Dr. Natalie B. Hogg

Cosmologist at the Institute of Astronomy, University of Cambridge

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Employment and appointments

Oct 2026 onwards Clare Hall, University of Cambridge
Research Fellow

- Competitive college appointment supported by the Isaac Newton Trust.
- Responsibilities to include tutoring and sitting on the College Governing Board.

Oct 2025 – present Institute of Astronomy & Kavli Institute for Cosmology, University of Cambridge
Postdoctoral researcher

- Developing likelihood-free inference for strong lens modelling with Prof. Will Handley.
- Pioneering LLM-accelerated workflows for software development in cosmology.
- Paper on LLMs in astronomy under revision at *Nature Astronomy Comments*; invited talk at SISSA workshop on this topic.

Oct 2023 – Oct 2025 Laboratoire univers et particules, Université de Montpellier
Postdoctoral researcher

- Modelled strong lensing images for cosmology with Prof. Julien Larena; produced two papers applying our theoretical model for strong lensing shape distortions to real data for the first time.
- Co-led search for strong lenses in the JWST observations of the COSMOS field, producing three papers on our findings.
- Contributed to the expert visual inspection of Euclid Early Release and Q1 data, resulting in six papers.

Feb 2022 – Oct 2023 Institut de physique théorique, Paris-Saclay
Postdoctoral researcher

- Developed a new mathematical model for strong lensing shape distortions with Dr. Pierre Fleury.
- Implemented the model in the open-source software `lenstronomy`.
- Led the proof-of-concept paper demonstrating the success of this model when fitting simulated data.

Jun 2021 – Feb 2022 Instituto de física teórica, Universidad Autónoma de Madrid
Postdoctoral researcher

- Worked on applications of strong lensing and gravitational waves to cosmology with Dr. Matteo Martinelli and Dr. Pierre Fleury.
- Co-authored paper on primordial black hole detection from future gravitational wave detectors.
- Co-led the development of the `darksirens` Python package to simulate gravitational wave catalogues.

Education

2017 – 2021 **PhD in Cosmology**, University of Portsmouth

Thesis: Beyond ΛCDM: current and future constraints on alternative cosmological models
Supervisors: Dr. Marco Bruni, Prof. David Wands, Prof. Robert Crittenden

2013 – 2017 **MPhys Astrophysics 1st class hons.**, Aberystwyth University
with **Breen Prize** for best Master's dissertation in physics

Master's dissertation: Dynamical models of dark energy & their background cosmological evolution
Supervisor: Prof. Carsten van de Bruck (University of Sheffield; supervised remotely)

Major grants and awards

2026 **Isambard-AI Gateway grant**: £45,000
10,000 GPU hours on UK's premier supercomputing facility to benchmark strong lens modelling codes.

2021 **G-Research quantitative research grant**: £2000
Competitively awarded grant from major financial technology company.

2017 **Breen Prize**: £2000
Best Master's dissertation in physics, Aberystwyth University.

Travel grants

2020 **STFC Long-term Attachment**: £4000
Funding to spend six months visiting IFT Madrid; visit curtailed by COVID-19 pandemic.

2019 **EU COST-Action CANTATA**: £1000
Competitively awarded EU funding spent on a second visit to the Lorenz Institute, Leiden.

2018 **Santander Bank**: £500
Competitively awarded funding used to attend the ICTP Cosmology Summer School in Trieste.

2017 **EU COST-Action CANTATA**: £1000
Competitively awarded EU funding for a week's visit to the Lorenz Institute, Leiden.

Highlighted talks

See Annex for a complete list of talks.

May 2026 **Agentic AI for research: friend or foe?**
Invited workshop talk, SISSA, Trieste

Jul 2025 **Line-of-sight shear: progress and challenges**
Contributed talk, National Astronomy Meeting, Durham

Apr 2025 **Strong and weak lensing for cosmology**
Invited colloquium, CEICO, Prague

Nov 2024 **Lensing for cosmology: theory review**
Invited plenary talk, News from the Dark workshop, Marseille

Aug 2023 **Strong and weak lensing for cosmology**
Invited plenary talk, Lensing at Different Scales workshop, University of Chicago

Apr 2023 **The weak lensing of strong lensing: a new cosmological probe**
Invited seminar, LUTH, Observatoire de Paris

Sep 2022 **Dancing in the dark: detecting a population of distant primordial black holes**
Invited seminar, IAS, Orsay

Apr 2022 **The distance duality relation: violations, constraints and biases**
Invited seminar, IAP, Paris

Feb 2022 **The Universe Howling – What are Standard Sirens?**
Outreach talk for IFT Youtube channel with over 15,000 views.

"Thanks ever so much for a fabulous presentation yesterday! It was incredible how you were able to present complex theories in such an accessible way." — Audience feedback after outreach talk on the history of general relativity and cosmology.

Supervision and teaching

Supervision Fabio Mongillo, undergraduate student research project, 2025.
Jason Makechemu, undergraduate student research project, 2022.

Co-supervision Toby Lovick, PhD student at the University of Cambridge, ongoing.
Davide Pedrotti, PhD student at the University of Trento, ongoing.
Marco Sebastianutti, PhD student at the University of Sussex, 2022 – 2023.

Mentorship Giacomo Queirolo, postdoc at the Université de Montpellier, since 2024.
Daniel Johnson, PhD student at the Université de Montpellier, since 2022.
Théo Duboscq, PhD student at the Université de Montpellier, 2023 – 2025

Teaching Lab demonstrator for Computational Physics module, 2018–2019
Coursework and exam marking for Cosmology module, 2018 – 2019.

Open-source software development

See my Github for a complete list of software.

- `lenstronomy`

  Top contributor to this open-source Python package for strong gravitational lensing analysis.
  → I led the implementation of a new sub-package for line-of-sight effects.
  → I implemented the `zeus` ensemble slice sampler for MCMC parameter inference.
  → I contributed to the JAX port of the code, now published in *JOSS*.

- `tdcosmo_ext`

  Sole developer of this external strong lensing likelihood package for the Bayesian analysis software `Cobaya`.

- `analosis`

  Lead developer of this Python wrapper for `lenstronomy`, created to systematically generate and analyse large catalogues of strong lensing images.

- `darksirens`

  Co-developer of this open-source Python package for creating mock gravitational wave event catalogues.

- `hoverscope`

  Creator and lead developer of this Chrome and Firefox browser extension which provides in-browser hovering tooltip information about telescopes, surveys and simulations.

→ Experienced user of Python, Fortran, Bash, Git and HPC (SLURM, PBS).
→ Other codes and software used includes `astropy`, `CAMB`, `CosmoMC`, `Cobaya`, `emcee`, `zeus`, `dynesty` and `Polychord`.
→ Confident user of large language models at the command line, such as Claude Code and Codex.

Leadership & service

Ongoing **Referee** for MNRAS, JCAP, OJA, ApJ & PDU.

2026 – present **Co-organiser**, Institute of Astronomy seminar series

2025 – present **Co-lead**, COSMOS-Web Lensing Working Group

2024 **Organiser**, Strong Lensing Beyond the Main Lens workshop, Montpellier.

2022 – 2023 **Organiser**, IPhT cosmology & gravity journal club and IPhT cosmology seminar series.

2020 **Chair**, local organising committee, South Coast Cosmology meeting, University of Portsmouth.

2018 – 2019 **PhD student representative**, ICG management committee & Faculty Research Degrees committee, University of Portsmouth.

Annex

Publications

[1] **Natalie B. Hogg**. Provenance, plagiarism and distrust: the effect of large language models on astronomy, April 2026. *Nature Astronomy Comments* under review.

[2] Alan Huang, Simon Birrer, **Natalie B. Hogg**, Aymeric Galan, Daniel Gilman, Anowar Shajib, and Nan Zhang. JAXtronomy: A JAX port of lenstronomy. *The Journal of Open Source Software*, 11(120):9685, April 2026.

[3] Pierre Fleury, Daniel Johnson, Théo Duboscq, **Natalie B. Hogg**, and Julien Larena. Cosmology with the line-of-sight shear of strong gravitational lenses, March 2026.

[4] Diana Scognamiglio et al. An ultra-high-resolution map of (dark) matter. *Nature Astronomy*, 10(4):573–582, 2026.

[5] Vincent Van Eylen, Richard Massey, et al. Transformational astrophysics and exoplanet science with Habitable Worlds Observatory's High Resolution Imager, December 2025.

[6] **Natalie B. Hogg**, Daniel Johnson, Anowar J. Shajib, and Julien Larena. Line-of-sight shear in SLACS strong lenses II: validation tests with an extended sample, December 2025.

[7] N. E. P. Lines et al. Euclid Quick Data Release (Q1). The Strong Lensing Discovery Engine C: Finding lenses with machine learning, June 2025.

[8] Edward Berman et al. On Soft Clustering For Correlation Estimators. *The Open Journal of Astrophysics*, 8:135, September 2025.

[9] Elsa M. Teixeira, William Giarè, **Natalie B. Hogg**, Thomas Montandon, Adèle Poudou, and Vivian Poulin. Implications of distance duality violation for the Ho tension and evolving dark energy. *Phys. Rev. D*, 112(2):023515, 2025.

[10] P. Bergamini et al. Euclid Quick Data Release (Q1). The first catalogue of strong-lensing galaxy clusters, March 2025.

[11] P. Holloway et al. Euclid Quick Data Release (Q1). The Strong Lensing Discovery Engine E – Ensemble classification of strong gravitational lenses: lessons for Data Release 1, March 2025.

[12] M. Walmsley et al. Euclid Quick Data Release (Q1): The Strong Lensing Discovery Engine A – System overview and lens catalogue, March 2025.

[13] **Natalie B. Hogg**, James W. Nightingale, Quihan He, Jacqueline McCleary, Guillaume Mahler, et al. The COSMOS-Web Lens Survey(COWLS) III: forecasts versus data. *Monthly Notices of the Royal Astronomical Society*, 544(1):782–798, 2025.

[14] Guillaume Mahler, James W. Nightingale, **Natalie B. Hogg**, et al. The COSMOS-Web Lens Survey (COWLS) II: depth, resolution, and NIR coverage from JWST reveal 17 spectacular lenses. *Monthly Notices of the Royal Astronomical Society: Letters*, 8:L14, 2025.

[15] James W. Nightingale, Guillaume Mahler, Jacqueline McCleary, Quihan He, **Natalie B. Hogg**, et al. The COSMOS-Web Lens Survey (COWLS) I: Discovery of >100 high redshift strong lenses in contiguous JWST imaging. *Monthly Notices of the Royal Astronomical Society*, 543(1):203–222, 2025.

[16] **Natalie B. Hogg**, Daniel Johnson, Anowar J. Shajib, and Julien Larena. Line-of-sight shear in SLACS strong lenses I: shear and mass model parametrisations, January 2025.

[17] R. Pearce-Casey et al. Euclid: Searches for strong gravitational lenses using convolutional neural nets in Early Release Observations of the Perseus field. *Astronomy & Astrophysics*, 696:A214, 2025.

[18] J. A. Acevedo Barroso et al. Euclid: The Early Release Observations Lens Search Experiment. *Astronomy & Astrophysics*, 697:A14, 2025.

[19] Théo Duboscq, **Natalie B. Hogg**, Pierre Fleury, and Julien Larena. Weak lensing of strong lensing: beyond the tidal regime. *JCAP*, 08:021, 2024.

[20] Marco Sebastianutti, **Natalie B. Hogg**, and Marco Bruni. The interacting vacuum and tensions: A comparison of theoretical models. *Phys. Dark Univ.*, 46:101546, 2024.

[21] **Natalie B. Hogg**. Constraints on dark energy from TDCOSMO & SLACS lenses. *Monthly Notices of the Royal Astronomical Society: Letters*, 528(1):L95–L100, 2024.

[22] **Natalie B. Hogg**, Pierre Fleury, Julien Larena, and Matteo Martinelli. Measuring line-of-sight shear with Einstein rings: a proof of concept. *Monthly Notices of the Royal Astronomical Society*, 520(4):5982–6000, 2023.

[23] Matteo Martinelli, Francesca Scarcella, **Natalie B. Hogg**, Bradley J. Kavanagh, Daniele Gaggero, and Pierre Fleury. Dancing in the dark: detecting a population of distant primordial black holes. *Journal of Cosmology and Astroparticle Physics*, 08(08):006, 2022.

[24] Elcio Abdalla et al. Cosmology intertwined: A review of the particle physics, astrophysics, and cosmology associated with the cosmological tensions and anomalies. *Journal of High Energy Astrophysics*, 34:49–211, 2022.

[25] Fabrizio Renzi, **Natalie B. Hogg**, and William Giarè. The resilience of the Etherington–Hubble relation. *Monthly Notices of the Royal Astronomical Society*, 513(3):4004–4014, 2022.

[26] R. Alves Batista et al. EuCAPT White Paper: Opportunities and Challenges for Theoretical Astroparticle Physics in the Next Decade, October 2021.

[27] **Natalie B. Hogg** and Marco Bruni. Shan–Chen interacting vacuum cosmology. *Monthly Notices of the Royal Astronomical Society*, 511(3):4430–4443, 2022.

[28] Fabrizio Renzi, **Natalie B. Hogg**, Matteo Martinelli, and Savvas Nesseris. Strongly lensed supernovae as a self-sufficient probe of the distance duality relation. *Physics of the Dark Universe*, 32:100824, 2021.

[29] **Natalie B. Hogg**, Matteo Martinelli, and Savvas Nesseris. Constraints on the distance duality relation with standard sirens. *Journal of Cosmology and Astroparticle Physics*, 12:019, 2020.

[30] **Natalie B. Hogg**, Marco Bruni, Robert Crittenden, Matteo Martinelli, and Simone Peirone. Latest evidence for a late time vacuum–geodesic CDM interaction. *Physics of the Dark Universe*, 29:100583, 2020.

[31] Matteo Martinelli, **Natalie B. Hogg**, Simone Peirone, Marco Bruni, and David Wands. Constraints on the interacting vacuum–geodesic CDM scenario. *Monthly Notices of the Royal Astronomical Society*, 488(3):3423–3438, 2019.

Bibliometrics (NASA-ADS)
Total citations: 2008 — Mean citations: 66.9 — h-index: 16.

Talks

🏆 indicates best talk prize.

May 2026 **Agentic AI: friend or foe?**
Invited lecture, PhD school, SISSA

Apr 2026 **Large language models in cosmology**
Contributed talk, Euclid Strong Lensing Science Working Group Face-to-Face meeting, Portsmouth

Mar 2026 **The weak lensing of strong lensing: a new probe of cosmology**
Invited seminar, Queen Mary University of London

Jan 2026 **The weak lensing of strong lensing: a new probe of cosmology**
Invited seminar, University of Sussex

Oct 2025 **COWLS III: forecasts versus data**
Contributed talk, Scaling Up Lensing workshop, University of Liège

Jul 2025 **Line-of-sight shear: progress and challenges**
Contributed talk, National Astronomy Meeting, Durham University

Jul 2025 **The weak lensing of strong lensing: a new probe of cosmology**
Invited seminar, Institute of Astronomy, University of Cambridge

May 2025 **COWLS III: forecasts versus data**
Contributed talk, COSMOS-Web annual collaboration meeting, Marseille

Apr 2025 **COWLS III: forecasts versus data**
Invited seminar, Laboratoire d'Astrophysique de Marseille

Apr 2025 **The weak lensing of strong lensing: a new probe of cosmology**
Invited seminar, CEICO, Prague

Dec 2024 **The weak lensing of strong lensing: a new probe of cosmology**
Invited seminar, APC, Paris (Cité)

Dec 2024 **The weak lensing of strong lensing: a new probe of cosmology**
Invited seminar, LPNHE, Paris (Sorbonne)

Nov 2024 **Lensing for cosmology: theory review**
Invited plenary talk, News from the Dark, Marseille

Apr 2024 **Strong and weak lensing for cosmology**
Invited colloquium, ICG, University of Portsmouth

Apr 2024 **Strong lensing constraints on dark energy**
Invited seminar, CPPM, Marseille

Aug 2023 **Strong and weak lensing for cosmology**
Invited plenary talk, "Lensing at Different Scales" workshop, University of Chicago

Jun 2023 **Cosmology's first century: a guided tour of the Universe from Einstein to JWST**
Invited outreach talk, Charlbury Beer Festival

May 2023 **The weak lensing of strong lensing: a new cosmological probe**
Contributed talk, Progress on Old and New Themes in Cosmology conference, Avignon

Apr 2023 **The weak lensing of strong lensing: a new cosmological probe**
Invited seminar, LUTH, Observatoire de Paris

Nov 2022 **One Ring to Rule Them All: line-of-sight shear as a new cosmological probe**
Contributed talk, Rencontres des jeunes physicien.nes, Collège de France

Oct 2022 **Dancing in the dark: detecting a population of distant primordial black holes**
Invited seminar, ICG, University of Portsmouth

Sep 2022 **Dancing in the dark: detecting a population of distant primordial black holes**
Invited seminar, IAS, Orsay

Jun 2022 **Measuring the LOS shear using Einstein rings: a proof-of-concept**
Contributed talk, Line-of-sight effects in strong gravitational lensing workshop, Montpellier

Jun 2022 **Dancing in the dark: detecting a population of distant primordial black holes**
Invited talk, THC meeting, Leiden

May 2022 **Understanding the dark Universe**
Contributed talk, IPhT retreat, Autrans

May 2022 **The curious incident of the distances in the nighttime**
Department seminar, IPhT

May 2022 **The resilience of the Etherington–Hubble relation**
Contributed talk, Action Dark Energy meeting, Marseille

May 2022 **Shan–Chen interacting vacuum cosmology**
Contributed talk, Action Dark Energy meeting, Marseille

Apr 2022 **The distance duality relation: violations, constraints and biases**
Invited seminar ("GRECO"), IAP, Paris

Apr 2022 **The distance duality relation: violations, constraints and biases**
Invited seminar, IFT, Madrid (*delivered remotely*)

Oct 2021 **The distance duality relation: violations, constraints and biases**
Invited seminar ("CAPT"), University of Nottingham (*delivered remotely*)

Jul 2021 **Novel probes of the distance duality relation**
Invited seminar, University of Leiden (*delivered remotely*)

Jul 2021 **Constraints on the distance duality relation with standard sirens**
Contributed talk, Cosmology from Home (*delivered remotely*)

May 2021 **Constraints on the distance duality relation with standard sirens**
Contributed talk, EUCAPT Symposium, CERN (*delivered remotely*)

Apr 2021 **Is the standard model of cosmology wrong?**
Invited seminar, Aberystwyth University (*delivered remotely*)

Apr 2021 **Constraints on the distance duality relation with standard sirens**
Contributed talk, Britgrav, University College Dublin (*delivered remotely*)

Jun 2020 **Standard sirens and the distance duality relation**
Invited seminar, ICG, University of Portsmouth (*delivered remotely*)

Apr 2020 **New constraints on beyond-ΛCDM cosmologies**
Invited seminar, Queen Mary University of London (*delivered remotely*)

Dec 2019 **Interacting vacuum dark energy**
Invited seminar ("CRAG"), University of Sheffield

Dec 2019 🏆 **Interacting vacuum dark energy**
Contributed talk, TEXAS Symposium, Portsmouth

Jun 2019 🏆 **Testing the standard model of cosmology**
Contributed talk, Faculty of Technology Research & Innovation conference, University of Portsmouth

Mar 2019 **Is the standard model of cosmology wrong?**
Contributed talk, 26eme Congrés des Doctorants, Paris

Jan 2019 **Interacting vacuum dark energy**
Department seminar, ICG, University of Portsmouth

Jan 2019 **New constraints on interacting vacuum dark energy**
Contributed talk, South Coast Cosmology meeting, University of Portsmouth

Oct 2018 **Interacting vacuum dark energy**
Contributed talk, CANTATA meeting, Valencia

May 2018 🏆 **Dark energy: theories and observations**
Contributed talk, British Federation of Women Graduates Annual meeting, London

Apr 2018 **Interacting vacuum dark energy**
Contributed talk, Britgrav, University of Portsmouth

Apr 2018 **Interacting vacuum dark energy**
Contributed talk, Advances in HEP and Cosmology, University of Southampton

Dec 2017 **Interacting dark energy**
Contributed talk, Euclid UK Consortium Meeting, University of Portsmouth

Nov 2017 **Dynamical dark energy**
Contributed talk, PhD student day, University of Portsmouth

Sep 2017 **Dynamical dark energy**
Contributed talk, CANTATA Cosmology Summer School, Corfu