

# Benjamin M. Roberts

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- Theoretical atomic and astroparticle physics: atomic structure calculations, violation of fundamental symmetries, precision laboratory and astrophysical tests of the Standard Model, searches for dark matter and exotic physics
- Programming (C++, Fortran, Python, Mathematica), experience in parallel computing and statistical data analysis
- 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](https://inspirehep.net/author/profile/B.M.Roberts.1)

## Academic Positions

*May 2021 – current*

ARC DECRA Fellow, University of Queensland

- Tests of fundamental physics at low-energy, and searches for dark matter
- Lecturer: Computational Physics, Quantum Field Theory, Astrophysics
- Supervision of several PhD, honours, and undergraduate students

*2019 – 2021*

Postdoctoral Researcher, University of Queensland

- Working with Dr. Jacinda Ginges on atomic structure theory, high-precision calculations
- Supervision of several honours and undergraduate students

*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

## Education

*2013 – 2015*

Doctor of Philosophy in Physics

Department of Theoretical Physics, University of New South Wales, 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

*2009 – 2012*

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

University of New South Wales, Sydney, Australia

- Thesis: *Parity nonconservation in atomic transitions and tests of Unification Theories*

## Prizes & Awards

2021: ARC Discovery Early Career Researcher Award, \$439K

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*

2013-16: 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); received excellent student feedback
- Course Coordinator: Computational Physics (4th year)

2012 – 2015

University of New South Wales, Sydney, Australia

- Teaching Assistant and Demonstrator in Charge, first year physics teaching laboratory
  - Supervision of up to three demonstrators and forty-five students
- Ran tutorial classes of forty students for the Physics Bridging Course
- Involved in implementation of *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, 3 undergraduate projects
- Previously (graduated): 3 honours students, 7 undergraduate projects

2016 – 2018

University of Nevada, Reno, NV, USA

Assisted in supervision of several graduate and undergraduate students

- Received award recognising *Exceptional Postdoctoral Mentoring*

## Selected Publications

- *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)
- *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)
- *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: [roberts999.com](http://roberts999.com)

## Selected Invited Talks

- *Frontiers in Quantum Matter Workshop: Electric Dipole Moments*, Australian National University (ANU), Canberra, Australia, 2019
- *7<sup>th</sup> International Colloquium on Scientific and Fundamental Aspects of GNSS*, ESA (European Space Agency), ETH Zürich, Switzerland, 2019
- *15<sup>th</sup> Marcel Grossmann Meeting*, University of Rome (La Sapienza), Italy, 2018
- *New Directions in Dark Matter and Neutrino Physics*, Perimeter Institute for Theoretical Physics, Canada, 2017
- *The Ultra-Light Frontier*, Mainz Institute for Theoretical Physics, Johannes Gutenberg University, Mainz, Germany, 2015

## Selected Coverage in Popular Press

- 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
- MIT Tech. Review, *Astrophysicists turn GPS into giant dark matter detector*, 4 May 2017
- Science, *Hunting dark matter with GPS data*, A. Cho, 30 Jan 2017

## Other Positions & Service

2014 – current

Referee for peer-reviewed journals including *Physical Review Letters*, *Physical Review A*

2012 – 2015

Physoc: the UNSW physics student society.

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