

# Justin L. Ripley

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## Academic Employment

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<b>Research Associate</b> , Department of Physics, University of Illinois at Urbana-Champaign	<b>August 2022-present</b>
<b>Research Associate</b> , DAMTP, University of Cambridge	<b>October 2020-June 2022</b>
<b>Research and Teaching Assistant</b> , Princeton University	<b>September 2014-July 2020</b>

## Education

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<b>PhD, Physics</b> , Princeton University Advisor: Frans Pretorius	<b>September 2014-July 2020</b>
<b>BA, Physics</b> , Columbia University Minor in Mathematics Departmental honors in Physics, <i>summa cum laude</i> , Phi Beta Kappa	<b>September 2010-May 2014</b>

## Computational Experience

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- Languages: C/C++, Fortran (77/90), Python, Julia, Wolfram (Mathematica)
- Parallel computing: OpenMP, MPI
- Partial differential equations: finite differences, (pseudo)-spectral methods, adaptive mesh refinement
- Statistical analysis: Bayesian statistics, signal processing, Markov chain Monte-Carlo, machine learning
- Extensive experience developing and rapidly prototyping new codes. Github account: JLRipley314
- Experience working collaboratively on scientific software packages (GRChombo collaboration).

## Awards/Grants

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<b>Hartle award</b> International Society on General Relativity and Gravitation (GR 22/Amaldi 13 conference)	<b>December 2019</b>
<b>Erwin H. Leiwant Scholarship</b> Columbia University	<b>September 2013-May 2014</b>
<b>John Jay Scholar</b> Columbia University	<b>September 2010-May 2014</b>

## Teaching and Mentorship

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<b>Mentorship of PhD students</b>	
Daniel Caballero (University of Illinois at Urbana-Champaign)	<b>2023-present</b>
*Abhishek Hegade K. R. (University of Illinois at Urbana-Champaign)	<b>2022-present</b>
*Hengrui Zhu (Princeton University)	<b>2022-2024</b>
*Maxence Corman (Perimeter Institute for Theoretical Physics)	<b>2021-2022</b>
*Alex Pandya (Princeton University)	<b>2021-2022</b>
*Tamara Evstafyeva (University of Cambridge)	<b>2021-2022</b>
*Led to publication.	
<b>Mentorship of undergraduate students</b>	
Shikhar Kumar (University of Cambridge)	<b>Summer 2021</b>
Adam Wills (University of Cambridge)	<b>Summer 2021</b>
<b>Assistant Instructor, Princeton University</b> EGR/PHY 191, An integrated introduction to engineering, math, physics	<b>Fall 2019</b>

PHY 103/105, General Physics I Lab  
 PHY 304, Advanced Electromagnetism  
 AST 203, The Universe  
 PHY 523, General Relativity (graduate course)  
 AST 204, Topics in Modern Astronomy  
 PHY 301, Thermal Physics

Fall 2018  
 Spring 2018  
 Spring 2017, 2018  
 Fall 2017  
 Spring 2016  
 Fall 2015, Spring 2016

## Professional Activities

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### University of Illinois at Urbana-Champaign

University of Chicago - UIUC joint meetings co-organizer

September 2023-December 2023

### University of Cambridge, DAMTP

Friday general relativity seminar co-organizer

October 2020-June 2022

General relativity journal club co-organizer

October 2020-June 2022

### Princeton University Department of Physics

Member on the Climate and Inclusion Committee

September 2019-May 2020

### External PhD thesis reader

External thesis reader and committee member for Thanassis Giannakopoulos (University of Lisbon) September 2022

### Referee

Physical Review D, Physical Review Letters, Classical and Quantum Gravity

## Refereed Publications

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Link to all papers, including preprints: InSpire Hep

23. Hengrui Zhu, **Justin L. Ripley**, Alejandro Cárdenas-Avendano, Frans Pretorius, *Challenges in quasinormal mode extraction: Perspectives from numerical solutions to the Teukolsky equation*. Phys.Rev.D 109 (2024) 4, 044010 arXiv:2309.13204
22. **Justin L. Ripley**, Abhishek Hegade K.R., Nicolás Yunes, *Probing internal dissipative processes of neutron stars with gravitational waves during the inspiral of neutron star binaries*. Phys. Rev. D 108 (2023) 10, 103037 arXiv:2306.15633
21. Abhishek Hegade K.R., **Justin L. Ripley**, Nicolás Yunes, *Nonrelativistic limit of first-order relativistic viscous fluids*. Phys.Rev.D 107 (2023) 12, 124029 arXiv:2305.09725
20. Tamara Evstafyeva, Michalis Agathos, **Justin L. Ripley**, *Measuring the ringdown scalar polarization of gravitational waves in Einstein-scalar-Gauss-Bonnet gravity*. Phys. Rev. D 107 (2023), 124010 arXiv:2212.11359
19. Abhishek Hegade K.R., **Justin L. Ripley**, Nicolás Yunes, *Where and why does Einstein-scalar-Gauss-Bonnet theory break down?*. Phys.Rev.D 107 (2023) 4, 044044. arXiv:2211.08477
18. Maxence Corman, **Justin L. Ripley**, William E. East, *Nonlinear studies of binary black hole mergers in Einstein-scalar-Gauss-Bonnet gravity*. Phys.Rev.D 107 (2023) 2, 024014. arXiv:2210.09235
17. Alex Pandya, **Justin L. Ripley**, *Dynamics of a nonminimally coupled scalar field in asymptotically  $AdS_4$  spacetime*. Class.Quant.Grav. 39 (2022) 21, 215018. arXiv:2206.08854
16. **Justin L. Ripley**, *Numerical relativity for Horndeski gravity*. IJMPD 31(13):2230017, 2022. arXiv:2207.13074
15. Maxence Corman, William E. East, **Justin L. Ripley**, *Evolution of black holes through a nonsingular cosmological bounce*. JCAP 09 (2022) 063 arXiv:2206.08466
14. **Justin L. Ripley**, *Computing the quasinormal modes and eigenfunctions for the Teukolsky equation using horizon penetrating, hyperboloidally compactified coordinates*. Class. Quantum Grav. 39 (14) 145009 (2022). arXiv:2202.03837
13. William E. East, **Justin L. Ripley**, *Dynamics of Spontaneous Black Hole Scalarization and Mergers in Einstein-Scalar-Gauss-Bonnet Gravity*. Phys. Rev. Lett. 127, 101102 (2021). arXiv:2105.08571
12. **Justin L. Ripley**, *A symmetric hyperbolic formulation of the vacuum Einstein equations in affine-null coordinates*. Journal of Mathematical Physics 62, 062501 (2021). arXiv:2104.09972

11. **Justin L. Ripley**, Nicholas Loutrel, Elena Giorgi, and Frans Pretorius. *Numerical computation of second-order vacuum perturbations of Kerr black holes*. Phys. Rev. D 103 (10), 104018 (2021). arXiv:2010.00162
10. Nicholas Loutrel, **Justin L. Ripley**, Elena Giorgi, and Frans Pretorius. *Second Order Perturbations of Kerr Black Holes: Reconstruction of the Metric*. Phys. Rev. D 103, 104017 (2021). arXiv:2008.11770
9. William E. East, **Justin L. Ripley**. *Evolution of Einstein-scalar-Gauss-Bonnet gravity using a modified harmonic formulation*. Phys.Rev.D 103 4, 044040 (2021). arXiv:2011.03547
8. **Justin L. Ripley**, Frans Pretorius. *Dynamics of a  $\mathbb{Z}_2$  symmetric EdGB gravity in spherical symmetry*. Class. Quantum Grav. 37 (15), 155003 (2020). arXiv:2005.05417
7. **Justin L. Ripley**, Frans Pretorius. *Scalarized black hole dynamics in Einstein-dilaton-Gauss-Bonnet gravity*. Phys. Rev. D 101 (4), 044015 (2019). arXiv:1911.11027
6. **Justin L. Ripley**. *Excision and avoiding the use of boundary conditions in numerical relativity*. Class. Quantum Grav. 36 (23) 237001 (2019). arXiv:1908.04234
5. **Justin L. Ripley**, Frans Pretorius. *Gravitational collapse in Einstein dilaton Gauss-Bonnet gravity* Class. Quantum Grav. 36 (13) 134001 (2019). arXiv:1903.07543
4. **Justin L. Ripley**, Frans Pretorius. *Hyperbolicity in Spherical Collapse of a Horndeski Theory*. Phys. Rev. D 99 (8), 084014 (2019). arXiv:1902.01468
3. **Justin L. Ripley**, Kent Yagi. *Black hole perturbation under a 2+2 decomposition in the action*. Phys. Rev. D 97 (2), 024009 (2017). arXiv:1705.03068
2. Anna Ijjas, **Justin L. Ripley**, Paul J. Steinhardt. *NEC violation in mimetic cosmology revisited*. Phys.Lett. B760 132-138 (2016). arXiv:1604.08586
1. **Justin L. Ripley**, Brian D. Metzger, Almudena Arcones, and Gabriel Martinez-Pinedo. *X-ray Decay Lines from Heavy Nuclei in Supernova Remnants as a Probe of the r-Process Origin and the Birth Periods of Magnetars*. Mon. Not. Roy. Astron. Soc. 438 (4), 3243-3254 (2013). arXiv:1310.2950

**GRChombo collaboration papers:** For contributions to the GRChombo collaboration numerical relativity code.

2. Radia et al., *Lessons for adaptive mesh refinement in numerical relativity*. Class. Quant. Grav. 39 (13) 135006 (2022). arXiv:2112.10567
1. Andrade et al., *GRChombo: An adaptable numerical relativity code for fundamental physics*. J. Open Source Softw. 6 (2021) 3703. arXiv:2201.03458

## Colloquia, Seminars, and Conferences

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### Colloquia

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|----------------------------------------------------------|----------------------|
| 1. Oregon State University, Corvallis, OR                | <b>November 2023</b> |
| <i>Neutron stars: a window into dense nuclear matter</i> |                      |

### Invited conference talks/seminars

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|-----------------------------------------------------------------------------------------|-----------------------|
| 21. University of Illinois at Urbana-Champaign, Urbana, IL                              | <b>February 2024</b>  |
| <i>Probing the internal dynamics of neutron stars with gravitational waves</i>          |                       |
| 20. Infinity seminar (online)                                                           | <b>December 2023</b>  |
| <i>Measuring quasinormal modes in hyperboloidal slicings of Kerr</i>                    |                       |
| 19. University of Oregon, Eugene, OR                                                    | <b>November 2023</b>  |
| <i>Probing the internal dynamics of neutron stars with gravitational waves</i>          |                       |
| 18. University of Mississippi, Oxford, MS (online)                                      | <b>October 2023</b>   |
| <i>Probing internal dissipative processes of neutron stars with gravitational waves</i> |                       |
| 17. California Institute of Technology, Pasadena, CA                                    | <b>August 2023</b>    |
| <i>Probing internal dissipative processes of neutron stars with gravitational waves</i> |                       |
| 16. University of Illinois at Urbana-Champaign, Urbana, IL                              | <b>September 2022</b> |
| <i>Modeling black hole binaries in modified theories of gravity</i>                     |                       |

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| 15. Black Hole Initiative, Harvard University, Cambridge, MA (online)<br><i>Numerical Relativity and testing General Relativity with gravitational waves: Parts I&amp;II</i> | <b>March 2022</b>    |
| 14. University of Tübingen, Tübingen, DE (online)<br><i>Evolution of binary black hole systems in scalar Gauss-Bonnet gravity</i>                                            | <b>February 2022</b> |
| 13. Albert Einstein Institute, Potsdam, DE (online)<br><i>Evolution of binary black hole systems in scalar Gauss-Bonnet gravity</i>                                          | <b>November 2021</b> |
| 12. Sapienza University of Rome, Rome, IT (online)<br><i>Computing the second order gravitational perturbation of Kerr black holes</i>                                       | <b>May 2021</b>      |
| 11. University of Oxford, Oxford, UK (online)<br><i>The classical evolution of binary black hole systems in scalar-tensor theories</i>                                       | <b>February 2021</b> |
| 10. University of Virginia, Charlottesville, VA (online)<br><i>The classical evolution of binary black hole systems in scalar-tensor theories</i>                            | <b>February 2021</b> |
| 9. Kyoto University, Kyoto, JP (online)<br><i>The classical evolution of binary black hole systems in scalar-tensor theories</i>                                             | <b>February 2021</b> |
| 8. University of Southampton, Southampton, UK (online)<br><i>The classical evolution of binary black hole systems in scalar-tensor theories</i>                              | <b>January 2021</b>  |
| 7. University of Cambridge, Cambridge, UK (online)<br><i>Computing the second order gravitational perturbation of Kerr black holes</i>                                       | <b>November 2020</b> |
| 6. Johns Hopkins University, Baltimore, MD (online)<br><i>Numerical computation of second order vacuum perturbations of Kerr black holes</i>                                 | <b>November 2020</b> |
| 5. Princeton University, Princeton, NJ (online)<br><i>Classical modifications to Einstein's General Relativity around black holes</i>                                        | <b>October 2020</b>  |
| 4. Perimeter Institute, Waterloo, ON (online)<br><i>Exploring the nonlinear dynamics of Einstein dilaton Gauss-Bonnet gravity</i>                                            | <b>April 2020</b>    |
| 3. University of Illinois, Urbana, IL<br><i>Testing General Relativity and the nonlinear dynamics of modified gravity theories</i>                                           | <b>January 2020</b>  |
| 2. Massachusetts Institute of Technology, Cambridge, MA<br><i>Second order vacuum perturbation of a Kerr black hole</i>                                                      | <b>December 2019</b> |
| 1. Black Hole Initiative, Harvard University, Cambridge, MA<br><i>Nonlinear dynamics of Horndeski theories in spherical collapse</i>                                         | <b>December 2019</b> |

#### Contributed conference talks/seminars

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| 13. APS April Meeting, Sacramento, CA<br><i>Probing internal dissipative processes of neutron stars with gravitational waves</i>                           | <b>April 2024</b> |
| 12. Midwest Relativity Meeting, Chicago, IL<br><i>Probing internal dissipative processes of neutron stars with gravitational waves during the inspiral</i> | <b>Nov 2023</b>   |
| 11. Amaldi 15 (Online)<br><i>Probing internal dissipative processes of neutron stars with gravitational waves</i>                                          | <b>July 2023</b>  |
| 10. APS April Meeting, Minneapolis, MN<br><i>Impact of viscosity on the orbital dynamics of neutron star binaries</i>                                      | <b>April 2023</b> |
| 9. GR23 (online)<br><i>Evolution of binary scalar-hairy black holes</i>                                                                                    | <b>July 2022</b>  |
| 8. EPS-HEP2021 Conference (online)<br><i>Modeling black hole binaries in scalar-tensor theories of gravity</i>                                             | <b>July 2021</b>  |
| 7. APS April Meeting, Sacramento, CA (online)<br><i>Application of the modified generalized harmonic formulation to scalar-tensor gravity theories</i>     | <b>April 2021</b> |

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| 6. BritGrav21, UCD, Dublin, Ireland (online)<br><i>Computing the second order vacuum perturbation of Kerr black holes</i>            | <b>April 2021</b>    |
| 5. XIII Black Holes Workshop, IST, Lisbon, PT (online)<br><i>Computing the second order vacuum perturbation of a Kerr black hole</i> | <b>December 2020</b> |
| 4. APS April Meeting, Washington, DC (online)<br><i>Second order perturbation of a Kerr black hole</i>                               | <b>April 2020</b>    |
| 3. GR 22/Amaldi 13, Valencia, Spain<br><i>Nonlinear dynamics of Horndeski theories in spherical collapse</i>                         | <b>July 2019</b>     |
| 2. APS April Meeting, Denver, CO<br><i>Hyperbolicity in gravitational collapse in a modified gravity theory</i>                      | <b>April 2019</b>    |
| 1. Numerical Relativity beyond General Relativity, Benasque, Spain<br><i>Gravitational collapse in a modified gravity theory</i>     | <b>June 2018</b>     |