

Dr Barry Wardell

ASSISTANT PROFESSOR, SCHOOL OF MATHEMATICS AND STATISTICS,
UNIVERSITY COLLEGE DUBLIN, DUBLIN 4, IRELAND

RESEARCHERID: B-6697-2008, ORCID: 0000-0001-6176-9006

TEL +353-1-716 2543 EMAIL barry.wardell@gmail.com WEB <http://www.barrywardell.net>

Career profile

I am an Assistant Professor working in the School of Mathematics and Statistics at University College Dublin (UCD). My main research interests involve the study of gravitational waves from astrophysical objects such as black holes and cosmic strings, from both numerical and analytical perspectives. I am also interested in other aspects of general relativity, astrophysics, and computational science.

Academic and professional appointments

- 2016— Assistant Professor, School of Mathematics and Statistics, UCD.
- 2015–2016 Visiting Scientist, Astronomy Department, Cornell University.
- 2014–2016 Irish Research Council Postdoctoral Fellow, Complex & Adaptive Systems Laboratory, UCD.
- 2013–2015 Research Associate, Department of Astronomy, Cornell University.
- 2011–2013 Postdoctoral Researcher, Complex & Adaptive Systems Laboratory, UCD.
- 2009–2011 Postdoctoral Researcher, Albert Einstein Institute (Max-Planck Institute), Germany.
- 2009 Student Developer, Google Summer of Code 2009, VideoLAN project.
- 2005–2009 Irish Research Council Postgraduate Scholar, UCD.
- 2005–2009 Tutor, School of Mathematical Sciences, UCD.
- 2005 Student/intern, NASA Kennedy Space Center, Florida.
- 2004 Undergraduate research student, Department of Mathematical Physics, UCD.

Teaching experience and institutional responsibilities

- 2016— Lecturer - “Numerical Algorithms”, “Simulation Modelling”, “Foundations of Quantum Mechanics”, and “Mathematica for Research”.
- 2015–2016 Lecturer - “Differential Geometry and Topology in Physics” and “Mathematica for Research”.
- 2011–2015 Lecturer - “Case Studies in Computational Science”, UCD/Trinity College Dublin.
- 2015 Completed “Responsible Conduct in Research” course offered by Cornell University.
- 2007–2008 Lecturer - Portion of “Computational Physics” course, UCD.
- 2005–2009 Tutor - undergraduate mathematics, UCD.
- 2005–2009 PhD student seminar organiser, UCD.
- 2005 Completed tutor training course given by UCD Centre for Teaching and Learning.
- 2001–2009 One-to-one tuition at all levels including high school and undergraduate.

Mentoring and supervision of undergraduate and graduate students

- 2015— Supervision of UCD undergraduate research projects.
- 2011–2015 Co-supervision of PhD students: Dr Anna Heffernan, Dr Patrick Nolan, and Dr Christopher Kavanagh.

Education

- 2005–2009 PHD (THEORETICAL PHYSICS), UNIVERSITY COLLEGE DUBLIN, IRELAND
My PhD was funded by an Irish Research Council for Science Engineering and Technology Postgraduate Research Scholarship. Upon completion, I was awarded the 2009 Institute of Physics “Gravitational Physics Group Thesis Prize” for the best thesis worldwide on the topic of gravitational physics.
- 2005–2008 HDIP (COMPUTATIONAL SCIENCE), UNIVERSITY COLLEGE DUBLIN, IRELAND
I completed Masters-level courses in computational science, applied mathematics (including financial mathematics) and theoretical physics, receiving a final grade of 79%.
- 2001-2005 BSC (THEORETICAL PHYSICS), UNIVERSITY COLLEGE DUBLIN, IRELAND
I received an entrance scholarship and graduated with First Class Honours. Final grade: 83%.

Fellowships and grants

Fellowships

- 2014 Irish Research Council “Government of Ireland Postdoctoral Research Fellowship”
2005 Irish Research Council Postgraduate Scholarship

Research grants

- 2015 Royal Irish Academy Charlemont Grant
2015 UCD Seed Funding: Visiting Professor (co-investigator)
2015 UCD Seed funding: Dissemination & outputs
2013 UCD Seed funding: Developing a Vibrant Academic Community (co-investigator)
2013 UCD Seed funding: Dissemination & outputs
2012 PI for Class B supercomputer allocation from the Irish Centre for High-End Computing (ICHEC)
2009 Institute of Physics Student Conference Travel Fund
2009 UCD Seed funding: Dissemination & outputs
2008 Institute of Physics Gravitational Physics Group Postgraduate Seminar Exchange

Additional activities and experience

Invited guest speaker

- Nov 2015 Cambridge University, DAMTP Journal Club seminar
Mar 2015 Perimeter Institute, Canada
Sep 2014 Louisiana State University, Gravitational Physics Group seminar
Mar 2014 University of Maryland, Department of Physics gravity seminar
Feb 2014 California Institute of Technology, TAPIR seminar series
June 2013 Kavli IPMU, University of Tokyo, Astronomy - Cosmology - Particle Physics seminar
May 2013 SISSA, Italy, Astrophysics seminar series
Nov 2012 University of Southampton, Relativity seminar series
June 2012 University of Guelph/Perimeter Institute, Canada, Informal seminar series
May 2011 SFB/Transregio 7 Video Seminar, Institutes across Germany
Dec 2008 Queen Mary, University of London, Seminar series
Oct 2008 CENTRA, Instituto Superior Técnico, Lisbon, Seminar series
Apr 2008 University of Southampton, Relativity seminar series

Invited presentations to peer-reviewed, internationally established conferences

- June 2015 18th Capra Meeting on Radiation Reaction, Kyoto, Japan
June 2015 General Relativity and Gravitation: A Centennial Perspective, Penn State University
June 2014 17th Capra Meeting on Radiation Reaction, Caltech
Feb 2013 Equations of Motion in Relativistic Gravity, Bad Honnef, Germany
June 2012 15th Capra Meeting on Radiation Reaction, University of Maryland
Apr 2011 Institute of Physics Nuclear and Particle Physics Divisional Conference, Glasgow

Prizes, awards and memberships

- Winner of the international Institute of Physics Gravitational Physics Group Thesis Prize, awarded for the best PhD thesis worldwide in the area of gravitational physics in 2009.
- Featured in the Classical and Quantum Gravity journal's "Highlights of 2010-2011".
- Meritorious award in the 2004 COMAP International Mathematical Contest in Modeling.
- UCD Undergraduate Entrance Scholarship.
- Irish Department of Education “Scolaireacht Gaeilge” (Irish scholarship), awarded yearly to the top 15 students in the country who sit their final exams through the Irish language.
- Member of the Institute of Physics.
- Member of the Einstein Toolkit consortium, providing open software for relativistic astrophysics.
- Member of the international Numerical Relativity-Astrophysical Relativity collaboration.

Organisation of Scientific Meetings

- Member of scientific and local organising committee: “Irish Quantum Foundations”, Dublin, Ireland (May 2017).
- Member of scientific and local organising committee: “16th Capra Meeting on Radiation Reaction in General Relativity”, Dublin, Ireland (July 2013). Responsibilities included: securing funding, organising scientific programme, creating website, reserving venue, organising accommodation.

Commissions of Trust

- Peer-reviewed journal referee: “Classical and Quantum Gravity”, “JPCS”, “Physical Review D”.
- Scientific computing lead on the committee which bought and tested the Albert Einstein Institute’s 2400 core cluster Datura, including design of the tender requirements.

Public outreach

- Featured in national televised news coverage of the gravitational wave discovery announcement by the LIGO collaboration (<http://www.rte.ie/news/2016/0211/767084-theory-of-general-relativity-einstein/>).
- Contributor to Dublin’s “City of Physics” public outreach project.
- Contributor to “DART of Physics” educational outreach project.

Scientific computing activities

- Active contributor to the Einstein Toolkit and Cactus open source scientific software.
- Co-author of “SimulationTools”, open source package for analysing large-scale scientific simulation data.
- Extensive experience with computer programming and highly proficient in languages including C, C++, Matlab, Maple, Mathematica, FORTRAN, Objective C, Python, Perl, PHP and Assembly.

Non-academic activities

- Captain and member of UCD Trampoline Club committee, 2003-2006.
- Member of UCD Windsurfing Club committee, 2003-2005.
- Google “Summer of Code” student developer.

Major collaborations

- Prof. David Chernoff and Prof. Eanna Flanagan, Astronomy Department, Cornell University.
Project: Gravitational back-reaction on cosmic strings.
- Dr. Chad Galley and Dr. Anil Zenginoglu, TAPIR, Caltech.
Project: Numerical methods for computing the Green function in curved spacetimes.
- Dr. Peter Diener (Louisiana State University), Dr. Ian Vega (University of the Philippines), Prof. Steven Detweiler (University of Florida), Dr. Jonathan Thornburg (Indiana University).
Project: Self-consistent evolution of point particles in curved spacetimes.
- Prof. Leor Barack (University of Southampton), Dr. Adam Pound (University of Southampton), Dr. Niels Warburton (MIT). Project: Second order gravitational self-force.

References

Prof. Adrian Ottewill,
School of Mathematical Sciences,
University College Dublin,
Dublin, Ireland.
Email: adrian.ottewill@ucd.ie
Tel: +353-1-716-5366

Prof. David F. Chernoff,
Department of Astronomy,
Cornell University,
Ithaca, NY 14853, USA.
Email: chernoff@astro.cornell.edu
Tel: +1 607-255-4755

Prof. Leor Barack,
School of Mathematics,
University of Southampton,
Southampton, United Kingdom.
Email: l.barack@soton.ac.uk
Tel: +44-23-80595134

Publications

Publications in peer-reviewed journals

1. Scalar self-force for highly eccentric equatorial orbits in Kerr spacetime
J. Thornburg and B. Wardell, Phys. Rev. D (in press)
2. Second-order perturbation theory: the problem of infinite mode coupling
J. Miller, B. Wardell, A. Pound, Phys. Rev. D 94, 104018 (2016)
3. Analytical high-order post-Newtonian expansions for spinning extreme mass ratio binaries
C. Kavanagh, A. C. Ottewill, B. Wardell, Phys. Rev. D 93, 124038 (2016)
4. Science with the space-based interferometer eLISA. I: Supermassive black hole binaries
A. Klein, E. Barausse, A. Sesana, A. Petiteau, E. Berti, S. Babak, J. Gair, S. Aoudia, I. Hinder, F. Ohme, B. Wardell, Phys. Rev. D 92, 123008 (2015)
5. Applying the effective-source approach to frequency-domain gravitational self-force calculations
B. Wardell and N. Warburton, Phys. Rev. D 92, 084019 (2015)
6. Octupolar invariants for compact binaries on quasi-circular orbits
P. Nolan, C. Kavanagh, S. R. Dolan, A. C. Ottewill, N. Warburton and B. Wardell, Phys. Rev. D 92, 123008 (2015)
7. Analytical high-order post-Newtonian expansions for extreme mass ratio binaries
C. Kavanagh, A. C. Ottewill, and B. Wardell, Phys. Rev. D (in press)
8. Tidal invariants for compact binaries on quasi-circular orbits
S. R. Dolan, P. Nolan, A. C. Ottewill, N. Warburton and B. Wardell, Phys. Rev. D 91, 023009 (2015)
9. Self-force via Green functions and worldline integration
B. Wardell, C. R. Galley, A. Zenginoglu, M. Casals, S. R. Dolan, and A. C. Ottewill, Phys. Rev. D 89, 084021 (2014)
10. Gravitational Self-Torque and Spin Precession in Compact Binaries
S. R. Dolan, N. Warburton, A. I. Harte, A. Le Tiec, B. Wardell, and L. Barack, Phys. Rev. D 89, 064011 (2014)
11. Applying the effective-source approach to frequency-domain self-force calculations
N. Warburton and B. Wardell, Phys. Rev. D 89, 044046 (2014)
12. Error-analysis and comparison to analytical models of numerical waveforms produced by the NRAR Collaboration
I. Hinder; et al., Class. Quantum Grav. 31, 025012 (2014)
13. High-order expansions of the Detweiler-Whiting singular field in Kerr spacetime
A. Heffernan, A. C. Ottewill, and B. Wardell, Phys. Rev. D 89, 024030 (2014)
14. Scalar self-force for a generic orbit around a Schwarzschild black hole
I. Vega, B. Wardell, P. Diener, S. Cupp and R. Haas, Phys. Rev. D 88, 084021 (2013)
15. Self-Force and Green Function in Schwarzschild spacetime via Quasinormal Modes and Branch Cut
M. Casals, S. R. Dolan, A. C. Ottewill and B. Wardell, Phys. Rev. D 88, 044022 (2013)
16. eLISA: Astrophysics and cosmology in the millihertz regime
P. Amaro-Seoane, et al., GW Notes 6 (2012)
17. High-order expansions of the Detweiler-Whiting singular field in Schwarzschild spacetime
A. Heffernan, A. C. Ottewill, and B. Wardell, Phys. Rev. D 86, 104023 (2012)
18. Generic effective source for scalar self-force calculations
B. Wardell, I. Vega, J. Thornburg, and P. Diener, Phys. Rev. D 85, 104044 (2012)
19. Self-Consistent Orbital Evolution of a Particle around a Schwarzschild Black Hole
P. Diener, I. Vega, B. Wardell, and S. Detweiler, Phys. Rev. Lett. 108, 191102 (2012)
20. Transport equation approach to calculations of Hadamard Green functions and non-coincident DeWitt coefficients
A. C. Ottewill and B. Wardell, Phys. Rev. D 84, 104039 (2011)
21. Self-force via m-mode regularization and 2+1D evolution. II. Scalar-field implementation on Kerr spacetime
S. R. Dolan, L. Barack, and B. Wardell, Phys. Rev. D 84, 084001 (2011)
22. Falloff of the Weyl scalars in binary black hole spacetimes
I. Hinder, B. Wardell, and E. Bentivegna, Phys. Rev. D 84, 024036 (2011)
23. Effective source approach to self-force calculations
I. Vega, B. Wardell, and P. Diener, Class. Quantum Grav. 28 134010 (2011)

24. Padé approximants of the Green function in spherically symmetric spacetimes
M. Casals, S. R. Dolan, A. C. Ottewill, and B. Wardell, Phys. Rev. D 79, 124044 (2009)
25. Self-force calculations with matched expansions and quasinormal mode sums
M. Casals, S. R. Dolan, A. C. Ottewill, and B. Wardell, Phys. Rev. D 79, 124043 (2009)
26. Quasilocal contribution to the scalar self-force: Nongeodesic motion
A. C. Ottewill and B. Wardell, Phys. Rev. D 79, 024031 (2009)
27. Quasilocal contribution to the scalar self-force: Geodesic motion
A. C. Ottewill and B. Wardell, Phys. Rev. D 77, 104002 (2008)

Research monographs

28. Self-force: Computational Strategies,
B. Wardell, Fundamental Theories of Physics, Vol. 179, pp 487-522 (Springer, 2015)

Publications in conference proceedings

29. Method of Matched Expansions & the Singularity Structure of the Green Function
M. Casals, S. R. Dolan, A. C. Ottewill and B. Wardell, Proceedings of the 12th Marcel Grossman Meeting on General Relativity, Paris, France, 12-18 July 2009.
30. A Transport Equation Approach to Green Functions and Self-force Calculations
A. C. Ottewill and B. Wardell, Proceedings of the 12th Marcel Grossman Meeting on General Relativity, Paris, France, 12-18 July 2009.