

# Niels Warburton

## Curriculum Vitae

Kavli Institute for Astrophysics and Space Research  
Massachusetts Institute of Technology  
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### Academic Employment

- 10/2014-present **Marie Curie IOF Postdoctoral Fellow: Outgoing Phase**, Kavli Institute for Astrophysics and Space Research, Massachusetts Institute of Technology, USA.
- 09/2012-09/2014 **Irish Research Council Postdoctoral Fellow**, Complex and Adaptive Systems Laboratory, University College Dublin, Ireland.

### Education

- 2008-2012 **Ph.D. in Mathematical Physics**, University of Southampton, UK. Thesis title: *Frequency domain approach to self-force calculations*, Supervisor: Leor Barack.
- 2004-2008 **MPhys. in Theoretical Physics**, University of Leeds, UK. Masters project title: *Classical dynamics of  $O(3)$  sigma model solitons in non-Euclidean space*, Supervisor: Martin Speight.

### Research Interests

General relativistic two-body problem and sources of gravitational waves  
Black hole perturbation theory and the gravitational self-force  
Geodesic motion in black hole spacetimes

### Publication list

#### In preparation

17. *Calculation of gauge-invariants in Kerr spacetime*  
N. Warburton, M. Casals, C. Kavanagh, A. C. Ottewill, B. Wardell

#### Peer-Reviewed Publications

16. *Inspiral into Gargantua*  
S. E. Gralla, S. A. Hughes, N. Warburton  
*Class. Quant. Grav.* 33:155002 (2016), [arXiv:1603.01221](https://arxiv.org/abs/1603.01221)
15. *Highly eccentric inspirals into a black hole*  
T. Osburn, N. Warburton, C. R. Evans  
*Phys. Rev. D* 93:064024 (2016), [arXiv:1511.01498](https://arxiv.org/abs/1511.01498)
14. *Particle on the Innermost Stable Circular Orbit of a Rapidly Spinning Black Hole*  
S. E. Gralla, A. P. Porfyriadis, N. Warburton  
*Phys. Rev. D* 92, 064029 (2015), [arXiv:1506.08496](https://arxiv.org/abs/1506.08496)
13. *Applying the effective-source approach to frequency-domain self-force calculations: Lorenz-gauge gravitational perturbations*  
B. Wardell, N. Warburton  
*Phys. Rev. D* 92, 084019 (2015), [arXiv:1505.07841](https://arxiv.org/abs/1505.07841)

12. *Octupolar invariants for compact binaries on quasi-circular orbits*  
P. Nolan, C. Kavanagh, S. R. Dolan, A. C. Ottewill, N. Warburton, B. Wardell  
[Phys. Rev. D 92:123008 \(2015\)](#), [arXiv:1505.04447](#)
11. *Comparison Between Self-Force and Post-Newtonian Dynamics: Beyond Circular Orbits*  
S. Akcay, A. Le Tiec, L. Barack, N. Sago, N. Warburton  
[Phys. Rev. D 91, 124014 \(2015\)](#), [arXiv:1503.01374](#)
10. *Self force on a scalar charge in Kerr spacetime: inclined circular orbits*  
N. Warburton  
[Phys. Rev. D 91, 024045 \(2015\)](#), [arXiv:1408.2885](#)
9. *Tidal invariants for compact binaries on quasi-circular orbits*  
S. R. Dolan, P. Nolan, A. C. Ottewill, N. Warburton, B. Wardell  
[Phys. Rev. D 91, 023009 \(2015\)](#), [arXiv:1406.4890](#)
8. *Gravitational Self-Force Correction to the Innermost Stable Circular Equatorial Orbit of a Kerr Black Hole*  
S. Isoyama, L. Barack, S. R. Dolan, A. Le Tiec, H. Nakano, A. G. Shah, T. Tanaka, N. Warburton  
[Phys. Rev. Lett. 113, 161101 \(2014\)](#), [arXiv:1404.6133](#)
7. *Gravitational self-torque and spin precession in compact binaries*  
S. Dolan, N. Warburton, A. I. Harte, A. Le Tiec, B. Wardell, L. Barack  
[Phys. Rev. D 89, 064011 \(2014\)](#), [arXiv:1312.0775](#)
6. *Applying the effective-source approach to frequency-domain self-force calculations*  
N. Warburton, B. Wardell  
[Phys. Rev. D 89, 044046 \(2014\)](#), [arXiv:1311.3104](#)
5. *Frequency-domain algorithm for the Lorenz-gauge gravitational self-force*  
S. Akcay, N. Warburton, L. Barack  
[Phys. Rev. D 88, 104009 \(2013\)](#), [arXiv:1308.5223](#)
4. *Isofrequency pairing of geodesic orbits in Kerr geometry*  
N. Warburton, L. Barack, N. Sago  
[Phys. Rev. D 87, 084012 \(2013\)](#), [arXiv:1301.3918](#)
3. *Evolution of inspiral orbits around a Schwarzschild black hole*  
N. Warburton, S. Akcay, L. Barack, J. Gair, N. Sago  
[Phys. Rev. D 85, 061501\(R\) \(2012\)](#), [arXiv:1111.6908](#)
2. *Self force on a scalar charge in Kerr spacetime: eccentric equatorial orbits*  
N. Warburton, L. Barack  
[Phys. Rev. D 83, 124038 \(2011\)](#), [arXiv:1103.0287](#)
1. *Self force on a scalar charge in Kerr spacetime: circular equatorial orbits*  
N. Warburton, L. Barack  
[Phys. Rev. D 81, 084039 \(2010\)](#), [arXiv:1003.1860](#)

## Presentations

### Invited Conference Talks and Seminars

- August 2015 **ICRA/CBPF seminar series**, *Centro Brasileiro de Pesquisas Físicas.*  
*The self-force approach to the general-relativistic two-body problem*
- July 2015 **14<sup>th</sup> Marcel Grossman meeting**, *Sapienza University, Italy.*  
*Evolving high-eccentricity inspirals using the self-force*

- July 2015 **18<sup>th</sup> Capra Meeting on Radiation Reaction**, *Kyoto University, Japan.*  
*Evolving high-eccentricity inspirals & Fluxes from rapidly rotating black holes*
- March 2015 **MSU Physics Colloquium**, *Montana State University, Bozeman, MT, USA.*  
*The self-force approach to the general-relativistic two-body problem*
- October 2014 **GRITTS Seminar**, *Massachusetts Institute of Technology, Cambridge MA, USA.*  
*The self-force approach to the general-relativistic two-body problem*
- June 2014 **17<sup>th</sup> Capra Meeting on Radiation Reaction**, *California Institute of Technology, USA.*  
*Numerical approaches to calculating the self-force and related quantities*
- April 2014 **CASL Seminar**, *University College Dublin, Ireland.*  
*Modelling Black Hole Binaries: the Self-force Approach*
- July 2013 **16<sup>th</sup> Capra Meeting on Radiation Reaction**, *University College Dublin, Ireland.*  
*Orbit evolution with the self-force: progress and challenges*

#### Selected Contributed Talks

- July 2016 **General Relativity and Gravitation 21**, *Columbia University, New York City, USA.*  
*Inspiral into Gargantua*
- June 2016 **19<sup>th</sup> Capra Meeting on Radiation Reaction**, *Paris Observatory, France.*  
*Inspiral into Gargantua: gravitational waves from near-extremal black holes*
- April 2016 **American Physical Society April Meeting**, *Salt Lake City, USA.*  
*Inspiral into Gargantua*
- June 2015 **General Relativity and Gravitation: A Centennial Perspective**, *Penn. State, USA.*  
*Evolution of High-Eccentricity Extreme-Mass-Ratio Binaries Using the Self-force*
- April 2015 **American Physic Society April Meeting**, *Baltimore, USA.*  
*Tidal invariants for compact binaries on quasi-circular orbits*
- June 2014 **17<sup>th</sup> Capra Meeting on Radiation Reaction**, *California Institute of Technology, USA.*  
*Applying the effective-source approach to frequency-domain self-force calculations*
- April 2014 **14<sup>th</sup> British Gravity meeting**, *University of Cambridge, UK.*  
*Applying the effective-source approach to frequency-domain self-force calculations*
- July 2013 **General Relativity and Gravitation 20**, *Uniwersytet Warszawski, Warsaw, Poland.*  
*Isofrequency pairing of geodesic orbits in Kerr geometry*
- April 2013 **13<sup>th</sup> British Gravity meeting**, *University of Sheffield, UK.*  
*Isofrequency pairing of geodesic orbits in Kerr geometry*
- July 2012 **13<sup>th</sup> Marcel Grossman meeting**, *Stockholm University, Sweden.*  
*Evolution of inspiral orbits around a Schwarzschild black hole*
- June 2012 **15<sup>th</sup> Capra Meeting on Radiation Reaction**, *University of Maryland, USA.*  
*Evolution of inspiral orbits around a Schwarzschild black hole*
- Sep 2011 **AstroGR meeting**, *Palma, Mallorca, Spain.*  
*At last: Full self-force EMRI waveforms (for non-rotating MBHs)*
- July 2011 **14<sup>th</sup> Capra Meeting on Radiation Reaction**, *University of Southampton, UK.*  
*Frequency-domain approach to self-force calculations: scalar-field in Kerr*
- July 2010 **General Relativity and Gravitation 19**, *UNAM, Mexico City, Mexico.*  
*Scalar self-force in Kerr spacetime: eccentric equatorial orbits*
- June 2010 **13<sup>th</sup> Capra Meeting on Radiation Reaction**, *Perimeter Institute, Waterloo, Canada.*  
*Scalar self-force in Kerr spacetime: eccentric equatorial orbits*

- April 2010 **10<sup>th</sup> British Gravity meeting**, *Dublin City University, Ireland.*  
*Scalar self-force in Kerr spacetime: circular equatorial orbits*
- July 2009 **12<sup>th</sup> Marcel Grossman meeting**, *Paris, France.*  
*Scalar self-force in Kerr spacetime: circular equatorial orbits*
- June 2009 **12<sup>th</sup> Capra Meeting on Radiation Reaction**, *Indiana University Bloomington, USA.*  
*Scalar self-force in Kerr spacetime: circular equatorial orbits*

## Awards and Professional Service

- Feb. 2016 Awarded Sociedade Brasileira de Física (SBF) and the American Physical Society (APS) travel grant for a collaborative research visit to Brazil (worth \$3000)
- 2014-present Referee for Physical Review D, Classical and Quantum Gravity and General Relativity and Gravitation
- July 2013 Co-organizer of the 16<sup>th</sup> Capra Meeting on Radiation Reaction at University College Dublin
- Dec. 2011 Awarded Institute of Physics Research Student Conference Fund for travel to ICGC2011, Goa, India (award worth £250)
- July 2011 Co-organizer of the 14<sup>th</sup> Capra Meeting on Radiation Reaction at the University of Southampton

## Teaching experience

- 2015-2016 Mentor for a student as part of the Undergraduate Research Opportunities Program (UROP) at MIT (6 months)
- 2014 Lectured a half-semester Master's level course at UCD entitled 'Case Studies in Simulation Science: motion and images in black hole spacetimes'
- 2012-2014 Assistant mentor to a Ph.D. student. Regular meetings were held with the student to discuss progress and future directions for his work
- 2009-2012 Teaching in undergraduate mathematics workshops
- 2008-2012 Teaching in mathematics, physics and engineering undergraduate tutorials

## Public Outreach

- Apr. 2016 Invited to participate in a press conference at the APS April meeting leading to two popular science articles on [Space.com](#) and [ScienceNews.org](#)
- Apr. 2015 Outreach scientist for 'Science by the Pint' in Cambridge, MA, USA
- Oct. 2013 Gave a one-hour lecture to the UCD physics society entitled 'Gravitational wave astronomy: opening a new window on our universe'
- Oct. 2011 TEAtime lecture aimed at 16-17 year olds entitled 'Multi-messenger astronomy: seeing and hearing the universe as never before'
- Mar. 2011 TEAtime public lecture entitled 'Black Hole Mirrors and the Self-force' given as part of National Science and Engineering week (lecture attended by over 200 members of the public)
- June 2010 Assistant educator for the University of Southampton Spectrum of Science Roadshow exhibit at the Cheltenham Science Festival

## Computer Skills

- Programming C and C++ (with MPI and OpenMP), Matlab, Java

Computer Algebra  
Publishing Mathematica, Maple  
 $\LaTeX$