Alexander **Rawlings**
Theoretical Extragalactic Astrophysics

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I am a doctoral candidate in theoretical extragalactic astrophysics at the Unversity of Helsinki, Finland. I am modelling gas-free simulations of massive galaxy mergers to constrain the merger timescale of supermassive black hole binary systems. The simulations are conceptualised with observations in mind, providing physically-motivated models which bring us a step closer to understanding the distribution of supermassive black hole binary systems in the observed universe.

💼 PROFESSIONAL EXPERIENCE

Present
Sep 2021

Doctoral Candidate, University of Helsinki, Helsinki, Finland
> Design and analysis of gas-free merger simulations with realistic initial conditions
> Orbit modelling
> Bayesian hierarchical modelling and Gaussian processes
> Mock integral field unit observations
> Reference: Prof. Peter JOHANSSON · peter.johansson@helsinki.fi

`Python` `C/C++`

Feb 2021
Sep 2020

Research Assistant, University of Helsinki, Helsinki, Finland
> Design and analysis of galaxy merger simulations to investigate the stalling of supermassive black hole binary systems at parsec scales
> Reference: Prof. Peter JOHANSSON · peter.johansson@helsinki.fi

`Python` `C/C++`

Nov 2019
Jan 2019

Research Scholar, Sydney Institute for Astronomy, Sydney, Australia
> Determine the relationship between galaxy ellipticity and the spin parameter λ_R
> Academic writing
> Reference: Dr. Caroline FOSTER · caroline.foster@sydney.edu.au

`R` `bash`

Jun 2019
Dec 2018

Research Assistant, University of Southern Queensland, Toowoomba, Australia
with Observatoire de Paris
> Creation of parameter lists for all stars within the BRITEpol survey by script programming for literature searching
> Reference: Assoc. Prof. Stephen MARSDEN · stephen.marsden@usq.edu.au

`SQL` `R`

Dec 2018
Feb 2014

Research Assistant, University of Southern Queensland, Toowoomba, Australia
with James Cook University
> Analysis and collection of UV data, including the calibration and use of UV and IR detectors to determine correlation between solar UV and solar IR exposure
> Analysis of trends and modelling of results
> Modelling of climate trends
> Reference: Dr. Nathan DOWNS · nathan.downs@usq.edu.au

`MATLAB`

📕 PUBLICATIONS

2025	Identifying supermassive black hole recoil in elliptical galaxies — MNRAS vol. 537 pp. 3421-3447
2024	The supermassive black hole merger-driven evolution of high-redshift red nuggets into present-day cored early-type galaxies — MNRAS vol. 535 pp. 1202-1227
2023	Reviving stochasticity: uncertainty in SMBH binary eccentricity is unavoidable — MNRAS vol. 526 pp. 2688-2695
2023	KETJU - resolving small-scale supermassive black hole dynamics in GADGET-4 — MNRAS vol. 524 pp. 4062-4082
2022	Modelling the accretion and feedback of supermassive black hole binaries in gas-rich galaxy mergers — MNRAS vol. 520 pp. 4463-4489
2022	Signatures of the Many Supermassive Black Hole Mergers in a Cosmologically Forming Massive Early-Type Galaxy — ApJ vol. 929 pp. 167-176
2020	The SAMI Galaxy Survey: Rules of Behaviour for Spin-Ellipticity Radial Tracks in Galaxies — MNRAS vol. 491 pp. 324-343

🎓 EDUCATION

Present

Sep 2021

Doctoral Researcher, School of Particle Physics and Universe Sciences, University of Helsinki, Helsinki, Finland
- ❯ Doctoral thesis: 2 of 3 required first author publications complete
- ❯ 8 coauthor publications
- ❯ High performance computing courses
- ❯ Galactic dynamics
- ❯ Personal development courses

May 2021

Sep 2019

Master's of Particle Physics and Astrophysical Sciences, University of Helsinki, Helsinki, Finland
- ❯ GPA: 4.85/5.00
- ❯ *The Final Parsec Problem in Massive Early-Type Galaxies*
  A suite of collisionless galactic merger simulations were performed to investigate previous numerical results suggesting supermassive black hole binaries may be unable to merge. The galactic models were motivated from observational data, where it was found that the mass resolution between stellar particles and the supermassive black hole binary is critical in the final distribution of stellar particles that are able to interact with the binary.
- ❯ Studies: Galactic dynamics and evolution, observational astronomy, general relativity, radiative transfer, and Monte Carlo methods.

Nov 2018

Feb 2016

Bachelor of Science (Physical Sciences), University of Southern Queensland, Toowoomba, Australia
- ❯ GPA: 6.96/7.00
- ❯ *Insights into Stellar Dynamo Evolution: the Young Sun HD 106506*
  Doppler imagining and Zeeman Doppler imaging were performed on spectropolarimetric data of HD 106506. A prevailing polar starspot and a strong azimuthal magnetic field indicate the stellar dynamo is dominated by the toroidal component.
- ❯ Studies: astronomical sciences, statistics, and programming.

Jan 2018

Aug 2017

Exchange Studies, University of Zürich, Zürich, Switzerland
- ❯ Studies: Computational astrophysics (N-body simulations and smoothed particle hydrodynamics), mathematical methods for physics, and astrobiology

🎓 Funding and Awards

2025	University of Helsinki 30 under 30 recipient
2021	UH Research Foundation Doctoral Researcher — University of Helsinki
2019	Fully-Paid Tuition and Study Grant — University of Helsinki
2019	Denison Research Scholar — University of Sydney
2016	Chancellor's Scholarship — University of Southern Queensland

🗏 Skills

Communication
- Confident and apt public speaker
- Concise, professional academic writing
- Effective group communicator

Languages
- English (native)
- German (intermediate)
- Finnish (basic)

</> Programming Languages

Python	●●●●○
C/C++	●●●●○
Stan	●●●●○
R	●●●○○
bash	●●●○○
LaTeX	●●●○○
MATLAB	●●●○○
SQL	●●○○○
IRAF	●●○○○

✚ Specific Interests

- Galactic dynamics
- Galaxy formation & evolution
- Supermassive black hole dynamics
- Computational astrophysics
- Bayesian Statistics
- Hierarchical Modelling

🎓 Teaching and Mentoring

2021–Present	*University of Helsinki*: Graduate course assistant (astrophysics & statistics)
2019–2020	*University of Helsinki*: English language assistant
2017–2018	*University of Southern Queensland*: Undergraduate course assistant (physics)
2017–2019	Private Tutor

❝ References

Prof. Peter Johansson
Department of Physics
University of Helsinki
@peter.johansson@helsinki.fi

Dr. Caroline Foster
Sydney Institute for Astronomy
University of Sydney
@caroline.foster@sydney.edu.au

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