

Paul C. Duffell

Contact

Department of Physics and Astronomy
Purdue University
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Research Experience

Purdue University Assistant Professor January 2021 –	West Lafayette, IN
Center for Astrophysics Harvard & Smithsonian Institute for Theory and Computation Prize Postdoctoral Fellow September 2018 – December 2020	Cambridge, MA
University of California, Berkeley Theoretical Astrophysics Center Prize Postdoctoral Fellow September 2014 – August 2018	Berkeley, CA
New York University Center for Cosmology and Particle Physics Advisor: Prof. Andrew MacFadyen September 2008 – August 2014	New York, NY
Columbia University Physics Department Advisor: Prof. Amber Miller September 2006 – August 2008	New York, NY

Education

New York University	<i>New York, NY</i>
Ph.D., Physics, May 2014	
GPA: 3.97/4.00	
Thesis Title: “Moving Mesh Astrophysics”	
Thesis Advisor: Andrew MacFadyen	
University of Washington	<i>Seattle, WA</i>
Degree: B.S. in Physics	
Dates: Fall 1998 - Spring 2001	

Fellowships and Awards

Harvard ITC Fellow, 2018-2020
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.

Teaching experience**Instructor, Purdue University**

Physics 562 (High Energy Astrophysics)
Spring 2021

Instructor, UC Berkeley

Physics 110A (Electricity and Magnetism)
Spring 2018

Informal Teaching, UC Berkeley

Designed, organized and instructed a week-long summer course:
How to Write a Hydro Code
UC Berkeley, June 2016

Adjunct Instructor, New York University

Fall 2008 - Spring 2014 (Teaching Assistant)
Awarded "Outstanding Teaching Award" by New York University in 2013

Journal Articles Submitted or in Press

1. *Moving-mesh radiation-hydrodynamic simulations of wind-reprocessed transients*
Calderón, D., O. Pejcha, and P. C. Duffell
arXiv e-prints, arXiv:2105.08735 (2021)
2. *Proto-magnetar jets as central engines for broad-lined type Ic supernovae*
Shankar, S., and 4 colleagues
arXiv e-prints, arXiv:2105.08092 (2021)
3. *Orbital Evolution of Equal-Mass Eccentric Binaries Due to a Gas Disk: Eccentric Inspirals and Circular Outspirals*
D’Orazio, D. J. and P. C. Duffell
arXiv e-prints, arXiv:2103.09251 (2021)

Published Journal Articles

1. *The effect of jet-ejecta interaction on the viewing angle dependence of kilonova light curves*
Klion, H., P. C. Duffell, D. Kasen, and E. Quataert
Monthly Notices of the Royal Astronomical Society, 502, 865 (2021)
2. *Evolution of gas disc-embedded intermediate mass ratio inspirals in the LISA band*
Derdzinski, A., and 4 colleagues
Monthly Notices of the Royal Astronomical Society, 501, 3540 (2021)
3. *Circumbinary Disks: Accretion and Torque as a Function of Mass Ratio and Disk Viscosity*
Duffell, P. C., and 6 colleagues
The Astrophysical Journal, 901, 25 (2020)
4. *How Dense of a Circumstellar Medium Is Sufficient to Choke a Jet?*
Duffell, P. C. and A. Y. Q. Ho
The Astrophysical Journal, 900, 193 (2020)
5. *An Empirically Derived Formula for the Shape of Planet-induced Gaps in Protoplanetary Disks*
Duffell, P. C.
The Astrophysical Journal, 889, 16 (2020)
6. *Erratum: Probing gas disc physics with LISA: simulations of an intermediate mass ratio inspiral in an accretion disc*
Derdzinski, A. M., and 4 colleagues
Monthly Notices of the Royal Astronomical Society, 489, 4860 (2019)
7. *Probing gas disc physics with LISA: simulations of an intermediate mass ratio inspiral in an accretion disc*
Derdzinski, A. M., and 4 colleagues
Monthly Notices of the Royal Astronomical Society, 486, 2754 (2019)

8. *ALMA Detection of a Linearly Polarized Reverse Shock in GRB 190114C*
Laskar, T., and 13 colleagues
The Astrophysical Journal, 878, L26 (2019)
9. *Gas Flows Within Cavities of Circumbinary Disks in Eccentric Binary Protostellar Systems*
Mösta, P., R. E. Taam, and P. C. Duffell
The Astrophysical Journal, 875, L21 (2019)
10. *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, 866, 3 (2018)
11. *On the Deceleration and Spreading of Relativistic Jets. I. Jet Dynamics*
Duffell, P. C. and T. Laskar
The Astrophysical Journal, 865, 94 (2018)
12. *A GRB and Broad-lined Type Ic Supernova from a Single Central Engine*
Barnes, J., and 6 colleagues
The Astrophysical Journal, 860, 38 (2018)
13. *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)
14. *Interaction of a Supernova with a Circumstellar Disk*
McDowell, A. T., P. C. Duffell, and D. Kasen
The Astrophysical Journal, 856, 29 (2018)
15. *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)
16. *Rayleigh-Taylor Instability in Interacting Supernovae: Implications for Synchrotron Magnetic Fields*
Duffell, P. C. and D. Kasen
The Astrophysical Journal, 842, 18 (2017)
17. *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)
18. *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)
19. *A One-Dimensional Model for Rayleigh-Taylor Instability in Supernova Remnants*
Duffell, P. C.
The Astrophysical Journal, 821, 76 (2016)

20. *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)
21. *Eccentric Jupiters via Disk-Planet Interactions*
Duffell, P. C. and E. Chiang
The Astrophysical Journal, 812, 94 (2015)
22. *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)
23. *Producing Magnetar Magnetic Fields in the Merger of Binary Neutron Stars*
Giacomazzo, B., and 4 colleagues
The Astrophysical Journal, 809, 39 (2015)
24. *A Simple Analytical Model for Gaps in Protoplanetary Disks*
Duffell, P. C.
The Astrophysical Journal, 807, L11 (2015)
25. *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)
26. *Halting Migration: Numerical Calculations of Corotation Torques in the Weakly Nonlinear Regime*
Duffell, P. C.
The Astrophysical Journal, 806, 182 (2015)
27. *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)
28. *Shallow Cavities in Multiple-planet Systems*
Duffell, P. C. and R. Dong
The Astrophysical Journal, 802, 42 (2015)
29. *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)
30. *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)
31. *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)

32. *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)
33. *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)
34. *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)
35. *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)
36. *A “Boosted Fireball” Model for Structured Relativistic Jets*
Duffell, P. C. and A. I. MacFadyen
The Astrophysical Journal, 776, L9 (2013)
37. *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)
38. *Gap Opening by Extremely Low-mass Planets in a Viscous Disk*
Duffell, P. C. and A. I. MacFadyen
The Astrophysical Journal, 769, 41 (2013)
39. *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)
40. *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