ALEXANDER C. JENKINS

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ABOUT ME

I'm a theoretical physicist, working at the interface between *cosmology*, *astrophysics*, *high-energy physics*, and *quantum matter*. My research looks at new ways of probing the fundamental laws of Nature, whether that's using *gravitational waves* as powerful new astronomical messengers, or using cutting-edge *quantum technologies* to simulate the early Universe.

EMPLOYMENT

Gavin Boyle Fellow in Cosmology — *University of Cambridge* *2024–present*
+ UKRI Stephen Hawking Fellow

Research fellow hosted in the Kavli Institute for Cosmology Cambridge (KICC) and the Department of Applied Mathematics and Theoretical Physics (DAMTP) | Fellow of Selwyn College

Postdoctoral Research Fellow — *University College London* *2021–2024*

Led an international, interdisciplinary project to study false vacuum decay with quantum analogue experiments and numerical lattice simulations, as part of the QSimFP Consortium
Mentored by Profs Hiranya Peiris and Andrew Pontzen | Member of the Cosmoparticle Initiative

EDUCATION

PhD in Theoretical Physics — *King's College London* *2017–2021*

Funded by competitive faculty scholarship | Theoretical Particle Physics and Cosmology Group
Thesis: *'Cosmology and fundamental physics in the era of gravitational-wave astronomy'*
Supervised by Prof Mairi Sakellariadou | Examined by Profs Stephen Fairhurst and David Wands

MSci in Astrophysics (Part III) — *University of Cambridge* *2016–2017*

1st class | Ranked 5th in cohort | Elected a Bateman Scholar of Trinity Hall for 'excellent' exam results
Project: *'Understanding the outcomes of planet-planet scattering'* | Supervised by Dr Roman Rafikov

Leonid Grishchuk Internship Program — *Cardiff University* *Summer 2016*

Competitive, funded summer research internship in the Gravitational Physics Group

MA in Natural Sciences (Astrophysics) — *University of Cambridge* *2013–2016*

1st class | Elected a Scholar of Trinity Hall

GRANTS AND FUNDING SECURED (POST-PHD)

- UKRI Stephen Hawking Fellowship (PI, £385k) *2024*
  3-year research council fellowship supporting 'visionary scientists working in theoretical physics'
- Gavin Boyle Fellowship, Kavli Institute for Cosmology Cambridge and Selwyn College *2024*
  5-year institutional fellowship
- UKRI Quantum Technologies for Fundamental Physics Additional Research Grant (£69k) *2023*
  Successful proposal for 6-month extension to my research within QSimFP
- UCL Astro Group Small Grant | Secured first dedicated funding for seminar series (£1k) *2022*

AWARDS AND ACHIEVEMENTS

- Winner, Buchalter Cosmology Prize (2nd Prize) | UCL press release *2023*
  International award recognising *'ground-breaking theoretical, observational, or experimental work in cosmology that has the potential to produce a breakthrough advance in our understanding'*
- Honorable Mention in the GWIC-Braccini Thesis Prize competition *2022*
  Nominated for three other thesis prizes
- Best Student Talk Prize at BritGrav 21, sponsored by IoP Publishing *2021*
  Corresponding paper published in *Classical and Quantum Gravity* as an invited submission
- King's Education Award for 'extraordinary contributions' to teaching *2020*
- 'Rising Star' nominee, King's Education Awards (only PhD student nominee in Physics) *2019*
- Bateman Scholar of Trinity Hall (Cambridge), recognising 'excellent' exam results *2017*

RESPONSIBILITIES

- Lead organiser, UCL Cosmology/Extragalactic Seminars *2022–2023*
  Developed an ambitious program of in-person talks with speakers from across the UK and abroad, from what had previously been an online-only event due to COVID-19; secured and managed small grant (£1k) for speaker expenses and group lunches to encourage student participation
- Co-organiser, London Cosmology Discussion Meetings (LCDM) *2018–2021*
  Coordinated between five institutions to organise meetings at the Royal Astronomical Society on *'Dark Matter in Cosmology'*, *'Neutrinos in Cosmology'*, and *'Cosmological Probes of New Physics'*
- Organiser, Theoretical Particle Physics and Cosmology (TPPC) Journal Club *2021*
- Organiser, TPPC Gravity Meetings *2018–2020*
  Initiated a regular series of meetings with internal and external speakers on gravitational physics
- Expert referee for one UKRI Stephen Hawking Fellowship, *2019–present*
  one NSF Research Grant, and one ERC Consolidator Grant
- Referee for 27 articles in *Physical Review Letters (PRL)*, *Nature Astronomy*, *2020–present*
  Physical Review D (PRD), *Journal of Cosmology and Astroparticle Physics (JCAP)*,
  European Physical Journal C (EPJC), *The Astronomical Journal*, and *Universe*
- Student representative, KCL Physics Department Research Committee *2019–2021*

AFFILIATIONS

Scientific collaborations

- Quantum Simulators for Fundamental Physics (QSimFP) Consortium *2021–present*
- LISA Consortium *2018–present*
- Einstein Telescope (ET) Observational Science Board *2021–present*
- LIGO Scientific Collaboration *2016–2021*

Professional bodies

- Member, Institute of Physics (MInstP) *2018–present*
- Fellow, Royal Astronomical Society (FRAS) *2020–present*
- Junior Member, European Astronomical Society *2020–present*

SELECTED PUBLICATIONS

Citation statistics as of 1 October 2024 (data from INSPIRE-HEP):

Lead-author only	16 papers, 579 citations, h-index = 11
Non-LIGO only	29 papers, 2,230 citations, h-index = 18
All publications	104 papers, 29,911 citations, h-index = 61

Lead-author papers (author list is ordered alphabetically in some cases)

L1. **ACJ**, I. G. Moss, T. P. Billam, Z. Hadzibabic, H. V. Peiris, and A. Pontzen, *Generalized cold-atom analogues for vacuum decay* (2023), Phys. Rev. A **110**, L031301, arXiv:2311.02156 [cond-mat.quant-gas] | Letter

L2. **ACJ**, J. Braden, H. V. Peiris, A. Pontzen, M. C. Johnson, and S. Weinfurtner, *Analog vacuum decay from vacuum initial conditions* (2023), Phys. Rev. D **109**, 023506, arXiv:2307.02549 [cond-mat.quant-gas] | Editor's Suggestion

L3. A. K.-W. Chung, **ACJ**, J. D. Romano, and M. Sakellariadou, *Targeted search for the kinematic dipole of the gravitational-wave background* (2022), Phys. Rev. D **106**, 082005, arXiv:2208.01330 [gr-qc]

L4. M. R. Mosbech, **ACJ**, S. Bose, C. Boehm, M. Sakellariadou, and Y. Y. Y. Wong, *Gravitational-wave event rates as a new probe for dark matter microphysics* (2023), Phys. Rev. D **108**, 043512, arXiv:2207.14126 [astro-ph.CO]
Co-lead author with Markus Mosbech; I developed the core idea and led $\sim 50\%$ of the analysis
Featured in a Royal Astronomical Society press release at the 2023 National Astronomy Meeting

L5. **ACJ**, *Cosmology and Fundamental Physics in the Era of Gravitational-Wave Astronomy* (2022, PhD thesis), arXiv:2202.05105 [gr-qc]

L6. D. Blas and **ACJ**, *Bridging the μHz gap in the gravitational-wave landscape with binary resonance* (2022), Phys. Rev. Lett. **128**, 101103, arXiv:2107.04601 [astro-ph.CO]
Awarded a Buchalter Cosmology Prize (2nd Prize), recognising 'potential for remarkable impact'
Altmetric attention score of 397, in the top 0.3% of all publications ever tracked by Altmetric
Featured in the *Daily Express*, *Physics* magazine, *Big Think*, *SYFY wire*, and 40+ other outlets

L7. D. Blas and **ACJ**, *Detecting stochastic gravitational waves with binary resonance* (2022), Phys. Rev. D **105**, 064021, arXiv:2107.04063 [gr-qc]

L8. **ACJ** and M. Sakellariadou, *Nonlinear gravitational-wave memory from cusps and kinks on cosmic strings* (2021), Class. Quant. Grav. **38**, 165004, arXiv:2102.12487 [gr-qc]
Invited submission to CQG as winner of the Best Student Talk Prize at BritGrav 21

L9. **ACJ** and M. Sakellariadou, *Primordial black holes from cusp collapse on cosmic strings* (2020), arXiv:2006.16249 [astro-ph.CO]

L10. **ACJ**, J. D. Romano, and M. Sakellariadou, *Estimating the angular power spectrum of the gravitational-wave background in the presence of shot noise* (2019), Phys. Rev. D **100**, 083501, arXiv:1907.06642 [astro-ph.CO]

L11. **ACJ** and M. Sakellariadou, *Shot noise in the astrophysical gravitational-wave background* (2019), Phys. Rev. D **100**, 063508, arXiv:1902.07719 [astro-ph.CO]

L12. **ACJ**, R. O'Shaughnessy, M. Sakellariadou, and D. Wysocki, *Anisotropies in the astrophysical gravitational-wave background: The impact of black hole distributions* (2019), Phys. Rev. Lett. **122**, 111101, arXiv:1810.13435 [astro-ph.CO]

L13. **ACJ**, A. G. A. Pithis, and M. Sakellariadou, *Can we detect quantum gravity with compact binary inspirals?* (2018), Phys. Rev. D **98**, 104032, arXiv:1809.06275 [gr-qc]

L14. **ACJ**, M. Sakellariadou, T. Regimbau, and E. Slezak, *Anisotropies in the astrophysical gravitational-wave background: Predictions for the detection of compact binaries by LIGO and Virgo* (2018), Phys. Rev. D **98**, 063501, arXiv:1806.01718 [astro-ph.CO]

L15. **ACJ** and M. Sakellariadou, *Anisotropies in the stochastic gravitational-wave background: Formalism and the cosmic string case* (2018), Phys. Rev. D **98**, 063509, arXiv:1802.06046 [astro-ph.CO] Featured in PRD's 'kaleidoscope' for Sep 2018

Other selected papers (with summary of my main contributions)

O1. L. Zwick, D. Soyuer, D. J. D'Orazio, D. O'Neill, A. Derdzinski, P. Saha, D. Blas, **ACJ**, L. Z. Kelley, *Bridging the micro-Hz gravitational wave gap via Doppler tracking with the Uranus Orbiter and Probe Mission: Massive black hole binaries, early universe signals and ultra-light dark matter* (2024), arXiv:2406.02306 [astro-ph.HE] | Led sensitivity analysis for early-Universe signals

O2. N. Kouvatsos, **ACJ**, A. I. Renzini, J. D. Romano, M. Sakellariadou, *Unbiased estimation of gravitational-wave anisotropies from noisy data* (2023), arXiv:2312.09110 [astro-ph.CO] | Proposed new analysis method and led theoretical work; informal supervision of PhD student (N. Kouvatsos)

O3. M. Branchesi *et al.*, *Science with the Einstein Telescope: a comparison of different designs* (2023), JCAP **07**, 068, arXiv:2303.15923 [gr-qc] | Contributed to stochastic background sensitivity analysis for different Einstein Telescope configurations, guiding further development of the proposal

O4. S. Gasparrotto, R. Vicente, D. Blas, **ACJ**, and E. Barausse, *Can gravitational-wave memory help constrain binary black-hole parameters? A LISA case study* (2023), Phys. Rev. D **107**, 124033, arXiv:2301.13228 [gr-qc] | Helped define project and methodologies; informal supervision of PhD student (S. Gasparrotto)

O5. P. Auclair *et al.* (LISA Cosmology Working Group), *Cosmology with the Laser Interferometer Space Antenna* (2022), Living Rev. Rel. **26**, 5, arXiv:2204.05434 [astro-ph.CO] | LISA white paper; contributed to section on cosmic strings, led analysis of related gravitational-wave anisotropies

O6. A. I. Renzini, B. Goncharov, **ACJ**, and P. M. Meyers, *Stochastic Gravitational-Wave Backgrounds: Current Detection Efforts and Future Prospects* (2022), Galaxies **10**, 34, arXiv:2202.00178 [gr-qc] Invited review article; major contributions to sections on gravitational-wave theory and sources

O7. N. Bartolo *et al.* (LISA Cosmology Working Group), *Probing Anisotropies of the Stochastic Gravitational Wave Background with LISA* (2022), JCAP **11**, 009, arXiv:2201.08782 [astro-ph.CO] LISA review paper; coordinator for 'topological defects' section, with further contributions to 'astrophysical sources' section

O8. P. Auclair, J. J. Blanco-Pillado, D. G. Figueroa, **ACJ**, M. Lewicki, M. Sakellariadou, S. Sanidas, L. Sousa, D. A. Steer, J. M. Wachter, and S. Kuroyanagi (LISA Cosmology Working Group), *Probing the gravitational wave background from cosmic strings with LISA* (2019), JCAP **04**, 034, arXiv:1909.00819 [astro-ph.CO] | LISA review paper; significant writing contributions throughout

O9. B. P. Abbott *et al.* (LIGO, Virgo), *Directional limits on persistent gravitational waves using data from Advanced LIGO's first two observing runs* (2019), Phys. Rev. D **100**, 062001, arXiv:1903.08844 [gr-qc] | Led interpretation of observational results in the context of cosmological and astrophysical source models, wrote corresponding section

O10. B. P. Abbott *et al.* (LIGO, Virgo), *Search for the isotropic stochastic background using data from Advanced LIGO's second observing run* (2019), Phys. Rev. D **100**, 061101, arXiv:1903.02886 [gr-qc] Rapid communication | Led and wrote section on implications for cosmic string models

SELECTED TALKS

Total of 35 invited talks across three continents

- **General Relativity Seminar** (Invited) — *Dec 2024*
  DAMTP, University of Cambridge
- **Particle Cosmology Seminar** (Invited) — *Nov 2024*
  University of Nottingham
- **Cosmology/Extragalactic Seminar** (Invited) — *Oct 2024*
  University College London
- **Cambridge-LMU Meeting** (Invited) — *Oct 2024*
  Kavli Institute for Cosmology, University of Cambridge
- **GEMMA2 Workshop** (Invited) — *Sep 2024*
  Sapienza University of Rome
- **Majorana-Raychaudhuri Seminar** (Invited) — *Sep 2024*
  Kolkata/Salerno (online)
- **Cold atoms and molecules for fundamental physics** (Invited) — *Jul 2024*
  Cambridge
- **Quantum aspects of inflationary cosmology** — *Jul 2024*
  Munich Institute for Astro-, Particle and BioPhysics (MIAPbP)
- **Frontiers in Cosmology and Gravitational Physics** — *May 2024*
  Institute of Cosmology and Gravitation (ICG), University of Portsmouth
- **4th EuCAPT Symposium** (Invited plenary talk) — *May 2024*
  CERN, Geneva
- **British Applied Mathematics Colloquium (BAMC)** (Invited) — *Apr 2024*
  Newcastle University
- **Cosmology Lunch Seminar** (Invited) — *Feb 2024*
  DAMTP, University of Cambridge
- **Gravitational-Wave Group Meeting** (Invited) — *Jan 2024*
  Institute of Cosmology and Gravitation (ICG), University of Portsmouth
- **Next generation gravitational wave observatories** (One of six talks selected) — *Dec 2023*
  Royal Astronomical Society, London
- **Oberthaler Group Seminar** (Invited) — *Nov 2023*
  Kirchhoff Institute for Physics (KIP), Heidelberg
- **COSMO23** — *Sep 2023*
  Institute for Theoretical Physics (IFT), Madrid
- **Amaldi15** — *Jul 2023*
  Online
- **Cosmology from Home** (Invited expert panellist) — *Jul 2023*
  Online
- **National Astronomy Meeting** (RAS press release) — *Jul 2023*
  Cardiff University

- **Quantum Simulators for Fundamental Physics Workshop** (Invited) *Jun 2023*
  Perimeter Institute for Theoretical Physics, Waterloo, Canada
- **Astrophysics Seminar** (Invited) *May 2023*
  University of Leicester
- **Cosmology Seminar** (Invited) *May 2023*
  Beecroft Institute, Oxford
- **Theory Group Seminar** (Invited) *May 2023*
  Astroparticle and Cosmology Laboratory (APC), Paris
- **Cosmology and Relativity Seminar** (Invited) *Apr 2023*
  Queen Mary University of London
- **London Gravity Meeting** (Invited) *Mar 2023*
  Royal Society, London
- **UK-QFT XI** *Jan 2023*
  DAMTP, University of Cambridge
- **'Dark Matters' Workshop** (Invited) *Nov 2022*
  Université Libre de Bruxelles (ULB)
- **London-Oldenburg Relativity Seminar** (Invited) *Nov 2022*
  University College London/University of Oldenburg (online)
- **ICTP-AP Seminar** (Invited) *Sep 2022*
  International Centre for Theoretical Physics, Asia-Pacific (online)
- **Quantum Simulators for Fundamental Physics Workshop** (Invited) *Sep 2022*
  Science Gallery London
- **'Gravitational-Wave Orchestra' Workshop** (Invited) *Sep 2022*
  Université Catholique de Louvain, Belgium
- **International LISA Symposium XIV** *Jul 2022*
  University of Glasgow (online)
- **National Astronomy Meeting** *Jul 2022*
  University of Warwick
- **Circle University Meeting** *Jun 2022*
  King's College London
- **Theory Group Seminar** (Invited) *May 2022*
  Institute of High-Energy Physics (IFAE), Barcelona
- **UKCosmo meeting** (One of seven 'long' talks selected) *May 2022*
  Newcastle University
- **Quantum Technology Seminar** (Invited) *May 2022*
  London Centre for Nanotechnology, University College London
- **9th LISA Cosmology Workshop** *Dec 2021*
  Online
- **Cosmology/Extragalactic Seminar** *Nov 2021*
  University College London
- **Theory Group Seminar** (Invited) *Oct 2021*
  Astroparticle and Cosmology Laboratory (APC), Paris

- **European Physical Society Conference on High-Energy Physics** *Jul 2021*
  DESY/University of Hamburg (online)
- **Ibarra Group Seminar** (Invited) *Jul 2021*
  Technical University of Munich (online)
- **Gravitational Wave Probes of Physics Beyond the Standard Model** (Invited) *Jul 2021*
  University of Warsaw (online)
- **2nd European Physical Society Conference on Gravitation** *Jul 2021*
  King's College London (online)
- **BritGrav 21** (Winner of the Best Student Talk Prize) *Apr 2021*
  University College Dublin (online)
- **London Cosmology Discussion Meeting (LCDM)** (Invited) *Dec 2020*
  Royal Astronomical Society, London (online)
- **International LISA Symposium XIII** *Sep 2020*
  Online
- **Theoretical Cosmology Seminar** (Invited) *May 2020*
  Institute of Cosmology and Gravitation (ICG), University of Portsmouth (online)
- **Cosmology Seminar** (Invited) *May 2020*
  Beecroft Institute, University of Oxford (online)
- **London Cosmology Discussion Meeting (LCDM)** *Feb 2020*
  Royal Astronomical Society, London
- **30th Texas Symposium on Relativistic Astrophysics** (IoP travel award) *Dec 2019*
  Institute of Cosmology and Gravitation (ICG), University of Portsmouth
- **Gravitational Wave Probes of Fundamental Physics** (Invited) *Nov 2019*
  EuCAPT workshop, Amsterdam
- **UKCosmo meeting** (One of nine talks selected) *May 2019*
  DAMTP, University of Cambridge
- **14th Iberian Cosmology Meeting (IberiCOS)** *Apr 2019*
  University of the Basque Country, Bilbao
- **1st European Physical Society Conference on Gravitation** *Feb 2019*
  Sapienza University of Rome
- **Seminar** (Invited) *Feb 2019*
  Virtual Institute of Astroparticle Physics (online)
- **Cosmology Coffee Seminar** (Invited) *Oct 2018*
  Imperial College London
- **UKCosmo meeting** *May 2018*
  Swansea University
- **BritGrav 18** *Apr 2018*
  Institute of Cosmology and Gravitation (ICG), University of Portsmouth

TEACHING AND SUPERVISION

University of Cambridge *2024–present*

· Guest lecturer (3×1 hr) for 3rd-year *Relativity* (Part II Physics/Astrophysics)

University College London *2021–2024*

· Lead supervisor of research projects for two masters students: Phoebe Routh (distinction) and David Moody (distinction and awarded departmental prize)

· Postgraduate Teaching Assistant for 3rd-year *Physical Cosmology*: developed problem sets and delivered problem-solving tutorials

King's College London *2017–2021*

· Winner of a 2020 King's Education Award, recognising 'extraordinary contributions' to teaching

· 'Rising Star' nominee in the 2019 King's Education Awards (only PhD student nominee in Physics)

· Co-wrote lecture notes for 3rd-year *General Relativity and Cosmology*

· Examples class demonstrator for numerous courses, including 4th-year *Astroparticle Cosmology*, 3rd-year *General Relativity and Cosmology*, 2nd-year *Astrophysics*, 1st-year *Mathematics for Physicists*, ...

SOFTWARE AND NUMERICS

- Lead developer of Fortran lattice field theory code `lattice-fvd` and Python code `gw-resonance`
- Experience with advanced numerical methods including, e.g., Fourier and Chebyshev pseudospectral methods and symplectic integration
- Extensive experience in Unix environments (Ubuntu/MacOS), including in HPC settings
- Advanced Python user (object-oriented programming; data handling and visualisation; `Jupyter`, `NumPy`, `SciPy`, `h5py`, `Astropy`, `healpy`, `sympy`, ...)
- Other languages and software include Fortran, C++, Mathematica, Git, MATLAB, SageMath, SQL, LaTeX (including Ti*k*Z), ...

PUBLIC ENGAGEMENT

- Invited speaker for the Cambridge Astronomical Association *2024*
- My research and simulations featured in the documentary *'Do we live in a multiverse?'* *2024*
  Aired on French and German TV — more than 2 million combined views on YouTube
- YouTube video interview on *'Early Universe Cosmology in the Lab'* *2023*
- Outreach talk for alumni of UCL's 'Introduction to Astronomy' course, *2023*
  aimed at amateur astronomers and members of the public
- Participated in five interviews for media pieces on my paper *2022*
  'Bridging the μHz gap in the gravitational-wave landscape with binary resonance'
- Maths and physics tutor at Open Tutors London *2017–2020*
  Co-initiated free tutoring program for University of London students from under-represented groups
- Helped run an interactive exhibit on Dark Matter at Science Gallery London *2019*
- Local organiser, Pint of Science Festival *2018*