

KEATON J. BURNS

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EDUCATION

<i>Candidate for Ph.D. in Physics</i>	<i>Expected 2018</i>
Massachusetts Institute of Technology	2013 – Present
Master of Advanced Study in Mathematics (Part III)	2013
Churchill College, University of Cambridge	2012 – 2013
Bachelor of Arts in Applied Mathematics, Physics, and Astrophysics	2012
University of California Berkeley	2009 – 2012
University of Massachusetts Amherst	2008 – 2009
Highest Honors in Applied Mathematics, Physics	
Highest Distinction in General Scholarship	

RESEARCH INTERESTS

I am broadly interested in computational physics, particularly with applications to geophysical and astrophysical fluid dynamics. My current work focuses on nonlinear waves and turbulence in the ocean, planetary interiors, and stars. I am the lead developer of Dedalus, an open-source code for solving PDEs using spectral methods (<http://dedalus-project.org/>).

FELLOWSHIPS & APPOINTMENTS

Graduate Research Fellow	2012 – 2017
National Science Foundation	
Geophysical Fluid Dynamics Fellow	Summer 2016
Woods Hole Oceanographic Institute	
Visiting Scholar	February 2016
School of Mathematics and Statistics, University of Sydney	
Spectral methods for spherical tensor calculus, with Dr. Geoffrey Vasil	
Visiting Scholar	May 2015
UC Berkeley Astronomy Department	
Spectral methods for cylindrical tensor calculus, with Prof. Eliot Quataert	
Kavli Graduate Fellow	2013 – 2014
MIT Kavli Institute for Astrophysics and Space Research	
Department of Energy SULI Intern	Summer 2011
SLAC National Accelerator Laboratory	
Magnetohydrodynamic simulations, advised by Dr. Jeffrey S. Oishi	

Work-Study Researcher UC Berkeley Astronomy Department Radio telescope array calibration, advised by Prof. Geoffrey Bower	2010 – 2011
National Science Foundation REU Intern SETI Institute & NASA Ames Research Center Dynamical simulations of asteroid systems, advised by Dr. Franck Marchis	Summer 2010
High School Intern Smithsonian Astrophysical Observatory Solar x-ray observations, advised by Dr. Edward DeLuca	Summer 2007

TEACHING

MIT STEM Teaching Assistant Warrior Scholar Project	Summer 2017
Astrophysics I (Physics 8.901) Teaching Assistant Massachusetts Institute of Technology	Spring 2017
Radio Astronomy Laboratory (Astro 121) Teaching Assistant UC Berkeley Astronomy Department	Spring 2011
Multivariate Calculus (Math 233) Supplemental Instructor UMass Amherst Mathematics Department	Spring 2009

HONORS & AWARDS

Department Citation – UC Berkeley Astronomy Department	2012
Stewardship Science Graduate Fellowship (Declined) – DOE NNSA	2012
Peirce Fellowship (Declined) – Harvard Astronomy Department	2012
Ernest Coleman Award for Scholarship and Citizenship – SLAC SULI Program	2011
Chang Freshman Award for Academic Excellence – UMass Amherst Physics Department	2009

JOURNAL PUBLICATIONS

Rolling resistance of shallow granular deformation.

K. J. Burns, N. J. Balmforth, I. J. Hewitt. Submitted to RSPA.

Conversion of Internal Gravity Waves into Magnetic Waves.

D. Lecoanet, G. M. Vasil, et al. MNRAS 466-2, December 2016.

Turbulent Chemical Diffusion in Convectively Bounded Carbon Flames.

D. Lecoanet, J. Schwab, et al. ApJ 832-1, November 2016.

Tensor calculus in polar coordinates using Jacobi polynomials.

G. M. Vasil, K. J. Burns, et al. J. Comp. Phys. 325, November 2016.

A validated nonlinear Kelvin-Helmholtz benchmark for numerical hydrodynamics.
D. Lecoanet, M. McCourt, et al. MNRAS 455-4, February 2016.

Numerical simulations of internal wave generation by convection in water.
D. Lecoanet, M. Le Bars, et al. Phys. Rev. E 91-6, June 2015.

Conduction in Low Mach Number Flows. I. Linear and Weakly Nonlinear Regimes.
D. Lecoanet, B. P. Brown, et al. ApJ 797-2, December 2014.

FIRST, a fibered aperture masking instrument. I. First on-sky test results.
E. Huby, G. Perrin, et al. A&A 541, May 2012.

INVITED PRESENTATIONS

(Dedalus) Flexible Spectral Methods for Geophysical Flows
Oxford Mathematical Geoscience Seminar, June 2 2017
Mathematical Institute, University of Oxford

Simulations of turbulent meltwater plumes
Oxford Physical Oceanography Group Meeting, May 31 2017
Department of Earth Sciences, University of Oxford

Rolling Resistance on Sand
GFD Fellow Presentations, August 24 2016
Woods Hole Oceanographic Institute

Multivariate Chebyshev Discretizations of Incompressible Hydrodynamics
Spectral Methods Pop-Up Workshop, February 25 2016
School of Mathematics and Statistics, University of Sydney

WORKSHOP PARTICIPATION

Spectral Methods Pop-Up Workshop
School of Mathematics and Statistics, University of Sydney, February 2016

Geodynamo Benchmarking Workshop
Computational Infrastructure for Geodynamics, NCAR, February 2015

Wave-Flow Interaction in Geophysics, Climate, Astrophysics, and Plasmas
Kavli Institute for Theoretical Physics, UC Santa Barbara, May 2014

CONFERENCE PUBLICATIONS

The Turbulent Diffusivity of Convective Overshoot.
D. Lecoanet, J. Schwab, et al. AGU Fall Meeting, December 2016.

Sidewall-driven convection in a thermally and compositionally stratified fluid.
K. J. Burns, G. Flierl, A. Wells. APS DFD Meeting #69, November 2016.

Convective overshoot at stiffly stable interfaces.

B. Brown, J. Oishi, et al. APS DFD Meeting #69, November 2016.

The Turbulent Diffusivity of Convective Overshoot.

D. Lecoanet, J. Schwab, et al. APS DFD Meeting #69, November 2016.

Tachocline dynamics: convective overshoot at stiff interfaces.

B. Brown, D. Lecoanet, et al. AAS SPD Meeting #47, May 2016.

Internal Wave Generation by Turbulent Convection.

D. Lecoanet, M. Le Bars, et al. AGU Fall Meeting, December 2015.

Turbulent structures in convection from a heated sidewall in a stratified fluid.

K. J. Burns, A. Wells, G. Flierl. APS DFD Meeting #68, November 2015.

The Non-linear Saturation of the Goldreich-Schubert-Fricke Instability.

J. S. Oishi, K. J. Burns, et al. APS DFD Meeting #68, November 2015.

Convective Excitation of Internal Waves.

D. Lecoanet, M. Le Bars, et al. APS DFD Meeting #68, November 2015.

Stratified Convection in Stellar Interiors.

B. P. Brown, K. J. Burns, et al. AAS Meeting #225, January 2015.

Numerical Simulations of Nonlinear Wall-Mode Convection.

K. J. Burns, G. M. Vasil. AGU Fall Meeting, December 2014.

Simulations of Convective Excitation of Internal Waves in Water.

D. Lecoanet, G. Vasil, et al. APS DFD Meeting #67, November 2014.

On the Asymptotics of Nonlinear Wall-Localized Thermal Convection Waves.

G. M. Vasil, K. J. Burns. SIAM NWCS Meeting, August 2014.

Shape and Size of (90) Antiope Derived from an Exceptional Stellar Occultation...

F. Colas, J. Berthier, et al. AGU Fall Meeting, December 2011.

Dynamics and Stability in a Triple Asteroid System: Applications to Mission Design.

J. Bellerose, K. J. Burns, F. Marchis. AAS/AIAA Conference, August 2011.

Orbital Stability of Spacecraft Exploring Multiple Asteroid Systems.

K. Burns, F. Marchis, J. Bellerose. AAS Meeting #218, May 2011.

Diversity: A Mission Concept for a Grand Tour of Multiple Asteroid Systems.

F. Marchis, K. J. Burns, et al. LPSC Meeting #42, March 2011.

Mission Operations at Near-Earth Asteroids.

J. Bellerose, J. Chartres, et al. AAS GN&C Conference #34, February 2011.

Characteristics of Known Triple Asteroid Systems in the Main Belt.

F. Marchis, J. Berthier, et al. AAS DPS Meeting #42, October 2010.

OTHER WORKS

Chebyshev Spectral Methods with Applications to Astrophysical Fluid Dynamics.

K. J. Burns, advised by H. Latter. Cambridge Part III Essay, May 2013.

Tidal Effects in Binary Star Systems.

K. J. Burns, advised by E. Quataert. UC Berkeley Senior Thesis, June 2012.