

# Paul C. Duffell

## Contact

Harvard-Smithsonian Center for Astrophysics  
60 Garden Street  
Cambridge, MA 02138  
paul.duffell@cfa.harvard.edu

## Research Experience

**Harvard-Smithsonian Center for Astrophysics**      Cambridge, MA  
Institute for Theory and Computation  
Prize Postdoctoral Fellow  
September 2018 - Present

**University of California, Berkeley**      Berkeley, CA  
Theoretical Astrophysics Center  
Prize Postdoctoral Fellow  
September 2014 - August 2018

**New York University**      New York, NY  
Center for Cosmology and Particle Physics  
Advisor: Prof. Andrew MacFadyen  
September 2008 - August 2014

**Columbia University**      New York, NY  
Physics Department  
Advisor: Prof. Amber Miller  
September 2006 - August 2008

## Education

**New York University**      *New York, NY*  
Ph.D., Physics, May 2014  
GPA: 3.97/4.00  
Thesis Title: "Moving Mesh Astrophysics"  
Thesis Advisor: Andrew MacFadyen

**University of Washington**      *Seattle, WA*  
Degree: B.S. in Physics  
Dates: Fall 1998 - Spring 2001

## Fellowships and Awards

Harvard ITC Fellow, 2018-Present  
Gordon and Betty Moore Fellow, 2017-2018  
Berkeley TAC Fellow, 2014-2017  
NYU Outstanding Teaching Award, 2013  
Dean's Dissertation Fellow, 2013-2014  
Mark Leslie Fellow, 2011-2012  
James Arthur Fellow, 2010-2011  
Dean's Science Advisory Board Fellow, 2010  
MacCracken Fellow, 2008-2010

## Supercomputing Allocations

NASA High-end Computing SMD-14-5427, 2,457,602 processor-hours (204792 SBUs) on "Pleiades" at NAS, estimated full cost value \$90,000, November 1, 2014 – October 31, 2015.

## Journal Articles Submitted or in Press

1. *Jet Dynamics in Compact Object Mergers: GW170817 Likely had a Successful Jet*  
Duffell, P. C., E. Quataert, D. Kasen, and H. Klion  
The Astrophysical Journal, 2018
2. *Modeling of Mixing from Rayleigh-Taylor Instabilities in Core Collapse Supernovae Ejecta*  
Duffell, P. C. and L. Bildsten  
The Astrophysical Journal, 2018
3. *On the Deceleration and Spreading of Relativistic Jets II: Observational Signatures*  
Laskar, T. and P. Duffell  
The Astrophysical Journal, 2018
4. *On the Deceleration and Spreading of Relativistic Jets I: Jet Dynamics*  
Duffell, P. C. and T. Laskar  
The Astrophysical Journal, 2018

## Published Journal Articles

1. *A GRB and Broad-lined Type Ic Supernova from a Single Central Engine*  
Barnes, J., and 6 colleagues  
The Astrophysical Journal, 860, 38 (2018)
2. *Models of bright nickel-free supernovae from stripped massive stars with circumstellar shells*  
Kleiser, I. K. W., D. Kasen, and P. C. Duffell  
Monthly Notices of the Royal Astronomical Society, 475, 3152 (2018)
3. *Interaction of a Supernova with a Circumstellar Disk*  
McDowell, A. T., P. C. Duffell, and D. Kasen  
The Astrophysical Journal, 856, 29 (2018)
4. *Modules for Experiments in Stellar Astrophysics (MESA): Convective Boundaries, Element Diffusion, and Massive Star Explosions*  
Paxton, B., and 12 colleagues  
The Astrophysical Journal Supplement Series, 234, 34 (2018)
5. *Rayleigh-Taylor Instability in Interacting Supernovae: Implications for Synchrotron Magnetic Fields*  
Duffell, P. C. and D. Kasen  
The Astrophysical Journal, 842, 18 (2017)
6. *DISCO: A 3D Moving-mesh Magnetohydrodynamics Code Designed for the Study of Astrophysical Disks*  
Duffell, P. C.  
The Astrophysical Journal Supplement Series, 226, 2 (2016)
7. *A transition in circumbinary accretion discs at a binary mass ratio of 1:25*  
D’Orazio, D. J., and 4 colleagues  
Monthly Notices of the Royal Astronomical Society, 459, 2379 (2016)
8. *A One-Dimensional Model for Rayleigh-Taylor Instability in Supernova Remnants*  
Duffell, P. C.  
The Astrophysical Journal, 821, 76 (2016)

9. *A Narrow Short-duration GRB Jet from a Wide Central Engine*  
Duffell, P. C., E. Quataert, and A. I. MacFadyen  
The Astrophysical Journal, 813, 64 (2015)
10. *Eccentric Jupiters via Disk-Planet Interactions*  
Duffell, P. C. and E. Chiang  
The Astrophysical Journal, 812, 94 (2015)
11. *A reduced orbital period for the supermassive black hole binary candidate in the quasar PG 1302-102?*  
D’Orazio, D. J., and 4 colleagues  
Monthly Notices of the Royal Astronomical Society, 452, 2540 (2015)
12. *Producing Magnetar Magnetic Fields in the Merger of Binary Neutron Stars*  
Giacomazzo, B., and 4 colleagues  
The Astrophysical Journal, 809, 39 (2015)
13. *A Simple Analytical Model for Gaps in Protoplanetary Disks*  
Duffell, P. C.  
The Astrophysical Journal, 807, L11 (2015)
14. *From Engine to Afterglow: Collapsars Naturally Produce Top-heavy Jets and Early-time Plateaus in Gamma-Ray Burst Afterglows*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal, 806, 205 (2015)
15. *Halting Migration: Numerical Calculations of Corotation Torques in the Weakly Nonlinear Regime*  
Duffell, P. C.  
The Astrophysical Journal, 806, 182 (2015)
16. *High-frequency Voronoi noise reduced by smoothed-mesh motion*  
Duffell, P. C. and A. I. MacFadyen  
Monthly Notices of the Royal Astronomical Society, 449, 2718 (2015)
17. *Shallow Cavities in Multiple-planet Systems*  
Duffell, P. C. and R. Dong  
The Astrophysical Journal, 802, 42 (2015)
18. *Binary black hole accretion during inspiral and merger*  
Farris, B. D., P. Duffell, A. I. MacFadyen, and Z. Haiman  
Monthly Notices of the Royal Astronomical Society, 447, L80 (2015)
19. *Characteristic signatures in the thermal emission from accreting binary black holes*  
Farris, B. D., P. Duffell, A. I. MacFadyen, and Z. Haiman  
Monthly Notices of the Royal Astronomical Society, 446, L36 (2015)
20. *Balancing the Load: A Voronoi Based Scheme for Parallel Computations*  
Steinberg, E., A. Yalinewich, R. Sari, and P. Duffell  
The Astrophysical Journal Supplement Series, 216, 14 (2015)
21. *The Migration of Gap-opening Planets is Not Locked to Viscous Disk Evolution*  
Duffell, P. C., and 4 colleagues  
The Astrophysical Journal, 792, L10 (2014)
22. *Shock Corrugation by Rayleigh-Taylor Instability in Gamma-Ray Burst Afterglow Jets*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal, 791, L1 (2014)
23. *Binary Black Hole Accretion from a Circumbinary Disk: Gas Dynamics inside the Central Cavity*  
Farris, B. D., P. Duffell, A. I. MacFadyen, and Z. Haiman  
The Astrophysical Journal, 783, 134 (2014)

24. *The Fate of Fallback Matter around Newly Born Compact Objects*  
Perna, R., P. Duffell, M. Cantiello, and A. I. MacFadyen  
The Astrophysical Journal, 781, 119 (2014)
25. *A “Boosted Fireball” Model for Structured Relativistic Jets*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal, 776, L9 (2013)
26. *Rayleigh-Taylor Instability in a Relativistic Fireball on a Moving Computational Grid*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal, 775, 87 (2013)
27. *Gap Opening by Extremely Low-mass Planets in a Viscous Disk*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal, 769, 41 (2013)
28. *Global Calculations of Density Waves and Gap Formation in Protoplanetary Disks Using a Moving Mesh*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal, 755, 7 (2012)
29. *TESS: A Relativistic Hydrodynamics Code on a Moving Voronoi Mesh*  
Duffell, P. C. and A. I. MacFadyen  
The Astrophysical Journal Supplement Series, 197, 15 (2011)

#### Invited Talks and Conference Proceedings

- Invited Talk: Canadian Institute for Theoretical Astrophysics, May 2018
- Invited Talk: Center for Computational Astrophysics, February 2018
- Invited Talk: University of Pennsylvania, February 2018
- Invited Talk: University of Amsterdam, January 2018
- Invited Talk: University of California, Santa Cruz, Transient Lunch, November 2017
- Invited Talk: Center for Computational Astrophysics, October 2017
- Invited Talk: Columbia University, October 2017
- Invited Talk: Carnegie Observatories, October 2017
- Invited Talk: California Institute of Technology, TAPIR Seminar, October 2017
- Invited Talk: Harvard Center for Astrophysics, ITC Colloquium, October 2017
- Invited Talk: Univ. of Illinois, Astrophysics, Gravitation and Cosmology Seminar, September 2017
- Invited Talk: Kavli Institute for Theoretical Physics, Conference on “Phenomena, Physics, and Puzzles Of Massive Stars and their Explosive Outcomes”, March 2016
- Invited Talk: University of California, Santa Cruz, FLASH Seminar, May 2015
- Invited Talk: New York University, CCPP Astrophysics Seminar, March 2015
- Invited Talk: California Institute of Technology, TAPIR Seminar, February 2015
- Invited Talk: Stony Brook University, Astronomy Seminar, April 2014
- Invited Talk, Princeton University, Astrophysics Seminar, December 2013
- Contributed Talk: American Astronomical Society Meeting, Abstracts #223, 223, #308.02 (2014)
- Contributed Talk: 26th Texas Symposium on Relativistic Astrophysics, December 2013
- Invited Talk: University of Colorado, Boulder, CASA Astrophysics Lunch Seminar, October 2013
- Invited Talk: University of California, Berkeley, TAC Astrophysics Seminar, August 2013
- Invited Talk: American Museum of Natural History, Astrophysics Department Seminar, May 2011
- Invited Talk: Harvard Center for Astrophysics, ITC Seminar, March 2011

**Teaching experience**

Instructor for Physics 110A (Electricity and Magnetism for advanced undergraduates)  
UC Berkeley, Spring 2018

**Teaching evaluations available upon request**

Designed, organized and instructed a week-long summer course:

*How to Write a Hydro Code*

UC Berkeley, June 2016

Teaching assistant for the following courses at New York University:

- *Electricity and Magnetism for advanced undergraduate students*  
Fall 2009, Fall 2011, Fall 2012
- *Electricity and Magnetism for graduate students*  
Spring 2010, Spring 2013
- *General Relativity for advanced undergraduate students*  
Spring 2010, Spring 2012, Spring 2014
- *Fluid Dynamics*  
Spring 2014
- *Computational Physics*  
Fall 2013
- *Physics III (Waves, Optics, Thermodynamics)*  
Fall 2010
- *Mathematical Methods in Physics*  
Spring 2011
- *General Physics (Physics for non-majors, typically pre-med)*  
Fall 2008, Spring 2009