Dr. Rajika Kuruwita — Citizenship: Australian

Contact Information

Heidelberg Institute for
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Research Interests

Star formation, binary and multiple star systems, protoplanetary disks and planets in binary star systems, MHD simulations, and software development.

Education

Australian National University, Canberra, Australia **February, 2015 - January, 2019**

PhD

- Thesis Topic: "The formation, evolution, and survivability of discs around young binary stars"
- Primary Supervisor: Associate Professor Christoph Federrath
- Secondary Supervisor: Professor Michael Ireland

Macquarie University, Sydney, Australia **February, 2010 - January, 2015**

MRes. Physics and Astronomy

- Thesis Topic: "Fallback disks and the end of the common envelope phase"
- Primary Supervisor: Professor Orsola De Marco
- Secondary Supervisor: Assistant Professor Jan Staff

BSc. Astronomy and Astrophysics

Employment History

Heidelberg Institute for Theoretical Studies, Heidelberg, Germany
Independent Postdoc Fellow **October, 2019 - Present**
Research the formation of binary and multiple star systems via numerical simulations.

University of Copenhagen, Copenhagen, Denmark
Post-doctorate researcher (Marie Sklodowska-Curie Interactions Fellow) **April, 2019 - August, 2022**
Investigate protostellar multiplicity and binarity on disk evolution.

Australian National University, Canberra, Australia
Research Assistant **February, 2019 - April, 2019**
Research the formation of binary star systems via simulations.
Outreach Assistant **December, 2015 - April, 2019**
Organise and run outreach observing and site tours for the public, school, scout, and private groups, as well as design activities for the observatory visitor centre.

Macquarie University, Sydney, Australia
Laboratory Demonstrator **February, 2014 - January, 2015**
Taught lab experiments for undergraduate students. This also involved marking lab books.
Observatory and Planetarium Supervisor **February, 2010 - January, 2015**
Coordinated groups, created tours/presentations, operated observatory and planetarium.
Vacation Scholarship Researcher **December, 2012 - February, 2013**
Simulated light curves to understand the influence of exoplanets on the asteroseismological pulsation spectrum of stars.
Vacation Scholarship Researcher **January, 2012 - February, 2012**
Carried out research on nanowires using white light interferometry.

Time Awarded

Australian National University 2.3m Telescope

- **PI**: Building a Census of Protoplanetary Disks in Binary Star Systems (20 nights over 3 years)

LUMI Supercomputer

- **CO-I**: Embedded Disks: 24000000 core hours over 12 months

PRACE

- **CO-I**: Embedded Disks (2021250113): 40000000 core hours over 12 months

Selected Talks

European Astronomical Society ASM — **July, 2024**
Invited Review Talk — Padua, Italy

ESO Star & planet formation seminar — **September, 2023**
Invited Talk — Garching, Germany

Anton Pannekoek Institute for Astronomy — **April, 2022**
Invited Talk — Amsterdam, The Netherlands

Distorted Astrophysical Discs — **May, 2021**
Contributed Talk — Cambridge, UK

Niels Bohr Institute — **January, 2019**
Invited Talk — Copenhagen, Denmark

Sutherland Astronomical Society Incorporated — **September, 2018**
Invited Talk — Sydney, Australia

Franco-Australian Astrobiology and Exoplanet School and Workshop — **December, 2017**
Contributed Talk — Canberra, Australia

Mt Stromlo Students Seminars — **December, 2016**
Contributed Talk (Awarded Best Theme Talk) — Canberra, Australia

Star Formation — **August, 2016**
Computational Astrophysics splinter session (Invited) — Exeter, UK

Awards and Honors

- 2023: Isobel Rojas Travel Award recipient (3000EUR)
- 2023: Hochschulwettbewerb (national college competition) winners. Received 10000EUR to create a communication project about 'Our Universe'.
- 2022: Became the first HITS Independent Research Fellow (includes funding of 5000EUR per year)
- 2021: Kvinder i Fysik (Danish Women in Physics) Prize 2021 Nominee
- 2020: European Union INTERACTIONS Fellowship
- 2017: Joan Duffield Research Supplementary Scholarship
- 2015: Australian Postgraduate Award
- 2013: Macquarie University Research Training Scholarship
- 2012: Vacation Scholarship (Macquarie University)
- 2011: Vacation Scholarship (Macquarie University)

Teaching

Computational astrophysics lecturing — **November, 2019 - February 2021**
Gave post-graduate level lectures on computational astrophysics reviewing hydrodynamics and modelling shock waves.

Laboratory demonstrator — **February, 2014 - January, 2015**
Taught lab experiments for undergraduate students in physics and astronomy. I also marked lab books.

Supervision

Niels Bohr Institute masters students — **August, 2021 - 2022**
I co-supervised three master's students who worked on producing synthetic observations from my simulations and built a pipeline using machine learning to fit synthetic observations to real observations of young protostars.

Niels Bohr Institute bachelors projects — **February-April, 2021, 2022**
Supervised 5 bachelor student groups on projects including modelling exoplanet interiors, and n-body simulations of the solar system and stellar systems.

Mt Stromlo Observatory summer research — **December, 2017 - February, 2018**
Co-supervised honours student Isabella Gerard on a research project on turbulent magnetic fields and star formation. I am a co-author of the paper published from this project.

Mt Stromlo Observatory winter school — **June-July, 2017**
Advised undergraduate students Lara Cullinane, Patrick Armstrong, Joshua Ho and Lillian Guo in planning observations and writing telescope proposals.

Computer Skills

- Computing Languages: Python, Fortran and HTML
- Applications: LaTeX, `yt`, simulation codes `RAMSES`, `FLASH`, `DISPATCH` and Enzo, analysis of hdf5 files from hydrodynamic simulations, reducing observational data in fits files, retrieving radial velocities.
- Operating Systems: Unix/Linux, Windows, and Mac.

Other Academic Services

- Reviewer for Monthly Notices of the Royal Astronomical Society
- Founded of Astronomy on Tap Copenhagen in 2020.
- Treasurer of Kvinder i Fysik (the Danish Women in Physics Society) from 2019 to 2022.
- Contributed popular science articles to the Sunday Space in the Canberra Times.
- Member of the Local Organising Committee for the 2017 Harley Wood Winter School and Annual Scientific Meeting of the Astronomical Society of Australia.
- Member of the Science Organising Committee for the 2016 Harley Wood Winter School.
- Chair of the Organising Committee for the 2016 Mt Stromlo Student Seminars.

Referee Details

- Associate Professor Troels Haugbølle, Center for Star and Planet Formation, University of Copenhagen, Geology Museum, Øster Voldgade 5-7, 1350 København K, Denmark. Tel: +45 35 32 11 41. Email: haugboel@nbi.ku.dk
- Associate Professor Christoph Federrath, Research School of Astronomy and Astrophysics, Australian National University, Mount Stromlo Observatory, Cotter Road, Weston Creek, ACT 2611, Australia. Tel: +61 2 6125 0217. Email: christoph.federrath@anu.edu.au
- Dr. Fabian Schneider, Heidelberg Institute for Theoretical Studies, Schloss-Wolfsbrunnenweg 35, 69118 Heidelberg, Germany. Tel: +49 6221 533 334. Email: fabian.schneider@h-its.org
- Professor Jes Kristian Jørgensen, Center for Star and Planet Formation, University of Copenhagen, Geology Museum, Øster Voldgade 5-7, 1350 København K, Denmark. Tel: +45 35 32 41 86. Email: jeskj@nbi.ku.dk

Refereed Publications

Kuruwita et al, *Protostellar spin-up and fast rotator formation through binary star formation*, 2024, *Accepted at Astronomy & Astrophysics*

- Lead author, and conductor of research and analysis.

Kuruwita & Haubølle, *The contribution of core-fragmentation on protostellar multiplicity*, 2023, Astronomy & Astrophysics, 674, A196

- Lead author, and conductor of research and analysis.

Kuruwita et al., *The dependence of episodic accretion on eccentricity during the formation of binary stars*, 2020, Astronomy & Astrophysics, 641, A59

- Lead author, and conductor of research and analysis.

Kuruwita & Federrath, *The role of turbulence during the formation of circumbinary disks*, 2019, Monthly Notices of the Royal Astronomical Society, 486, 3647-3663

- Lead author, and conductor of research and analysis.

Kuruwita et al., *Multiplicity of disc-bearing stars in Upper Scorpius and Upper Centaurus-Lupus*, 2018, Monthly Notices of the Royal Astronomical Society, 480, 5099–5112

- Lead author, and conductor of research and analysis.
- Collected the majority of observations.

Kuruwita et al., *Binary star formation and the outflows from their discs*, 2017, Monthly Notices of the Royal Astronomical Society, 470, 1626-1641

- Lead author, and conductor of research and analysis.

Kuruwita et al., *Considerations on the role of fall-back discs in the final stages of the common envelope binary interaction*, 2016, Monthly Notices of the Royal Astronomical

Society, 461, 486-496
- Lead author, and conductor of research and analysis.

Li, S. **et al**, *Observations of high-order multiplicity in a high-mass stellar protocluster*, 2024, Nature Astronomy, https://doi.org/10.1038/s41550-023-02181-9
- Used my models from Kuruwita & Haugbølle (2023) to interpret statistics of this massive star-forming region.

Tuhtan, V., Al-Belmpeisi, R., Christensen, M. B., **Kuruwita, R.**, & Haugbølle, T., *Simulated Analogues I: apparent and physical evolution of young binary protostellar systems*, 2024, *In review at MNRAS*
- Co-supervised Vito, Rami, and Mikkel for their Master's thesis

Al-Belmpeisi, R., Tuhtan, V., Christensen, M. B., **Kuruwita, R.**, & Haugbølle, T., *Simulated analogues II: a new methodology for non-parametric matching of models to observations*, 2024, *Accepted at MNRAS*
- Co-supervised Vito, Rami, and Mikkel for their Master's thesis

Evans, E. **et al**, *Orbital Architectures of Planet-Hosting Binaries III. Testing Mutual Inclinations of Stellar and Planetary Orbits in Triple- Star Systems*, 2024, *in review at MNRAS*
- Took observations used in this paper.

Jørgensen, J. & **Kuruwita, R.** et al, *Binarity of a protostar affects the evolution of the disk and planets*, 2021, Nature, Volume 606, Issue 7913, p.272-275
- Lead the theoretical component of paper. Conducted analysis of simulations used for comparison with observations.

Gerrard, I., Federrath, C., & **Kuruwita, R.**, *The role of magnetic field structure in the launching of protostellar jets*, 2019, Monthly Notices of the Royal Astronomical Society, 485, 5532-5542
- Co-supervised Gerrard in running simulations and analysing them

Green **et al.**, *Testing the binary trigger hypothesis in FUors*, 2016, The Astrophysical Journal, 830, 29
- Obtained observational data with Keck and contributed to paper writing.

Childress **et al.**, *The ANU WiFeS SuperNovA Programme (AWSNAP)*, 2016, Publications of the Astronomical Society of Australia, 33, 29
- Obtained observational data with Australian National University 2.3m telescope.

Little **et al.**, *Phase-stepping interferometry of GaAs nanowires: Determining nano-wire radius*, 2013, Applied Physical Letters, 103, 161107
- Obtained experimental data with white light interferometry of nanowires.