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Will Barker
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Employment

2021

Rosamund Chambers Research Fellow in Astrophysics, *Girton College, Cambridge, Cavendish Astrophysics Group, Kavli Institute for Cosmology, Cambridge.*

2021

Part-time guest (unfunded), *Lorentz Institute, Leiden University.*

Education

2017

2021

Ph.D. Physics (Theoretical Cosmology), *Wolfson College, Cambridge, Cavendish Astrophysics Group, Kavli Institute for Cosmology, Cambridge.*

✦ Supervisors: Prof. A. N. Lasenby, Prof. M. P. Hobson & Dr. W. J. Handley

✦ Thesis: Gauge Theories of Gravity

2016

2017

M.Sc. Master of Natural Sciences, *Queens' College, Cambridge, 1st Class/4.0 GPA.*

✦ Natural Science Tripos Part III: ■ Quantum field theory ■ Gauge field theory ■ Particle physics ■ Relativistic astrophysics & cosmology ■ Formation of structure in the universe ■ General physics

✦ Dissertation: Pushing electrons in one dimension

2013

2016

BA Bachelor of Arts, *Queens' College, Cambridge, 1st Class/4.0 GPA.*

✦ Natural Science Tripos Part II: ■ Theoretical physics 1 & 2 ■ Relativity ■ Thermal & statistical physics ■ Advanced quantum physics ■ Optics & electrodynamics ■ Astrophysical fluid dynamics ■ Particle & nuclear physics ■ Quantum condensed matter physics ■ Research review

✦ Natural Science Tripos Part IB: ■ Physics A ■ Physics B ■ Mathematics

✦ Natural Science Tripos Part IA: ■ Mathematics ■ Physics ■ Materials science ■ Earth science

2011

2013

School, *Truro and Penwith College, A-Level: 3A*, As-Level: 4A, GCSE: 10A*.*

Publications (see [Inspire HEP](https://inspirehep.net))

- 2021 **Barker, W. E. V.**, A. N. Lasenby, M. P. Hobson, and W. J. Handley (Jan. 2021). "Non-linear Hamiltonian analysis of new quadratic torsion theories Part I. Cases with curvature-free constraints". In: *arXiv e-prints*, arXiv:2101.02645, arXiv:2101.02645. arXiv: [2101.02645 \[gr-qc\]](https://arxiv.org/abs/2101.02645).
- 2020 **Barker, W. E. V.**, A. N. Lasenby, M. P. Hobson, and W. J. Handley (Oct. 2020a). "Mapping Poincaré cosmology to Horndeski theory for emergent dark energy". In: *Phys. Rev. D* 102.8, 084002. Featured in [His Dark CMBlog](https://www.cambridge.org/core), p. 084002. DOI: [10.1103/PhysRevD.102.084002](https://doi.org/10.1103/PhysRevD.102.084002). arXiv: [2006.03581 \[gr-qc\]](https://arxiv.org/abs/2006.03581).
- Barker, W. E. V.**, A. N. Lasenby, M. P. Hobson, and W. J. Handley (July 2020b). "Systematic study of background cosmology in unitary Poincaré gauge theories with application to emergent dark radiation and H_0 tension". In: *Physical Review D* 102.2, 024048. Featured in [Quanta Magazine](https://www.cambridge.org/core), p. 024048. DOI: [10.1103/PhysRevD.102.024048](https://doi.org/10.1103/PhysRevD.102.024048). arXiv: [2003.02690 \[gr-qc\]](https://arxiv.org/abs/2003.02690).
- 2019 **Barker, W. E. V.**, A. N. Lasenby, M. P. Hobson, and W. J. Handley (May 2019). "Static energetics in gravity". In: *Journal of Mathematical Physics* 60.5, 052504, p. 052504. DOI: [10.1063/1.5082730](https://doi.org/10.1063/1.5082730). arXiv: [1811.09844 \[gr-qc\]](https://arxiv.org/abs/1811.09844).

2017 **Barker, W. E. V.** (Aug. 2017). "Effects of the circularly polarized beam of linearized gravitational waves". In: *Classical and Quantum Gravity* 34.16, 167001, p. 167001. DOI: [10.1088/1361-6382/aa7da9](https://doi.org/10.1088/1361-6382/aa7da9). arXiv: [1612.00905](https://arxiv.org/abs/1612.00905) [gr-qc].

Barker, W. E. V., T. Ledvinka, D. Lynden-Bell, and J. Bičák (Oct. 2017). "Rotation of inertial frames by angular momentum of matter and waves". In: *Classical and Quantum Gravity* 34.20, 205006, p. 205006. DOI: [10.1088/1361-6382/aa8a34](https://doi.org/10.1088/1361-6382/aa8a34). arXiv: [1710.10360](https://arxiv.org/abs/1710.10360) [gr-qc].

Awards and Funding

2021/6

Secured 1,800€ funding, Delta ITP Ph.D. visitor program.

2021/3

University of Arizona Postdoctoral Fellowship (3 years), declined.

2021/2

Vaidya-Raychaudhuri Postdoctoral Fellowship (3 years), declined.

2021/1

KIAA Fellowship (3 years), declined.

2020/03

Secured 400,000¥ funding, Collaboration at Iwate University, geometric algebra techniques and transformation optics. On hold due to coronavirus pandemic.

2015

2017

Queens' College Cambridge Foundation Scholar, For high exam performance.

Research Experience

2021

Delta ITP visitor, Lorentz Institute, Prof. S. Patil.

2021

Ph.D. Physics, Cavendish Astrophysics Group, Prof. A. N. Lasenby.

2017

2021

M.Sc. Dissertation, Cavendish Theory of Condensed Matter Group, Prof. E. Artacho,

- Novel quantum description of fermionic fluid in quenched, one-dimensional systems
- Two-particle interactions via Hartree-Fock implemented in C++.

2016

2017

Summer student, Institute of Astronomy, Prof. D. Lynden-Bell, Prof. J. Bičák & Dr. T. Ledvinka,

- Addressing Mach's principle by gravitomagnetically rotating inertial frames
- Gravitoelectromagnetic proof that the graviton has spin-parity 2^+ .

2016

2016

Research Review, Cavendish Quantum Optics Group, Prof. U. Schneider, Literature review of the eigenstate thermalisation hypothesis.

2016

2016

Seminars, Colloquia and Conference Talks

Select Talks

2020/12

Torsion cosmology and beyond, ▪ Invited speaker, Queen Mary London cosmology seminar ▪ Invited speaker, [PITP cosmology seminar](#) ▪ Invited speaker, CEICO cosmology seminar ▪ Parallel speaker, [Cosmology from Home 2020](#) (see [YouTube/slides](#)).

2020/2

Addressing Hubble Tension with Emergent Dark Radiation in Unitary Gravity,

- Invited speaker at [DAMTP GR Seminar Series](#) ▪ Battcock Seminar Series ▪ Parallel speaker at 30th Texas Symposium on Relativistic Astrophysics.

2019/3

Habitable Tordion Worlds, ▪ Poster session at [Strings, Cosmology & Gravity 2019](#) conference in Munich ▪ Flash talk/poster session at KICC 10th Anniversary Symposium.

2018/1

Gravitational Fields of Massless Particles, Battcock Seminar Series (see [slides](#)).

2017/1

Pushing Electrons in One Dimension, Theory of Condensed Matter Group Seminar.

Select Conferences

2020/8

Cosmology from Home 2020, Led seminar with over 50 participants *Theoretical Requirements of Modified Gravity*.

2019/12

30th Texas Symposium on Relativistic Astrophysics.

2019/9

KICC 10th Anniversary Symposium.

2019/3

Strings, Cosmology and Gravity Student Conference 2019.

Press and Media

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

2021

Springer *Advances in Applied Clifford Algebras* (Impact Factor 1.072).

2020

Elsevier *Physics of the Dark Universe* (Impact Factor 4.473).

Undergraduate Teaching

2018

4th-year *Relativistic Astrophysics and Cosmology* (30 hours).

2017

3rd-year *Relativity* (70 hours).

2017

2018

1st-year *Mathematics B* (100 hours), Also co-authored [mock exam](#).

Outreach

2019/6

REACH Summer School *Astronomy and Astrophysics* (40 hours), Designed [intensive two-week course](#) for 14-18 year-olds from across the globe.

2013/12

Academic Life, *Truro and Penwith College*, Outreach talk for high-school students.

Computing

Operating systems

▪ Arch Linux (preferred) ▪ Manjaro Linux ▪ CentOS Linux ▪ Ubuntu Linux

Languages

▪ Wolfram (see [HiGGS](#)) ▪ Maple (see [CLIo](#)) ▪ T_EX (see [barxiv](#)) ▪ Python ▪ C++ ▪ HTML

Tools and skills

▪ Mathematica/xAct ▪ Git ▪ Vi ▪ Tmux ▪ i3 ▪ Gnuplot

References

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Prof. Jiří Bičák

Institute of Theoretical Physics
Charles University
V Holešovickách 2

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Prof. Emilio Artacho

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Dr. Will Handley

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