Garreth Martin

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Biography

I am a Senior Research Fellow at the University of Nottingham and a member of the Rubin Observatory Community Science Team, working at the interface of theory and observation to enable science with next-generation surveys such as Rubin/LSST and Euclid. I specialise in galaxy evolution: morphological transformation, low-surface-brightness science, and galaxy–black hole co-evolution. My current programme uses faint, diffuse stellar structures as a precision probe of dark matter and galaxy assembly, combining controlled and cosmological simulations with deep imaging surveys to test LCDM at small scales and to build the analysis infrastructure required by Rubin and Euclid.

LSST and Euclid will reveal diffuse stars, dwarf galaxies and tidal debris that carry the imprint of galaxy assembly and dark matter. I focus on low-mass galaxies and faint, diffuse structures because they are sensitive probes of both galaxy formation physics and the underlying dark matter distribution, allowing small-scale tests of LCDM, the foundation of modern astronomy; small-scale tensions in this regime could indicate new physics.

I combine forward modelling with explicit treatment of observational and simulation uncertainties to produce scalable, reproducible comparisons between data and theory. By modelling diffuse light in a self-consistent way, I aim to capture both its link to the underlying dark matter and its imprint of galaxy assembly, yielding stronger joint constraints on each. Using these measurements, I will incorporate our understanding of galaxy formation and evolution—and its impact on dark matter structure—to refine tests of fundamental physics and cosmology.

Research Interests

Statistical and computational methodology for large survey datasets — probabilistic forward modelling, simulation-based inference, unsupervised machine learning. Applications to: low-surface-brightness galaxy science; intracluster light as a dark matter tracer; dwarf galaxy structure and the interaction between dark matter and baryons; automated morphological classification at survey scale; cosmological and zoom-in hydrodynamical simulations of galaxy evolution.

Work Experience

Mar 2026–present

LSST Community Scientist, *Rubin Community Science Team, University of Nottingham*. Member of the Rubin Observatory Community Science Team through LSST:UK, supporting the scientific exploitation of Rubin Observatory data and community engagement with Rubin data products and analysis tools.

2023–present

Senior Research Fellow, *University of Nottingham*. Leading a programme to characterise and correct observational and simulation biases in modelling of intracluster light, as well as producing physical predictions and realistic mock Euclid images to support the development of the survey's low-surface-brightness pipeline. Day-to-day supervision of PhD students Harley Brown and Joseph Butler since 2023, with primary responsibility for designing their research projects.

2021–present

Visiting Research Fellow, *University of Hertfordshire*. Ongoing research collaboration and co-supervision of PhD and master's students, including Ilin Lazar (2021–2024; now a postdoctoral researcher at Hertfordshire) and Brian Bichang'a (2022–present).

2019–2023

KASI–Arizona Fellow, *University of Arizona & Korea Astronomy and Space Science Institute*. Independent joint fellowship. Established a research programme on low-surface-brightness science, delivering theoretical predictions for LSST and publishing key results on the detectability and structure of tidal features around galaxies.

Co-designed Steward Observatory's first climate survey and founded the International Scholars Allyship Programme.

May–Aug 2019

Balzan Visiting Fellow, *New College, University of Oxford*. Collaboration with the Beecroft Institute for Particle Astrophysics and Cosmology (Profs. Julien Devriendt and Adrianne Slyz). Projects on survey surface-brightness limits and stellar mass function bias, and on intrinsic alignments in elliptical galaxies.

Educational Qualifications

2015–2019

PhD in Astrophysics, *University of Hertfordshire*. Thesis: "On the key processes that drive galaxy evolution". Supervisor: Prof. Sugata Kaviraj.

2011–2015

MPhys (Hons) Astrophysics, First Class, *University of Hertfordshire*. Average grade 81%. Patrick Moore Prize for best performance in cohort. MPhys thesis supervisor: Prof. Marc Sarzi. Undergraduate thesis supervisor: Prof. Tim Gledhill.

Research Grants

2026

HPC Midlands Plus Tier-2 allocation, 1.6 million CPU hours total, allocated quarterly. Role: Principal Investigator. Awarded via competitive proposal to the UK national Tier-2 facility for the project "Mapping the stellar–dark matter connection across halo masses and shapes with controlled N-body simulations", supporting the controlled simulation suite underpinning the inference framework at the core of my current research programme.

2025

LSST:UK Travel Award, £1,250. Awarded by the LSST:UK consortium to support attendance at the LSST@Europe workshop.

2024

WEAVE LIFU observing proposal, "Dissecting the intracluster light in Abell 2626 with WEAVE", 10 hours awarded. Role: Co-Investigator (PI: Bellhouse). Instrument: WEAVE/ING. The programme maps the kinematics and stellar populations of intracluster light, complementing my work on diffuse structures.

LSST:UK Travel Award, £2,000. For attendance at the 2024 Rubin Community Workshop and organisation of two discussion sessions.

ISSI International Team Workshop, ~30,000 CHF (two meetings). Role: Co-organiser and core team member. Awarded by the International Space Science Institute (Bern) for the team "Exploiting Intracluster Light for Cosmology and Galaxy Evolution with Next Generation Facilities". I was a key contributor to the funding proposal.

2019

Grand Challenge GENCI/CINES, 40 million CPU hours. Role: Co-Investigator (PI: Dubois). French national supercomputing infrastructure, for the NewHorizon cosmological simulation — one of the few simulations of its class with sufficient resolution to fully resolve stellar stripping processes.

University Student Trust PGR Conference Funding, £460.

2016-2018

Royal Astronomical Society small grants, 2018: £600; 2017: £375; 2016: £400.

Supervision Experience

Current PhD Students

Harley Brown, *PhD candidate*, University of Nottingham. Dates: 2023–present. Project: ICL formation and assembly in cosmological simulations. Role: Primary day-to-day supervisor; designed the research project. Peer-reviewed output to date: Brown et al. 2024.

Joseph Butler, *PhD candidate*, University of Nottingham. Dates: 2023–present. Project: Phase-space properties of stripped stellar populations as dark matter tracers. Role: Primary day-to-day supervisor; designed the research project. Peer-reviewed output to date: Butler et al. 2025.

Brian Bichang'a, *PhD candidate*, University of Hertfordshire. Dates: 2022–present. Project: The role of black holes in dwarf galaxies. Role: Co-supervisor. Peer-reviewed output to date: Bichang'a et al. 2024, 2026.

Completed PhD Students

2021–2024 Ilin Lazar, *PhD (completed)*, University of Hertfordshire. Project: Morphological classification of dwarf galaxies with HSC-SSP. Role: Co-supervisor. Now a postdoctoral researcher at the University of Hertfordshire. Peer-reviewed output during PhD: Lazar et al. 2023, 2024a, 2024b.

Master's and Undergraduate Students

2025

Thomas Grant, *summer research project (BSc level)*, University of Nottingham. Project on the impact of cluster stacking on the measured ellipticity and radial extent of intracluster light across cosmological simulations; currently being written up for publication (in preparation).

2024

Drande Patogu, *summer research project (BSc level)*, University of Nottingham.

2019

James Bate, *undergraduate research project*, University of Oxford. Project on intrinsic alignments in elliptical galaxies; resulted in a peer-reviewed publication (Bate et al. 2020, MNRAS).

Students under my supervision have collectively produced more than ten peer-reviewed publications, indicated by (*) in the accompanying publication list. I have also provided informal mentorship and research project co-supervision to numerous further students across my collaborations, with around 20 papers in total where I have been second author or provided significant supervisory effort. I have also mentored and collaborated closely with early-career researchers during their PhDs, including Aman Khalid, now a postdoctoral researcher at Yonsei University.

Teaching Experience and Philosophy

Teaching Philosophy

My teaching experience spans undergraduate instruction, specialist workshop delivery, and sustained research supervision. I have taught tutorials in cosmology, stellar physics, and scientific programming at the University of Hertfordshire, and worked extensively as a demonstrator at Bayfordbury Observatory. More recently I have led several graduate-level workshops on data analysis and simulation methods, and since March 2026 design and deliver training on the Rubin Science Platform as part of the Rubin Community Science Team. I have supervised one PhD student to completion and currently co-supervise three more, with around 20 student-led peer-reviewed publications resulting from these relationships. I am comfortable contributing broadly to undergraduate and graduate teaching across physics and astronomy, from cosmology, galaxy evolution and observational astronomy to scientific computing and the statistical and machine-learning methods that underpin modern survey science.

Formal Teaching

2016–2018

Teaching Assistant and Demonstrator, *University of Hertfordshire*. Scientific Programming (Python, MATLAB, IDL), BSc level, TA and demonstrator in practical sessions with approximately 20 students per session. Cosmology and Large Scale Structure, BSc level, tutorials and observatory instruction at Bayfordbury Observatory. Physics of Stars, BSc level, tutorials and observatory instruction.

Workshops and Specialist Instruction

2026

Demonstrator, Euclid-UK & LSST:UK Meetings 2026, University of Manchester (13–17 April 2026). Delivered a hands-on demonstration of low-surface-brightness and Rubin Science Platform analysis tools at the joint Euclid-UK and LSST:UK community meeting.

Lead Instructor, *Leiden Observatory simulation analysis workshop*. Designed and delivered a hands-on simulation analysis workshop for an audience spanning early PhD students to staff, covering processing of cosmological hydrodynamical simulation data to study intracluster light, with hands-on exercises in particle data handling, mock observation generation, and ICL measurement.

2026–present Instructor, *Rubin Science Platform workshops*. Developing and delivering hands-on training on use of the Rubin Science Platform.

2025

Lead Instructor, *LSST@LATAM 2025 workshop (approximately 30 participants)*. Designed and delivered specialist training in low-surface-brightness imaging techniques for Rubin/LSST. Developed interactive Jupyter Python notebooks with live visual feedback (parameter sliders, masking tools, real-time plotting) allowing participants to interrogate background modelling and source detection assumptions using real survey data and analysis pipelines.

Course and Teaching Material Development

I have developed interactive, web-based research outputs to improve the accessibility and transparency of my work. The resource accompanying my most recent paper (Martin et al. 2026) provides interactive visualisations enabling users to explore the effects of varying key physical parameters in real time. The interactive Jupyter notebooks and other material I have developed are freely available and reusable by the community.

Academic Citizenship

Collegiality, EDI, and Research Culture

My commitment to inclusive academic environments has developed through direct involvement in departmental initiatives, student supervision, and community leadership, and reflects genuine conviction rather than obligation. I have seen how much the working environment shapes whether people, particularly those from under-represented groups, are able to do their best work, and I have tried to contribute concretely to improving it wherever I have been.

At Steward Observatory (University of Arizona), I co-designed and administered the department's first climate survey, collecting and analysing feedback from students and staff at all levels to identify barriers to inclusion. The findings informed the establishment of two initiatives: an International Scholars Task Force and the International Scholars Allyship Programme, which I helped found and organise.

Within the LSST collaboration, I co-founded the LSST:UK Junior Associate Network to provide representation and support for early-career researchers who often lack institutional stability or voice within large collaborations. As Co-Chair of the LSST Galaxies Science Collaboration Morphology Working Group, I have prioritised equitable distribution of leadership opportunities and authorship across career stages.

In supervision, I have actively worked with students from non-traditional pathways into astrophysics. Supervising Emir Uzeirbegovic, a part-time PhD student with a computer science background rather than astrophysics, required adapting both teaching and supervision approaches substantially. This experience reinforced my view that diverse entry routes to research are a source of strength rather than a complication to be managed.

Service and Professional Activities

2026

2026–present Member, Rubin Observatory Community Science Team through LSST:UK.

2025

2025–present Committee member, LSST:UK Junior Associate Network.

2024

2024–present Core member and co-organiser, ISSI International Team "Exploiting Intracluster Light for Cosmology and Galaxy Evolution with Next Generation Facilities".

2020

2020–present Co-Chair, LSST Galaxies Science Collaboration Galaxy Morphology Working Group (approximately 150 members).

2020–2022 Committee member and founding member of the Steward Observatory international scholars allyship programme.

2019

2019–2020 Chair, LSST Galaxies Science Collaboration Simulations Working Group.

Contributed to planning the observing strategy of the Rubin Observatory LSST (arXiv:2306.09414) as part of the LSST:UK in-kind contribution programme.

Referee for Monthly Notices of the Royal Astronomical Society, Astronomy & Astrophysics, and The Astrophysical Journal. Approximately four to five referee reports per year.

2015

2015–2019 Demonstrator at Bayfordbury Observatory. Organised activities for children, adults and amateur astronomers at observatory open evenings and science fairs.

Academic Leadership and Conference Organisation

Coordinated a 50-member international project within the LSST Galaxies Science Collaboration (Martin et al. 2022 and subsequent papers). Organised four specialist sessions at prominent meetings, including a two-day EAS symposium. Edited conference proceedings for two of these sessions.

Scientific Organising Committee (Chair or Member)

2024

"Exploring the low-surface-brightness universe with next-generation instruments" (chair), RAS Specialist Discussion Meeting, London.

"Galaxy Morphology and Low Surface Brightness Features" (chair), Rubin Community Workshop, Stanford.

2022

"Machine Learning: a giant leap towards space discovery", EAS, Valencia.

"Dwarf galaxies beyond the Local Group", EAS, Valencia.

2019

"Galaxy–Black Hole Co-evolution: Observational and Theoretical Perspectives", NAM, Lancaster.

Selected Presentations

Over 43 conference talks and seminars, including 17 invited talks and seminars:

A selected subset of presentations is listed below (not an exhaustive list).

2026

April | **Intra-Cluster Light: Bridging the Gap Between Theory and Observations** - *Lorentz Center, Leiden, Netherlands* (contributed talk)

February | **University of Lancaster Seminar** - *University of Lancaster, Lancaster, UK* (invited seminar)

2025

September | **LSST@Europe 7** - *LSST@Europe, Poznan, Poland* (contributed talk)

July | **National Astronomy Meeting** - *NAM, Durham, UK* (2 contributed talks)

May | **RAMSES User Meeting** - *RAMSES, Strasbourg, France* (contributed talk)

2024

October | **Korea Astronomy and Space Science Institute Seminar** - *KASI, Daejeon, South Korea* (invited talk)

October | **Galaxy evolution meeting lunch talk** - *Galaxy Evolution Meeting, Seoul, South Korea* (invited talk)

September | **A journey through galactic environments** - *Conference, Porto Ercole, Italy* (contributed talk)

2023

April | **Steward Observatory Seminar** - *Steward Observatory, Tucson, USA* (invited talk)

April | **RAMSES User Meeting** - *RAMSES, Oxford, UK* (contributed talk)

February | **9th ASIAA Galaxy Evolution Workshop** - *ASIAA, Kyoto, Japan* (contributed talk)

January | **KIAS Survey Science Workshop** - *KIAS, Jeongseon, South Korea* (invited talk)

2022

July | **National Astronomy Meeting** - *NAM, Warwick, UK* (contributed talk)

March | **Yonsei Galaxy Evolution Meeting** - *Yonsei University, Seoul, South Korea* (invited talk)

January | **Astronomy Seminar** - *University of Nottingham, Nottingham, UK* (invited talk)

January | **Oxford galaxy evolution seminar** - *University of Oxford, Oxford, UK* (invited talk)

2021

March | **Clash of the Titans: the Enigmatic Role of Mergers in Galaxy Evolution** - *Workshop, Online* (invited talk)

2020

February | **The Low Surface Brightness Universe as seen by LSST** - *Workshop, Sexten, Italy* (invited talk)

2019

October | **CAR Friday Lunch Talk** - *CAR, Hertfordshire, UK* (invited talk)

August | **LSST community workshop / galaxies science collaboration meeting** - *LSST, Tucson, USA* (invited talk)

February | **Astronomy Group Lunchtime Talk** - *University of St Andrews, St Andrews, UK* (invited talk)

January | **Cosmology Group Seminar** - *Seminar, Jerusalem, Israel* (invited seminar)

2018

August | **The Bewildering Nature of Ultra-diffuse Galaxies** - *Workshop, Leiden, Netherlands* (invited talk)

2017

October | **New frontiers in Galaxy Evolution Modelling** - *Conference, London, UK* (invited talk)

June | **Galaxy Evolution Seminar** - *Seminar, Oxford, UK* (invited seminar)

Research Impact and Outreach

I have developed 10 publicly accessible astronomical software tools, most notably an unsupervised machine learning framework for galaxy morphological classification, all released on GitHub with documentation and designed for broad community use. I have also developed interactive, web-based research outputs accompanying my publications: the resource accompanying Martin et al. 2026 allows users to explore model parameter sensitivities in real time (garrethmartin.github.io/interactive-profiles-ICL/). Interactive workshop materials from LSST@LATAM 2025 are similarly freely available (github.com/garrethmartin/lsst_latam_lsb_workshop_2025).

I have organised scientific meetings hosted by the Royal Astronomical Society, providing a platform for astronomers and members of the public to engage with current research. Earlier in my career, as a demonstrator at Bayfordbury Observatory (2015–2019), I delivered planetarium shows and public talks, and organised open evenings and science fair activities for children, adults, and amateur astronomers, reaching hundreds of visitors annually.

I have contributed directly to the planning of the Rubin Observatory LSST observing strategy (arXiv:2306.09414) as part of the LSST:UK in-kind contribution programme. This work has direct practical consequence for one of the largest scientific infrastructure investments of the coming decade.

Memberships and Collaborations

2026–present Rubin Observatory Community Science Team member (Affiliation)

2026–present COLIBRE simulation project member (Collaboration)

2023–present TheThreeHundred collaboration member (Collaboration)

2022–present LIGHTS (Legacy Imaging of Galactic Halos and Tidal Structures) collaboration member (Collaboration)

2021–present Euclid Consortium member (Affiliation)

2021–present Euclid consortium member (Collaboration)

2019–present Member of the Korean Astronomical Society (Affiliation)

2019–present SMUDGes (Systematically Measuring Ultra-Diffuse Galaxies) collaboration member (Collaboration)

2019–present Rubin Obs. galaxies SC member (Collaboration)

2017–present Rubin/LSST Junior Associate (Affiliation)

2017–present LSST:UK member (Affiliation)

2017–present Rubin Obs. junior associate (Collaboration)
2016–present Fellow of the Royal Astronomical Society (Affiliation)
2016–present Member of the Institute of Physics (Affiliation)
2016–present Member of the European Astronomical Society (Affiliation)
2016–present Member of the International Astronomical Union (Affiliation)
2016–2019 ANR SPIN(e) – Cosmic origin of the Hubble sequence (Collaboration)
2016–present Horizon simulation project member (Collaboration)

Prizes, Awards, and Other Merits

2022

KASI Outstanding Postdoctoral Researcher Award, 800,000 KRW. Awarded to 2 of approximately 200 postdoctoral researchers annually at KASI; a highly selective internal recognition of outstanding research performance.

2018

Balzan Fellowship, New College, University of Oxford (approximately £2,500 equivalent). Ten weeks of fully funded accommodation and subsistence support; awarded to approximately two applicants annually. I was hosted as the equivalent of a non-stipendiary Visiting Junior Research Fellow.

2015

Patrick Moore Prize, University of Hertfordshire. Awarded for best academic performance in the MPhys cohort.

2012

University of Hertfordshire Scholarship, £1,500. Awarded during undergraduate studies in recognition of academic performance.

Computational expertise: Python (advanced; NumPy, SciPy, Astropy, PyTorch, PyMC, emcee, statmorph), C, Fortran, IDL, SQL; Hydrodynamics codes: RAMSES, SWIFT, Gadget (N-body/hydrodynamics); HPC workflow management (SLURM, PBS); Git/GitHub version control; Jira project management.

Referees

Prof. Frazer Pearce

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