Paul C. Duffell

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Education

New York University *New York, NY*
Ph.D., Physics, May 2014
GPA: 3.97/4.00
Concentration: Computational Astrophysics
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

Berkeley TAC Fellowship, 2014-Present

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

WAVE Scholar, 1998-2000

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.

Published (or in press) Journal Articles

1. *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)
2. *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)
3. *A One-Dimensional Model for Rayleigh-Taylor Instability in Supernova Remnants*
   Duffell, P. C.
   The Astrophysical Journal, 821, 76 (2016)

4. *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)
5. *Eccentric Jupiters via Disk-Planet Interactions*
   Duffell, P. C. and E. Chiang
   The Astrophysical Journal, 812, 94 (2015)
6. *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)
7. *Producing Magnetar Magnetic Fields in the Merger of Binary Neutron Stars*
   Giacomazzo, B., and 4 colleagues
   The Astrophysical Journal, 809, 39 (2015)
8. *A Simple Analytical Model for Gaps in Protoplanetary Disks*
   Duffell, P. C.
   The Astrophysical Journal, 807, L11 (2015)
9. *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)
10. *Halting Migration: Numerical Calculations of Corotation Torques in the Weakly Nonlinear Regime*
    Duffell, P. C.
    The Astrophysical Journal, 806, 182 (2015)
11. *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)
12. *Shallow Cavities in Multiple-planet Systems*
    Duffell, P. C. and R. Dong
    The Astrophysical Journal, 802, 42 (2015)
13. *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)
14. *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)
15. *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)
16. *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)
17. *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)
18. *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)

19. *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)
20. *A "Boosted Fireball" Model for Structured Relativistic Jets*
Duffell, P. C. and A. I. MacFadyen
The Astrophysical Journal, 776, L9 (2013)
21. *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)
22. *Gap Opening by Extremely Low-mass Planets in a Viscous Disk*
Duffell, P. C. and A. I. MacFadyen
The Astrophysical Journal, 769, 41 (2013)
23. *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)
24. *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: 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, AMNH Astrophysics Department Seminar, May 2011
Invited Talk: Harvard Center for Astrophysics, ITC Seminar, March 2011

Research

University of California, Berkeley Berkeley, CA
Theoretical Astrophysics Center
Prize Postdoctoral Fellow
August 2014 - Present

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

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

Computer skills

Thorough expertise in the C programming language. Broad knowledge of Linux, Unix, and MacOS development environments. Considerable experience developing and deploying software on distributed memory (Beowulf-style) Linux clusters including NASA's petaflop SGI cluster, *Pleiades*. Experience coding and running parallel simulations on 10,000+ cores. Fluent with the Message Passing Interface (MPI). Experience with developing parallel algorithms for data mapping and communication. Familiar with HDF5 operations for hardware-intensive data transfers. Working knowledge of GPU multi-threaded programming and the CUDA programming language.

Working knowledge of commercial software such as Mathematica, Matlab, and IDL. Experience with scientific data visualization by programming directly with the OpenGL C API.

Experience with additional science API's include the FFTW interface, Intel's Math Kernel Library, LAPACK, the GNU Science Library, and the mesh generation packages Triangle, Qhull and TetGen.

Teaching experience

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