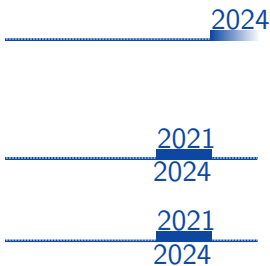


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Dr. Will Barker

Employment

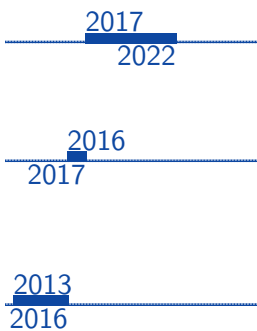


Marie Skłodowska-Curie Actions (MSCA) Fellow, *Physics For Future Programme, Central European Institute for Cosmology and Fundamental Physics, Division of Elementary Particle Physics, Institute of Physics of the Czech Academy of Sciences*

Junior Research Fellow (JRF), *Rosamund Chambers Fellowship in Astrophysics, Girton College, Cambridge, Cavendish Laboratory Astrophysics Group, Kavli Institute for Cosmology, Cambridge*

College Lecturer in Astrophysics (concurrently with JRF), *Girton College, Cambridge*

Education



Ph.D. Theoretical Physics: "Gauge theories of gravity", *Wolfson College, Cambridge, Cavendish Laboratory Astrophysics Group, Kavli Institute for Cosmology, Cambridge*

Advisor: Prof. A. N. Lasenby • Examiners: Prof. A. D. Challinor (internal), Dr. T. Zlosnik (external)

M.Sc. Master of Natural Sciences (First Class), *Queens' College, Cambridge*

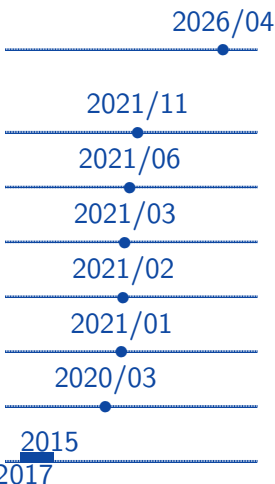
- Quantum field theory • Gauge field theory • Particle physics • Relativistic astrophysics & cosmology
- Formation of structure in the universe • General physics

Thesis: "Pushing electrons in one dimension", theory and Hartree-Fock in C++, with Prof. E. Artacho

BA Bachelor of Arts (First Class), *Queens' College, Cambridge*

- Theoretical physics 1 & 2 • Relativity • Thermal & statistical physics • Advanced quantum physics
- Optics & electrodynamics • Astrophysical fluid dynamics • Particle & nuclear physics • Quantum condensed matter physics • Dissertation on eigenstate thermalisation with Prof. U. Schneider

Awards and funding



IFPU Focus Week, *main proponent of "The non-Riemannian and Palatini whitepaper: The view from quantum field theory", Trieste, February 2027* **15,000 EUR**

Abdus Salam Prize in Theoretical Physics, *best Ph.D. publication* **500 GBP**

Delta ITP Ph.D. visitor program, *placement at Lorentz Institute, Leiden University* **1,800 EUR**

University of Arizona Postdoctoral Fellowship, *declined* **[3-year salary]**

Vaidya-Raychaudhuri Postdoctoral Fellowship, *declined* **[3-year salary]**

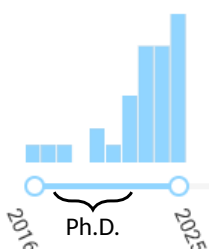
KIAA Postdoctoral Fellowship, *declined* **[3-year salary]**

Iwate University visitor grant, *collaboration cancelled by pandemic* **400,000 JPY**

Queens' College Cambridge Foundation Scholarship, *for high exam performance*

Published papers (click wevbarker.co.uk/publications)

I am very interested in outputs, and have developed a sustained high publication rate since graduating. These are 'grassroots' publications, since I am not yet part of any large consortia. I am first author on about 70% of my publications, including three single-author papers. The full publication list is attached where requested.



Published software (click wevbarker.co.uk/software)

'Published' refers to packages presented in peer-reviewed physics journals or released under license, or UK copyright.

2023/9

Tools for science

PSALTer: Particle Spectrum for Any Tensor Lagrangian, Predicting the propagating quantum particle states in any tensorial field theory, including for gravity.

URL: github.com/wevbarker/PSALTer; License: GPL-3.0

Companion paper(s): W. Barker, C. Marzo, and C. Rigouzzo, "Particle spectrum for any tensor Lagrangian," *Phys. Rev. D* **112**, 016018 (2025), arXiv:2406.09500; W. Barker, G.K. Karananas, and H. Tu, "Particle spectra of parity-violating theories: A less radical approach and an upgrade of the particle spectrum for any tensor Lagrangian framework," *Phys. Rev. D* **112** (2025), arXiv:2506.02111

2022/6

HiGGS: Hamiltonian Gauge Gravity Surveyor, Tools for Hamiltonian constraint, canonical reduction, and Dirac–Bergmann analysis of gravity theories with spacetime curvature and torsion.

URL: github.com/wevbarker/HiGGS; License: GPL-3.0

Companion paper(s): W.E.V. Barker, "Supercomputers against strong coupling in gravity with curvature and torsion," *Eur. Phys. J. C* **83**, 658 (2023), arXiv:2305.04769

2025/1

Hamilcar, MCP-compliant tools for Hamiltonian analysis in canonical field theory, extending xAct for time-dependent field calculations.

URL: github.com/wevbarker/Hamilcar; License: GPL-3.0

2023/7

Tools for supporting science

xPlain, Formatting unambiguous, lasting derivations in Wolfram Language.

URL: github.com/wevbarker/xPlain; License: GPL-3.0

2024/6

NoMoreNotebooks, Programmatic Wolfram Notebook Interface.

URL: github.com/wevbarker/NoMoreNotebooks; License: UK copyright

2025/10

Martensite, Adversarial hardening for modern grantsmanship.

URL: github.com/wevbarker/Martensite; License: MIT

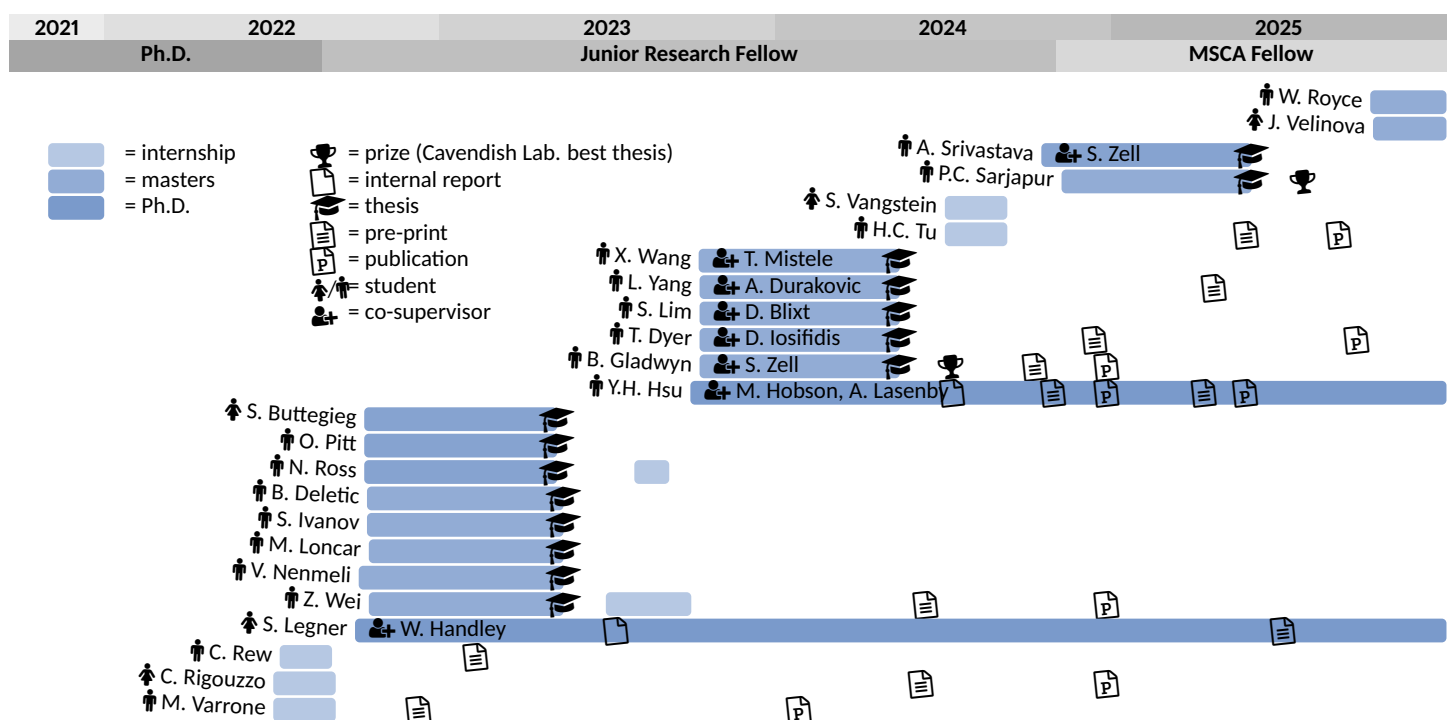
2025/10

Sauron, AI-powered academic collaborator discovery for theoretical physics.

URL: github.com/wevbarker/Sauron; License: MIT

Research supervision (click wevbarker.co.uk/graduate)

My portfolio of solo- and co-supervised research students is presented below. Master's mini-theses at Cambridge typically account for one third of one academic year's credits, culminating in a 10-20 page pre-print-style report.



Press and media

2025/8

From Cambridge to Prague, and Beyond Einstein: Will Barker's Quest for a New Gravity, [FZU CAS \(Institute of Physics\)](#)

2023/4

Deur Gravitational self-interaction Doesn't Explain Galaxy Rotation Curves, *lengthy public discussion of our work on* [Physics Forums](#)

2021/8

Constructing an alternative to general relativity: torsion and curvature squared?, [KICC annual report 2020](#)

2020/6

Top arXiv papers from week 24, 2020, [His Dark CMBlog](#)

2020/4

Why is the Universe expanding so fast?, [Quanta Magazine](#), featured alongside work by Lisa Randall and Marc Kamionkowski

Academic service, teaching and outreach

Peer Review

2025

IOP Journal of Cosmology and Astroparticle Physics (Impact Factor 5.9)

2025

APS Physical Review D (Impact Factor 5.3)

2020

Elsevier Physics of the dark universe (Impact Factor 4.5)

2025

Nature Scientific Reports (Impact Factor 3.9)

2023

MDPI Universe (Impact Factor 2.9)

2025

Elsevier Nuclear Physics B (Impact Factor 2.72)

2025

World Scientific International Journal of Modern Physics D (Impact Factor 2.0)

2021

Springer Advances in applied Clifford algebras (Impact Factor 1.1)

Undergraduate teaching (click wevbarker.co.uk/undergraduate)

2021

2nd-year Oscillations, waves and optics (50 hours)

2024

2021

2nd-year Quantum physics (50 hours)

2024

2021

2nd-year Condensed matter physics (50 hours)

2024

2021

2nd-year Experimental methods (25 hours)

2024

2018

4th-year Relativistic astrophysics and cosmology (30 hours)

2022

2017

3rd-year Relativity (70 hours)

2021

2017

1st-year Mathematics B (100 hours)

2018

Outreach (click wevbarker.co.uk/outreach)

2025/3

Educational tour of Chinese high schools, *Five schools across Guangdong and Shandong provinces*, Delivered lectures on "Western academia: admissions and experience" and workshops on Cambridge University interview techniques to over 500 students. Schools visited: • Longcheng High School (Shenzhen) • Guangdong Country Garden School (Foshan) • Shenzhen Concord College of Sino-Canada (Shenzhen) • The Bay International College (Shenzhen) • Shandong Experimental High School (Jinan)

2022

STEM-SMART widening participation programme, *University of Cambridge*, Mathematics teaching for high school students from under-represented backgrounds

2023

2019/6

REACH Summer School Astronomy and Astrophysics (40 hours), *Anglia Ruskin University and University of Cambridge*, Introduction to general relativity for highschool students

2013/12

Academic Life, *Truro and Penwith College*, Presentation on university life for highschool students

Computing

Operating systems

GNU/Linux power user since 2017, currently running *Arch*, previously *Manjaro* and *CentOS*

Main languages • *Wolfram Language* • *Maple* • *FORM* • *Python* • *C++* • *Bash* • *HTML* • *JavaScript* • *CSS* • *TikZ*

Basic tools • *Mathematica* • *xAct* • *Git* • *Vi/Vim* • *tmux* • *Jupyter* • *SLURM* • environment modules

AI tools • *Claude Code MAX* • *Codex CLI* • *Agents SDK* • *LangChain* • *LangGraph* • *MCP*

References

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Cambridge, UK

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(Research collaborator)

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University of Cambridge
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(Undergraduate supervisor)