Daniel Lecoanet

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PROFESSIONAL EXPERIENCE

Northwestern University Sept 2020-Present
Assistant Professor of Engineering Sciences and Applied Mathematics

Princeton University Sept 2016-Sept 2020
Center for Theoretical Science & Lyman Spitzer Jr. Postdoc Fellow

EDUCATION

University of California – Berkeley
PhD, Physics May 2016

University of Cambridge
Masters of Advanced Study, Applied Mathematics, with Distinction June 2011

University of Wisconsin – Madison
BS, Mathematics, Physics, with Comprehensive Honors May 2010

RESEARCH INTERESTS

Astrophysical & Geophysical Fluids: convection; internal waves; dynamo; thermals
Core developer of Dedalus pseudospectral code: dedalus-project.org; >400 papers use Dedalus
Nonlinear Optimization: dynamo; transition to turbulence; instanton

AWARDS AND HONORS

- Sloan Fellow (2024-2026)
- Princeton Center for Theoretical Science Postdoc Fellow (2016-2019).
- Lyman Spitzer Jr. Postdoc Fellow (2016-2021).
- Hubble Fellowship (declined).
- Einstein Fellowship (declined).
- Mary Elizabeth Uhl Prize – Berkeley Astrophysics Department Award (2016).
- Fluid Dynamics Research Prize (2015)
- Fannie and John Hertz Foundation Graduate Fellowship (2011-2016).
- Winston Churchill Foundation Scholarship (2010-2011) for study in the U.K.
- NSF Graduate Research Fellowship (2011-2014).
- KITP Graduate Fellowship (2014).
- Woods Hole Geophysical Fluid Dynamics Fellow (2013).
- Goldwater Scholar, 2008-2010.

GRANTS

- NSF Astronomy and Astrophysics Research Grant. **PI D. Lecoanet**, "Convective Boundary Mixing in Massive Stars," 2024-2027; Award amount: $402,908.
- Simons Foundation Targeted Grant in MPS. **PI D. Lecoanet**, co-PIs M. Le Bars, J. Noir, S. Llewellyn Smith, T. Shaw, W. Young, "Fundamental Fluid Processes in Climate, Stellar and Planetary Modeling," 2024-2028; Total award amount: $3,999,462.
- BSF Start-up Program. **co-PI's D. Lecoanet**, A. Frishman, "Arresting the Inverse Cascade: Theory and Simulations of Polar Vortices," 2023-2025; Total award amount: $150,000.
- NASA Support for Open-Source Tools, Frameworks, and Libraries. PI K. J. Burns, co-I's: **D. Lecoanet**, B. P. Brown, J. S. Oishi, "Support Dedalus, an open-source CFD framework with modern spectral methods," 2022-2024; Award to Northwestern: $27,667.
- NASA Heliophysics Theory, Modelling, and Simulation. **PI D. Lecoanet**, co-I's: B. P. Brown, K. J. Burns, J. S. Oishi, "Magneto-Rotational Instability in the Sun? Global Radiation-MHD Simulations of the Near-Surface Shear Layer," 2020-2023; Total award amount: $1,538,156.

REFEREED JOURNAL ARTICLES

1. **D. Lecoanet**, "Turbulent Convection in Stellar Cores." Invited review article for *Annual Review of Fluid Mechanics* (2025).
2. B. Hyatt, **D. Lecoanet**, E. H. Anders, K. J. Burns, "Multiple scales analysis of a nonlinear timestepping instability in simulations of solitons." *Submitted to JCP*.
3. G. M. Vasil, K. J. Burns, **D. Lecoanet**, J. S. Oishi, B. P. Brown, K. Julien, "Rapidly Rotating Wall-Mode Convection." *Submitted to JFM*.
4. A. Frishman, **D. Lecoanet**, "Universality of satellites in the breakup of a stretched fluid bridge." *under review at JFM*.
5. G. M. Vasil, **D. Lecoanet**, K. Augustson, K. J. Burns, J. S. Oishi, B. P. Brown, N. Brummell, K. Julien, "The solar dynamo begins near the surface." *Nature* **629** 769-772 (2024).
6. C. D. Duguid, N. B. de Vries, **D. Lecoanet**, A. J. Barker, "An efficient tidal dissipation mechanism via stellar magnetic fields." *ApJL* **966** L14 (2024).

7. L. O'Connor, **D. Lecoanet**, E. H. Anders, K. Augustson, K. J. Burns, G. M. Vasil, J. S. Oishi, B. P. Brown, "Iterative Methods for Navier-Stokes Inverse Problems." *PRE* **109** 045108 (2024).

8. H. Morrison, N. Jeevanjee, **D. Lecoanet**, J. M. Peters, "What controls the entrainment rate of dry buoyant thermals with varying initial aspect ratio?" *JAS* **80** 2711-2728 (2023).

9. **D. Lecoanet**, P. V. F. Edelmann, "Multidimensional Simulations of Core Convection." *Galaxies* **11** 89 (2023).

10. E. H. Ander, **D. Lecoanet**, M. Cantiello, K. J. Burns, B. A. Hyatt, E. Kaufman, R. H. D. Townsend, B. P. Brown, G. M. Vasil, J. S. Oishi, A. S. Jermyn, "The photometric variability of massive stars due to gravity waves excited by core convection." *Nature Astronomy* **7** 1228-1234 (2023).

11. S. Ji, J. Fuller, **D. Lecoanet**, "Magnetohydrodynamic Simulations of the Tayler Instability in Rotating Stellar Interiors." *ApJ* **521** 5372-5383 (2023).

12. E. Kaufman, **D. Lecoanet**, E. H. Anders, B. P. Brown, G. M. Vasil, J. S. Oishi, K. J. Burns, "The Stability of Prendergast Magnetic Fields." *MNRAS* **517** 3332-3340 (2022).

13. A. S. Jermyn, E. H. Anders, **D. Lecoanet**, M. Cantiello, "An Atlas of Convection in Main-sequence Stars." *ApJS* **262** 19 (2022).

14. M. Joyce, J. Tayar, **D. Lecoanet**, "Gender Disparity in Publishing Six Months after the KITP Workshop Probes of Transport in Stars." *PASP* **134** 084503 (2022).

15. A. S. Jermyn, E. H. Anders, **D. Lecoanet**, M. Cantiello, "Convective Penetration in Early-Type Stars." *ApJ* **929** 182 (2022).

16. E. H. Anders, A. S. Jermyn, **D. Lecoanet**, A. E. Fraser, I. G. Cresswell, M. Joyce, J. R. Fuentes, "Schwarzschild and Ledoux are equivalent on evolutionary timescales." *ApJL* **928** L10 (2022).

17. **D. Lecoanet**, D. M. Bowman, T. Van Reeth, "Asteroseismic inference of the near-core magnetic field strength in the main-sequence B star HD 43317." *MNRASL* **512** L16-20 (2022).

18. E. Anders, A. S. Jermyn, **D. Lecoanet**, B. P. Brown, "Stellar convective penetration: parameterized theory and dynamical simulations." *ApJ* **926** 169 (2022).

19. M. Bouffard, B. Favier, **D. Lecoanet**, M. Le Bars, "Internal gravity waves in a stratified layer atop a convecting liquid core in a non-rotating spherical shell." *GJI* **228** 337 (2022).

20. L. O'Connor, **D. Lecoanet**, E. H. Anders, "Marginally-Stable Thermal Equilibria of Rayleigh-Bénard Convection." *PRF* **6** 093501 (2021).

21. **D. Lecoanet**, M. Cantiello, E. H. Anders, E. Quataert, L.-A. Couston, M. Bouffard, B. Favier, M. Le Bars, "Surface Manifestation of Stochastically Excited Internal Gravity Waves." *MNRAS* **508** 132 (2021).

22. M. Cantiello, **D. Lecoanet**, A. S. Jermyn, L. Grassitelli, "On the Origin of Stochastic, Low-Frequency Photometric Variability in Massive Stars." *ApJ* **915** 112 (2021).

23. J. S. Oishi, K. J. Burns, S. E. Clark, E. H. Anders, B. P. Brown, G. M. Vasil, **D. Lecoanet**, "eigentools: A Python package for studying differential eigenvalue problems with an emphasis on robustness" *JOSS* **6** 3079 (2021).

24. P. Leard, **D. Lecoanet**, M. Le Bars, "Multi-modal excitation to model the Quasi-Biennial Oscillation." *PRL* **125** 234501 (2020).

25. B. P. Brown, J. S. Oishi, G. M. Vasil, **D. Lecoanet**, K. J. Burns, "Single-hemisphere Dynamos in M-dwarf Stars." *ApJL* **902** L3 (2020).

26. L.-A. Couston, **D. Lecoanet**, B. Favier, M. Le Bars, "Shape and size of large-scale vortices : a universal fluid pattern in geophysical fluid dynamics." *PRR* **2** 023143 (2020).

27. Y. Su, **D. Lecoanet**, D. Lai, "Physics of tidal dissipation in early-type stars and white dwarfs: hydrodynamical simulations of internal gravity wave breaking in stellar envelopes." *MNRAS* **495** 1239 (2020).

28. K. J. Burns, G. M. Vasil, J. S. Oishi, **D. Lecoanet**, B. P. Brown, "Dedalus: A Flexible Framework for Numerical Simulations with Spectral Methods." *PRR* **2** 023068 (2020).

29. M. Le Bars, L.-A. Couston, B. Favier, P. Leard, **D. Lecoanet**, P. Le Gal, "Fluid dynamics of a mixed convective/stably stratified system—A review of some recent works." *Compte Rendus. Physique* **21** 151-164 (2020).

30. B. McKim, N. Jeevanjee, **D. Lecoanet**, "Buoyancy-Driven Entrainment in Dry Thermals." *QJRMS* **146** 415 (2020).

31. J. S. Oishi, G. M. Vasil, M. Baxter, A. Swan, K. J. Burns, **D. Lecoanet**, B. P. Brown, "The magnetorotational instability prefers three dimensions." *PRSA* **476** 20190622 (2020).

32. **D. Lecoanet**, M. Cantiello, E. Quataert, L.-A. Couston, K. J. Burns, B. J. S. Pope, A. S. Jermyn, B. Favier, M. Le Bars, "Low-frequency variability in massive stars: Core generation or surface phenomenon?" *ApJL* **886** L15 (2019).

33. **D. Lecoanet**, N. Jeevanjee, "Entrainment in Resolved, Dry Thermals." *JAS* **76** 3785 (2019).

34. E. H. Anders, **D. Lecoanet**, B. P. Brown, "Entropy Rain: Dilution and Compression of Thermals in Stratified Domains." *ApJ* **884** 65 (2019).

35. G. M. Vasil, **D. Lecoanet**, K. J. Burns, J. S. Oishi, B. P. Brown, "Tensor calculus in spherical coordinates using Jacobi polynomials. Part-I: Mathematical analysis and derivations." *JCP:X* **3** 100013 (2019).

36. **D. Lecoanet**, G. M. Vasil, K. J. Burns, B. P. Brown, J. S. Oishi, "Tensor calculus in spherical coordinates using Jacobi polynomials, Part-II: Implementation and Examples." *JCP:X* **3** 100012 (2019).

37. E. Quataert, **D. Lecoanet**, E. R. Coughlin, "Black hole accretion discs and luminous transients in failed supernovae from non-rotating supergiants." *MNRASL* **485** L83-L88 (2019).

38. L.-A. Couston, **D. Lecoanet**, B. Favier, M. Le Bars, "The energy flux spectrum of internal gravity waves generated by turbulent convection." *JFM Rapids* **854** R3 (2018).

39. L.-A. Couston, **D. Lecoanet**, B. Favier, M. Le Bars, "Order out of chaos: slowly-reversing mean flows emerge from turbulently-generated internal waves." *PRL* **120** 244505 (2018).

40. N. Tarshish, N. Jeevanjee, **D. Lecoanet**, "Buoyant Motion of a Turbulent Thermal." *JAS* ***75*** 3233-3244 (2018).

41. O. Mickelin, J. Słomka, K. J. Burns, **D. Lecoanet**, G. M. Vasil, L. M. Faria, J. Dunkel, "Anomalous chained turbulence in actively driven flows on spheres." *PRL* **120** 164503 (2018).

42. **D. Lecoanet**, R. R. Kerswell, "The Connection between Nonlinear Optimal Perturbations and Instantons." *PRE* **97** 012212 (2018).

43. L.-A. Couston, **D. Lecoanet**, B. Favier, M. Le Bars, "Dynamics of Mixed Convective—Stably-Stratified Fluids." *PRF* **2** 094804 (2017).

44. **D. Lecoanet**, G. M. Vasil, J. Fuller, M. Cantiello, K. J. Burns, "Conversion of Internal Gravity Waves into Magnetic Waves." *MNRAS* **466** 2181-2193 (2017).

45. **D. Lecoanet**, J. Schwab, E. Quataert, L. Bildsten, F. X. Timmes, K. J. Burns, G. M. Vasil, J. S. Oishi, B. P. Brown, "Turbulent Chemical Diffusion in Convectively Bounded Carbon Flames." *ApJ* **832** 71 (2016).

46. **D. Lecoanet**, M. McCourt, E. Quataert, K. J. Burns, G. M. Vasil, J. S. Oishi, B. P. Brown, J. Stone, R. O'Leary, "A Validated Nonlinear Kelvin-Helmholtz Benchmark for Numerical Hydrodynamics." *MNRAS* **455** 4274-4288 (2016).

47. G. M. Vasil, K. J. Burns, **D. Lecoanet**, S. Olver, B. P. Brown, J. S. Oishi, "Tensor calculus in polar coordinates using Jacobi polynomials." *JCP* **325** 53-73 (2016).

48. J. Fuller, M. Cantiello, **D. Lecoanet**, E. Quataert, "The spin rate of pre-collapse stellar cores: wave driven angular momentum transport in massive stars." *ApJ* **810** 101 (2015).

49. M. Le Bars, **D. Lecoanet**, J. M. Aurnou, S. Perrard, A. Ribeiro, L. Rodet, P. Le Gal, "Experimental study of internal wave generation by convection in water." *Fluid Dyn Res* **47** 045502 (2015).

50. **D. Lecoanet**, M. Le Bars, K. J. Burns, E. Quataert, G. M. Vasil, B. P. Brown, J. S. Oishi, "Numerical Simulations of Internal Wave Generation by Convection in Water." *PRE* **91** 063016 (2015).

51. P. Marcus, S. Pei, C.-H. Jiang, J. Barranco, P. Hassanzadeh, **D. Lecoanet**, "Zombie Vortex Instability I: The "Dead" Zones of Protoplanetary Disks are Not Dead." *ApJ* **808** 87 (2015).

52. **D. Lecoanet**, B. P. Brown, E. G. Zweibel, K. J. Burns, J. S. Oishi, G. M. Vasil, "Conduction in Low Mach Number Flows: Part I Linear & Weakly Nonlinear Regimes." *ApJ* **797** 94-105 (2014).

53. J. Fuller, **D. Lecoanet**, M. Cantiello, B. Brown, "Angular Momentum Transport via Internal Gravity Waves in Evolving Stars." *ApJ* **796** 17-28 (2014).

54. G. M. Vasil, **D. Lecoanet**, B. P. Brown, E. G. Zweibel, "Energy Conservation and Gravity Waves in Sound-proof Treatments of Stellar Interiors: Part II Lagrangian Constrained Analysis." *ApJ* **773** 169-191 (2013).

55. **D. Lecoanet**, E. Quataert, "Internal Gravity Wave Excitation by Turbulent Convection." *MNRAS* **430** 2363-2376 (2013).

56. **D. Lecoanet**, I. J. Parrish, E. Quataert, "The Dynamics of Rayleigh-Taylor Stable and Unstable Contact Discontinuities with Anisotropic Thermal Conduction." *MNRAS* **423** 1866-1882 (2012).

57. **D. Lecoanet**, E. G. Zweibel, R. H. D. Townsend, Y.-M. Huang, "Violation of Richardson's Criterion via Introduction of a Magnetic Field." *ApJ* **712** 1116-1128 (2010).

58. **D. Lecoanet**, F. C. Adams, A. M. Bloch, "Mean Motion Resonances in Extrasolar Planetary Systems with Turbulence, Interactions, and Damping." *ApJ* **692** 659-676 (2009).

59. A. Mitra, J. P. Wojcik, **D. Lecoanet**, T. Muller, R. West, "A Bis(silaselenone) with Two Donor-Stabilized Si=Se Bonds from an Unexpected Stereoconvergent Hydrolysis of a Diselenadisiletane." *Angewandte Chemie* **48** 4069-4072 (2009).

BOOKS

1. M. Le Bars, **D. Lecoanet** (eds.), "Fluid Mechanics of Planets and Stars." Springer (2020).

INVITED PRESENTATIONS

1. MIT, Earth, Atmospheric & Planetary Science Department Lecture Series, "Model Hierarchies for Understanding the Quasi-Biennial Oscillation," Sept 17, 2024.

2. Virtual Nordic Dynamo Seminar, "Measuring Magnetic Fields in Stellar Interiors," Sept 10, 2024.

3. International Congress of Theoretical and Applied Mechanics. "Thermal Equilibrium at Convective—Stably-Stratified Boundaries," August 30, 2024.

4. UCSC, Geophysical & Astrophysical Fluid Dynamics Seminar. "Waves, Tubulence, and Stars," May 17, 2024.

5. Univeristy of Edinburgh, Applied and Computational Mathematics Seminar, "Turbulence, Waves, and Stars," Apr 17, 2024.

6. Ohio State University, Astronomy Colloquium, "Recent Advances in Stellar Astrophysics from Multi-Dimensional Simulations," Apr 4, 2024.

7. University of Pennsylvania, Geoscience Colloquium, "Model Hierarchies for Fluid Process Modeling," Mar 29, 2024.

8. NYU, Physics Colloquium, "Understanding Fluid Processes in Astrophysics & Geophysics via Numerical Simulation," Feb 7, 2024.

9. UChicago, Geosciences Seminar, "Model Hierarchies for Fluid Process Modeling," Feb 2, 2024.

10. Beyond Boussinesq for Astrophysical and Geophysical fluids: Numerical tools and experiments of the future, Lyon, France. "Generation and Propagation of Convectively Excited Gravity Waves," Oct 18, 2023.

11. CCA, Flatiron Fluid Dynamics Summer School. “Dedalus,” Aug 8, 2023.
12. WHOI, Summer GFD Program. “Waves, Turbulence, and Stars,” July 31, 2023.
13. University of Wisconsin, Applied and Computational Math Seminar. “Wave Generation by Convective Turbulence,” Oct 28, 2022.
14. UCSC, Geophysical & Astrophysical Fluid Dynamics Seminar. “Measuring Magnetic Fields in Stellar Interiors,” Oct 20, 2022.
15. University of Toronto, CITA Seminar. “Measuring Magnetic Fields in Stellar Interiors,” July 4, 2022.
16. Northwestern University, Theoretical & Applied Mechanics Seminar. “Wave Generation by Convective Turbulence,” Mar 10, 2022. https://www.youtube.com/watch?v=OD7fqoFqcFI
17. UCSD, MAE Fluids Seminar. “Turbulent Excitation of Internal Waves by Convection,” Nov 1, 2021.
18. Northwestern University, CIERA Seminar, “Mixing near Stellar Convective Boundaries,” Oct 26, 2021.
19. University of Exeter, Astrophysics Seminar. “Convective Overshoot and Penetration in Stars,” Oct 20, 2021.
20. IRPHE, Marseille, Seminar. “Convection and Waves in Stellar Interiors,” Sept 14, 2021.
21. Spinning Fluids 2021. “What Drives Solar Magnetism?” Sept 6, 2021.
22. WHOI GFD Summer Seminar Series. “Convection and Waves in Stellar Interiors,” Aug 2, 2021.
23. Université Côte d'Azur, ANEDP Seminar. “Code Comparison using the Dedalus PDE Solver,” Mar 28, 2021.
24. University of Michigan, Applied and Interdisciplinary Mathematics Seminar. “Probing the Cores of Massive Stars through their Surface,” Mar 19, 2021.
25. University of Leeds, Fluids & MHD Seminar. “Measuring Core Stellar Magnetic Fields using Wave Conversion,” Jan 28, 2021. https://www.youtube.com/watch?v=eeTuoKC8Qak
26. University of Wisconsin – Madison, Plasma Physics Seminar. “Zonal Flow Generation by Convectively Excited Waves,” Oct 26, 2020.

27. University of Victoria, Physics Seminar. “How wavy are stars?” Nov 19, 2019.

28. WHOI, Summer GFD Program. “Thermals in the Atmosphere and in Stars,” July 29, 2019.

29. Waves, Instabilities, and Turbulence in Geophysical and Astrophysical Fluids, Cargese, France. “Excitation of Internal Gravity Waves by Convection in Stars,” July 10, 2019.

30. Festival de Theorie, Aix en Provence, France. “Order Out of Chaos: Slowly Reversing Mean Flows Emerge from Turbulently Generated Internal Waves,” July 1, 2019.

31. Fields Institute, Scientific Computing Across Scales: Extreme Events and Criticality in Fluid Mechanics. “Transition Probabilities between Metastable States,” Apr 15, 2019.

32. Courant Institute, Atmosphere Ocean Science Colloquium. “Parameterizing Convective Overshoot using Dedalus,” March 6, 2019.

33. Yale University, Atmosphere, Ocean, and Climate Dynamics Seminar. “Testing Parameterizations of Convective Overshoot,” Feb 21, 2019.

34. Northwestern University, Applied Math Colloquium. “Testing Theories of Wave Generation by Convection,” Feb 4, 2019.

35. University of Sydney, Dynamics Group Seminar. “Testing Theories of Wave Generation by Convection,” Jan 31, 2019.

36. University of New South Wales, Climate Change Research Centre Seminar. “Testing Parameterizations of Convective Overshoot,” Jan 23, 2019.

37. Cornell University, Astrophysics Lunch Seminar. “Dynamics at Stellar Radiative-Convective Interfaces,” Nov 7, 2018.

38. Cornell University, Scientific Computing (SCAN) Seminar. “Code Comparison Using the Dedalus PDE Solver,” Nov 5, 2018.

39. University of Alberta, Physics Colloquium. “Dynamics at Stars’ Inner Boundaries,” Nov 2, 2018.

40. University of Wisconsin – Madison, Plasma Physics Seminar. “Wave Conversion from Stellar Magnetic Fields,” Oct 29, 2018.

41. Flatiron Institute, Flatware Conference, w/ Keaton Burns & Jeff Oishi. “Dedalus: A flexible framework for solving differential equations using spectral methods,” Oct 24, 2018.

42. GFDL, Lunchtime Seminar. “Testing Parameterizations of Convective Overshoot,” Oct 17, 2018.

43. NCAR, GTP workshop on Waves, Turbulence, and Large-Scale Structures in Rotating Magnetic Fluids. “Mean Flow Interaction with Convectively Generated Internal Waves,” Sep 10, 2018. https://youtu.be/ny0ivAWQaSY?list=PLUJIX4Fd9aciZeRyyr38T141_aJ_Lfae3&t=3550

44. UCSB, Kavli Institute for Theoretical Physics. “Using Dedalus, a flexible, Python-based, spectral PDE-solver,” May 16, 2018. http://online.kitp.ucsb.edu/online/blayers18/dedalus/

45. UCSB, Kavli Institute for Theoretical Physics. “Convection and Entrainment in Stars,” May 7, 2018. http://online.kitp.ucsb.edu/online/blayers18/lecoanet/

46. University of Illinois, Astrophysical Seminar. “Veracity and Analysis of Astrophysical Simulations,” Feb 28, 2018.

47. University of Sydney, Sydney Dynamics Group Seminar. “Model hierarchies for computational data analysis,” Jan 12, 2018.

48. Northwestern University, Astrophysics Journal Club. “The Turbulent Diffusivity of Convective Overshoot,” Nov 7, 2017.

49. Northwestern University, Applied Math Colloquium. “Model Hierarchies for Data Analysis in Fluid Dynamics,” Nov 6, 2017.

50. University of Exeter, Astrophysics Seminar. “The Turbulent Diffusivity of Convective Overshoot,” Sept 26, 2017.

51. IRPHE, Marseille, Seminar. “Conversion of Internal Waves into Magnetic Waves in Stars,” Sept 15, 2017.

52. WHOI, Summer GFD Program. “Measuring Core Stellar Magnetic Fields using Wave Conversion,” July 19, 2017.

53. Astronum conference, St Malo, France. “Shear Flow Instabilities with Finite Volume and Spectral Methods,” Jun 27, 2017.

54. UCSB, Kavli Institute for Theoretical Physics. “Dedalus tutorial,” Apr 25, 2017. http://online.kitp.ucsb.edu/online/stars17/dedalus/

55. Northwestern University, CIERA Lunch. “Measuring Core Stellar Magnetic Fields using Wave Conversion,” Apr 17, 2017.

56. UCSB, Kavli Institute for Theoretical Physics. “Discussion on rotation, convection, and waves,” Apr 13, 2017. http://online.kitp.ucsb.edu/online/stars17/lecoanet/

57. Princeton University, Analysis of PDEs/Fluids Seminar. “Mixing in Compressible Hydrodynamics as Diffusivities Approach Zero,” Mar 16, 2017.

58. University of Sydney, Applied Maths Seminar. “Magnetic Wave Conversion in Stellar Interiors,” Mar 1, 2017.

59. Johns Hopkins University, Center for Environment and Applied Fluid Mechanics Seminar. “The Turbulent Diffusivity of Convective Overshoot,” Feb 10, 2017.

60. UCSB, Center for Interdisciplinary Research in Fluids Seminar. “The Turbulent Diffusivity of Penetrative Convection,” Jan 25, 2017.

61. UCSB, Kavli Institute for Theoretical Physics. “Dedalus: A Flexible Framework for Spectrally Solving Partial Differential Equations,” Jan 16, 2017. http://online.kitp.ucsb.edu/online/transturb17/lecoanet/

62. University of New Hampshire, Integrated Applied Mathematics Seminar. “The Turbulent Diffusivity of Convective Overshoot,” Nov 10, 2016.

63. NCAR, GTP workshop on Turbulent and Waves in Flows Dominated by Rotation. “The Turbulent Diffusivity of Convective Overshoot,” Aug 18, 2016. https://www.youtube.com/watch?v=8vvCNCqWkGY&index=1&list=PLUJIX4Fd9aci91IIo7tySxsf6hvBvy9g_

64. IRPHE, Marseille, Seminar. “The Turbulent Diffusivity of Convective Overshoot,” July 8, 2016.

65. Grenoble, Geodynamo Group Seminar. “The Turbulent Diffusivity of Convective Overshoot,” June 24, 2016.

66. IRPHE, Marseille, Tutorial lectures. “The Dedalus Pseudo-Spectral Framework for Solving Partial Differential Equations,” June 1-2, 2016.

67. University of Sydney, Spectral Workshop. “Kelvin-Helmholtz Instability in Spectral and Godunov Codes,” Feb 25, 2016.

68. Caltech, TAPIR Seminar. “Wave Excitation by Turbulent Stellar Convection,” Oct 30, 2015.

69. UCSD, Scripps Institution of Oceanography, CASPO Seminar. “Volumetric Excitation of Internal Waves,” Oct 28, 2015.

70. UCLA, Earth, Planetary, & Space Sciences Seminar. “Convective Excitation of Internal Waves,” Oct 26, 2015.

71. Harvard Earth & Planetary Sciences, Graduate Student & Postdoc Seminar. “Internal Wave Excitation by Convection,” Sep 24, 2015.

72. MIT, Physical Mathematics Seminar. “Internal Wave Excitation by Turbulent Convection,” Sep 22, 2015.

73. Center for Astrophysics, Harvard, Small Scale Phenomena Seminar. “How Do We Know if a Simulation is Correct?” Sep 21, 2015.

74. Courant Institute, NYU, Applied Math Lab Seminar. “Internal Wave Excitation by Turbulent Convection,” Sep 17, 2015.

75. WHOI, Summer GFD Program. “Internal Wave Excitation by Turbulent Convection,” July 3, 2015.

76. SIAM, Dynamical Systems. Session: Wave-turbulence Interactions in Geophysical and Astrophysical Fluid Dynamics. “Internal Wave Generation by Convection,” May 17, 2015.

77. IRPHE, Marseille, Seminar. “Simulations of Convective Excitation of Internal Waves in Water,” Sep 5, 2014.

78. UCSB, Kavli Institute for Theoretical Physics, presentation at Wave-Mean Flow Interaction program, with B. Brown & J. Oishi. “A Demonstration of the “Dedalus” Modeling Framework,” May 28, 2014. http://online.kitp.ucsb.edu/online/waveflows14/dedalus/

79. UCSB, Center for Interdisciplinary Research in Fluids Seminar. “Convective Excitation of Internal Waves in Water,” Feb 19, 2014.

80. AGU, Meeting of the Americans. Session: Waves and Instabilities in Surface and Internal Planetary Fluid Flows. “Excitation of Internal Gravity Waves by Turbulent Stellar Convection,” May 2013.

81. UCSC, GAFD Seminar. “Generating Internal Gravity Waves with Turbulent Convection,” Jan 24, 2013.

82. UC Berkeley, Fluids Seminar. “Anisotropic Conduction Along Magnetic Field Lines: New and Old Instabilities,” Nov 7, 2012.

83. University of Toronto, CITA Seminar. “Rayleigh-Taylor Instabilities in a Dilute Plasma,” Apr 12, 2012. http://hosting.epresence.tv/CITA/1/watch/426.aspx

TEACHING AND MENTORING EXPERIENCE

1. **PhD Students:**
   i. Emma Kaufman. Started 2020. Received Chateaubriand fellowship (4 month research visit to IRPHE in Marseille, France). Received NASA FINESST 2024.
   ii. Liam O'Connor. Started 2020. Received NSF GRFP 2022.
   iii. Benjamin Hyatt. Started 2022. Received NSF GRFP 2023.
2. **Postdocs:**
   i. Evan Anders (2020-2023); postdoc at KITP, industry
   ii. Kyle Augustson (2021-2024); research scientist at SWRI
   iii. Ilaria Fontana (2022-2024); postdoc at Arizona
3. **CISM Winter School Lecturer** (2018 & 2023)
   Gave 4.5 hours of lectures to grad students, postdocs, and researchers, on: Waves and instabilities in stars (2018); waves and MHD in geophysical & astrophysical fluids (2023)
4. **Geophysical Fluid Dynamics summer program at WHOI** (2023-2024)
   Mentored two PhD summer fellows (Yifeng Mao, Cy David) on summer projects related to waves in stars
5. **Brin Mathematical Research Center Summer School Lecturer** (2024)
   Gave 2 lectures on "Dedalus: Solving PDEs with Global Spectral Methods" and "Tracer Transport in Stars" at summer school on "Tracer Mixing in Fluids across Planetary Scales"
6. **Causeway Postbaccalaurate ("Bridge" program)** (2023)
   Mentored Rivkah Moshe (2023-2024)
7. **CIERA REU Mentor** (2021-present)
   Mentored three undergraduate summer students (Mallory Drevline, Ian Freeman, Reon Allen) on projects related to waves in stars.
8. **Courses:**
   i. Numerical Solution to PDEs with Finite Difference Methods (2020 & 2022-24)
   ii. Numerical Solution to PDEs with Spectral Methods (2022, 2024)
   iii. Multivariable Integral Calculus, Honors (2021-2023).
   iv. Multivariable Integral Calculus (2022-2024).
9. **Summer Students at GFDL** (2017-2019)
   Mentored two undergraduate summer students (Nathaniel Tarshish & Brett McKim), together with Nadir Jeevanjee. Both students published papers related to thermals.

SERVICE

- **KITP Program Coordinator:** "Probes of Transport in Stars" Oct 11 – Dec 17, 2021 (w/ Matteo Cantiello, Adam Jermyn, Jamie Tayar)
- **Hertz Fellowship:** Interviewer (2017-present); application reviewer (2021-present)
- **Soros Fellowship:** Specialty reviewer (2022-present)
- **Conference Organizer:**
  - "Fluid Mechanics of Planets and Stars," CISM Winter School, April 2018 and April 2023 (co-organized with Michael Le Bars)

    - "Transport in Stellar Interiors," KITP, Nov 2021 (co-organized with Jamie Tayar, Adam Jermyn)
    - "Spinning Fluids 2021," Schloss Ringberg, Sept 2021 (SOC)
    - "Convection in Nature," PCTS Conference, Feb 2018 (co-organized with Nadir Jeevanjee)
- **Journal Referee:** Astronomy & Astrophysics; Astrophysical Journal; ApJ Letters; Frontiers in Earth Science; International Journal of Thermal Sciences; Journal of the Atmospheric Sciences; Journal of Computational Physics; Journal of Fluid Mechanics; JFM Rapids; Monthly Notices of the Royal Astronomical Society; Physics Letters A; Physics of Plasmas; Physical Review Fluids; Physical Review Letters
- **Grant Review:** NSF (2021), ANR (2022, 2024), UKRI (2024)
- **Berkeley Fluids Seminar:** organizer (2013-2016)