0004-6361/202347613.
2. C. Maguire, N. P. Gibson, S. K. Nugroho, M. Fortune, **S. Ramkumar**, S. Gandhi, and E. de Mooij, "High resolution atmospheric retrievals of WASP-76b transmission spectroscopy with ESPRESSO: Monitoring limb asymmetries across multiple transits," *A&A*, 2024. DOI: 10.1051/0004-6361/202449449.
3. C. Maguire, N. P. Gibson, S. K. Nugroho, **S. Ramkumar**, M. Fortune, S. R. Merritt, and E. de Mooij, "High-resolution atmospheric retrievals of WASP-121b transmission spectroscopy with ESPRESSO: Consistent relative abundance constraints across multiple epochs and instruments," *MNRAS*, 2023. DOI: 10.1093/mnras/stac3388.

Talks and Presentations

2024
- **MASCARA: Does it help your eyelash?**
  Two HoRSEs, July 15-19, 2024 (poster presentation).
- **MASCARA: Does it help your eyelash?**
  Exoplanets 5, June 17-21, 2024 (poster presentation).
- **Atmospheres of Alien Worlds.**
  IOP Ireland Spring Conference: Rosse Medal entrant, Apr 06, 2024 (poster presentation).

2023
- **MASCARA: does it help your eyelash?**
  Irish National Astronomy Meeting (INAM) 2023, Aug 24-25, 2023 (contributed talk).
- **High-resolution emission spectroscopy retrievals of MASCARA-1b with CRIRES+**
  Exoplanets by the Lake Summer School, Jul 31-Aug 4, 2023 (contributed talk).
- **MASCARA: does it help your eyelash? High-resolution emission spectroscopy retrievals of MASCARA-1b with CRIRES+**
  2023 Sagan Exoplanet Summer Hybrid Workshop, Jul 24-28, 2023 (poster presentation).
- **The atmosphere of MASCARA-1b through the eyes of CRIRES+**
  Theo Murphy meeting, the Royal Society: Spectroscopy of exoplanets at high resolution, Feb 6-7, 2023 (flash talk).

Observing Experience and Proposals

2024
- **CRIRES+ at the Very Large Telescope (VLT)**
  Phase Curve observations (K-band) in designated Visitor Mode (dVM) during cycle P113, PI: Nugroho, CoI: S. Ramkumar.

2023
- **CRIRES+ at the Very Large Telescope (VLT)**
  Phase Curve observations (K-band) in designated Visitor Mode (dVM) during cycle P112, PI: Gibson, ***dPI: S. Ramkumar.***

Teaching and Outreach

2021 – 2024
- **Teaching Assistant in PYU33AP4 - JS AP Astro Computational Lab**
  Trinity College Dublin

Teaching and Outreach (continued)

Oct 2023 – Nov 2023 **Teaching Assistant in PYU33AP3 - JS Practical in Astrophysics**
Trinity College Dublin

Apr 2023 **Transition Year Physics Experience (TYPE) Mentor**
Trinity College Dublin
Mentor for the poster session - the Transition Year Physics Experience (TYPE) programme.

Nov 2022 – Mar 2023 **STEM@Universi-TY Educator**
Trinity Walton Club, Trinity College Dublin
`https://www.tcd.ie/waltonclub/ty.php`

Prizes, Awards & Grants

2021 – Present **Research Grant**, Provost's PhD Award
Trinity College Dublin

Aug 2023 **Peter Curran Award**
Astronomical Society of Ireland (ASI)
The award recognises the best contributions to the Irish National Astronomy Meeting (INAM) by a graduate student presenter for the year 2023.
`https://astronomers.ie/peter-curran-award/`

June 2024 **Science in Shorts 2024**
Nature Awards
Science in Shorts is one of Nature's Awards, where you present your research in a 1-minute video. My video was selected for inclusion in the Shortlist and is featured on their YouTube channel: `Science in Shorts: Turn into a force ghost!`

Technical Skills

Research Interests: Exoplanet atmospheres (observations and modelling), High-resolution spectroscopy, Cross-correlation analysis, Atmospheric retrievals, Planet formation.

Programming: Python (*advanced*), C/C++ (*intermediate*), SQL (*basic*)

Markup Languages: LaTeX(*advanced*), HTML (*intermediate*)

Miscellaneous: Bayesian inference with MCMC, Cross-correlation analysis

Languages

English **Fluent**

Tamil **Mother tongue**

Hindi **Conversational**