Benjamin M. Roberts

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

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- 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, 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, 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
- High-impact publications, including *Physical Review Letters*

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
- High-impact publications, including *Nature Communications*
- 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: University of Nevada, Reno Award for Professional Development (Postdoctoral)
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, 1 master's student
- Previously (graduated): 7 honours students, 17 undergraduate research projects
- Excellent outcomes for graduated honours students: received scholarships, pursuing postgraduate research at ETH Zurich, IMAPP 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
Department of Theoretical 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*
- Several publications: *Physical Review Letters, Physical Review A* & *D* (including an Editors' Suggestion), *Annual Review of Nuclear and Particle Science*
- Invited to the Perimeter Institute for Theoretical Physics, Canada, to collaborate
- Invited talk at Mainz Institute for Theoretical Physics, Germany

2009 – 2012
Bachelor of Science (Advanced) with Class 1 Honours in Physics
UNSW, Sydney, Australia

- Spruson & Ferguson Award for Innovation in Science (2012)
- Work published in *Physical Review Letters*

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 included separately, and 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)
- *Frontiers in Quantum Matter Workshop: Electric Dipole Moments*, Australian National University (ANU), Canberra, Australia, 2019
- 7^{th} *International Colloquium on Scientific and Fundamental Aspects of GNSS*, ESA (European Space Agency), ETH Zürich, Switzerland, 2019
- 15^{th} *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

Service & Other Positions

2022 – current
UQ Colloquium Committee. Organise and run physics colloquiums, host guest speakers

2022 – current
Computational workshops. Run workshops aimed at PhD/honours students on high-performance computing and using git and GitHub

2022 – current
Expert referee for Australian Research Council (ARC) grants, DP and DECRA

2018 – current
Outreach. Presented several outreach talks; given comment to popular science journalists

2014 – current
Referee for peer-reviewed journals including *Physical Review Letters*, *Physical Review A*, *Nature Astronomy* and others

2012 – 2015
UNSW physics student society. Coordinated the *Student Research Lectures*, and initiated and organised the *Climate Science* lecture series