

Benjamin M. Roberts

School of Mathematics and Physics, The University of Queensland, Brisbane, QLD 4072, Australia

@: b.roberts@uq.edu.au

www: broberts.io/

- Theoretical atomic and astroparticle physics: precision laboratory and astrophysical tests of the standard model, searches for dark matter and exotic physics, atomic structure calculations, violation of fundamental symmetries
- High-impact publications: *Nature Communications*, *Physical Review Letters*, several Editors' Suggestions
- Work covered in several popular science media publications: *Science*, *Cosmos*, *MIT Tech. Review*, and others
- Research profiles: ORCID: [0000-0002-0345-6375](https://orcid.org/0000-0002-0345-6375), Inspire: inspirehep.net/author/profile/B.M.Roberts.1

Academic Positions

2021 – current

ARC DECRA Fellow

University of Queensland, Australia

- Tests of fundamental physics at low-energy, and searches for dark matter
- Lecturer: Computational Physics, Quantum Field Theory, Particle Astrophysics
- Course coordinator for Computational Physics
- CI for successful ARC Discovery Project (DP230101685)
- Supervision of PhD, master's, honours, and undergraduate students
- Serve on colloquium committee; run yearly 'git and GitHub' workshop

2019 – 2021

Postdoctoral Researcher

University of Queensland, Australia

- Working with Dr. Jacinda Ginges on atomic structure theory, high-precision calculations
- Supervision of several honours and undergraduate students
- CI for successful ARC DECRA project (DE210101026)

2018 – 2019

Postdoctoral Researcher

SYRTE, Observatoire de Paris, France

- Working with Prof. Peter Wolf and Dr. Pacome Delva
- Developed methods for dark matter detection using networks of atomic clocks
- Calculations of atomic ionisation rates due to WIMP scattering

2016 – 2018

Postdoctoral Fellow

University of Nevada, Reno, Nevada, USA

- Working with Prof. Andrei Derevianko and Prof. Geoffrey Blewitt
- Using GPS atomic clock data to search for macroscopic dark matter candidates
- Assisted in supervision of several graduate and undergraduate students

Grants & Awards

2023: ARC Discovery Project (DP230101685), \$415K

2021: ARC Discovery Early Career Researcher Award (DE210101026), \$440K

2018: U. Nevada, Reno *Exceptional Postdoctoral Mentoring award* honourable mention

2017: Nominated by UNSW and the Australian Institute of Physics (NSW branch) for the *Bragg Gold Medal for Excellence in Physics*

2013: Australian Postgraduate Award

2012: Spruson & Ferguson Award for Innovation in Science

Teaching

2021 – current

University of Queensland, Australia

- Lecturer: Computational Physics (4th year), Advanced Quantum Field Theory (special topics course), Frontiers in Astrophysics (4th year)
- Course Coordinator: Computational Physics (4th year)
- Led curriculum development for Advanced Quantum Field Theory (first time course ran), and Computational Physics (major redesign of course)
- Excellent student feedback, particularly for my lecture material, and course I coordinate

2012 – 2015

UNSW, Sydney, Australia

- First-year Teaching Assistant, Demonstrator in Charge (supervise 3 demonstrators and 45 students), tutor for online course *Everyday Physics*
- Involved in implementing *Mechanics: Motion, Forces, Energy and Gravity*, a Massive Open Online Course designed and run by Prof. Joe Wolfe.

Research Supervision

2019 – current

University of Queensland, Australia

- Currently supervising: 2 PhD students, 2 honours students, and 2 master's students
- Previously (graduated): 7 honours students, 17 undergraduate research projects
- Excellent outcomes for graduated honours students: received scholarships, pursuing post-graduate research at ETH Zurich, IMAPP (International Master of Advanced Methods in Particle Physics, Europe) and others

2016 – 2018

University of Nevada, Reno, NV, USA

Assisted in supervision of several graduate and undergraduate students

- Received award recognising *Exceptional Postdoctoral Mentoring*

Education

2013 – 2016

Doctor of Philosophy in Physics

UNSW, Sydney, Australia

- Thesis: *Low-energy atomic phenomena: probing fundamental physics and searching for dark matter*. (Supervisors: Prof. Victor Flambaum and Dr. Vladimir Dzuba).
- Nominated for the *Bragg Gold Medal for Excellence in Physics*
- Invited to the Perimeter Institute for Theoretical Physics, Canada, to collaborate

2009 – 2012

Bachelor of Science (Advanced) with Class 1 Honours in Physics

UNSW, Sydney, Australia

- Spruson & Ferguson Award for Innovation in Science (2012)

Selected Publications

- *Empirical determination of the Bohr-Weisskopf effect in cesium and improved tests of precision atomic theory in searches for new physics*, G. Sanamyan, B. M. Roberts, and J. S. M. Ginges, **Phys. Rev. Lett.** **130**, 053001 (2023)
- *Variation of the Fine Structure Constant around the Supermassive Black Hole in Our Galactic Center*, A. Hees, T. Do, B. M. Roberts, Andrea M. Ghez, S. Nishiyama et al., **Phys. Rev. Lett.** **124**, 081101 (2020)
- *Nuclear magnetic moments of francium 207–213 from precision hyperfine comparisons*, B. M. Roberts and J. S. M. Ginges, **Phys. Rev. Lett.** **125**, 063002 (2020)
- *Search for domain wall dark matter with atomic clocks on board GPS satellites*, B. M. Roberts, G. Blewitt, C. Dailey, M. Murphy, M. Pospelov, A. Rollings, J. Sherman, W. Williams, and A. Derevianko, **Nature Comm.** **8**, 1195 (2017)
- *Ionization of Atoms by Slow Heavy Particles, Including Dark Matter*, B. M. Roberts, V. V. Flambaum, and G. F. Gribakin, **Phys. Rev. Lett.** **116**, 023201 (2016)
- *Dark matter scattering on electrons: Accurate calculations of atomic excitations and implications for the DAMA signal*, B. M. Roberts, V. A. Dzuba, V. V. Flambaum, M. Pospelov, and Y. V. Stadnik, **Phys. Rev. D** **93**, 115037 (2016)
- *Limiting P-Odd Interactions of Cosmic Fields with Electrons, Protons, and Neutrons*, B. M. Roberts, Y. V. Stadnik, V. A. Dzuba, V. V. Flambaum, N. Leefer, and D. Budker, **Phys. Rev. Lett.** **113**, 081601 (2014)
- *Revisiting Parity Nonconservation in Cesium*, V. A. Dzuba, J. C. Berengut, V. V. Flambaum, and B. M. Roberts, **Phys. Rev. Lett.** **109**, 203003 (2012)
- Full publication list available online: broberts.io/

Selected Invited Talks

- *Quantum sensors and new physics workshop*, MIAPbP (Munich Institute for Astro-, Particle, and Bio Physics), Germany, 2023 (upcoming)
- *International Workshop on Atomic Parity Violation (virtual)*, 2022
- *Frontiers in Quantum Matter Workshop: Electric Dipole Moments*, Australian National University (ANU), Canberra, Australia, 2019
- *7th International Colloquium on Scientific and Fundamental Aspects of GNSS*, European Space Agency (ESA), ETH Zürich, Switzerland, 2019
- *15th Marcel Grossmann Meeting*, University of Rome (La Sapienza), Italy, 2018
- *New Directions in Dark Matter and Neutrino Physics*, Perimeter Institute, Canada, 2017
- *The Ultra-Light Frontier*, Mainz Institute for Theoretical Physics, JGU, Germany, 2015

Selected Coverage in Popular Press

- Brisbane Times, *'Unusual' atom helps search for dark matter*, S. Layt, 28 Feb 2023
- APS Physics Synopsis, *Constants Still Constant Near Black Holes*, M. Stephens, 26 Feb 2020
- Quanta, *Ultra-Accurate Clocks Lead Search for New Physics*, G. Popkin, 16 Apr 2018
- Cosmos Mag., *GPS satellites "largest dark matter detector ever built"*, R. Lovett, 10 Nov 2017
- NBC News, *The search for dark matter just took a big step forward*, B. Bergan, 3 Nov 2017
- Science, *Hunting dark matter with GPS data*, A. Cho, 30 Jan 2017

Academic & Discipline Service

UQ Colloquium Committee

- Organise and run physics colloquiums, host guest speaker

Computational Workshops

- Run several workshops aimed at PhD/honours students on high-performance computing, and using git and GitHub effectively for research

Conference Contributions

- Organised UQ 'local hub' for virtual ACAMAR (Australia-China consortium for astrophysical research) particle astrophysics meeting 2022
- Chaired several conference sessions
- Organised UQ leg of the 2022 Australian Institute of Physics Women in Physics lecture

Thesis Examination

- Examined several honours and master's theses, and sat on many PhD milestone panels
- Chaired the panel for a PhD oral exam (PhD defence)

Outreach

- Presented several outreach talks
- Volunteer at several UQ astrophysics outreach events
- Provided comment to popular science journalists

Peer Review

- Expert referee for Australian Research Council (ARC) grants, DP and DECRA
- Referee for peer-reviewed journals including *Physical Review Letters*, *Physical Review A*, *Nature Astronomy* and others

UNSW physics student society (2012–2015)

- Coordinated the *Student Research Lectures*, and initiated and organised the *Climate Science* lecture series