Adrian E. Fraser

Hale Postdoctoral Fellow at University of Colorado, Boulder

Contact Information, Links

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Interests at a Glance

I study a variety of fluid and plasma instabilities, particularly how they saturate, drive turbulence, and affect mixing. I sometimes work to capture these details in reduced models that I check against direct numerical simulations. This involves code development, running massively parallelizable simulations and analyzing the results, and applying a variety of mathematical methods to model complex physical systems.

Affiliations and Education

Sep 1, 2022–	**Hale Postdoctoral Fellow, University of Colorado, Boulder** Applied Mathematics, Astrophysical and Planetary Sciences, and LASP
2020–2022	**University of California, Santa Cruz** Postdoc, Applied Mathematics PI: Pascale Garaud
2014–2020	**University of Wisconsin-Madison** Ph.D., Physics (Plasma) Advisors: Paul W. Terry, Ellen G. Zweibel Graduation date: Aug 23, 2020
2010–2014	**University of Oregon** B.S., Physics (with honors), Mathematics

Honors, Awards, and Scholarships

2022 **George Ellery Hale Postdoctoral Fellowship in Solar, Stellar, and Space Physics**, CU Boulder and the National Solar Observatory
Competitive postdoctoral fellowship to conduct independent research
(http://halefellows.org/postdoc_about.html)

2022 **Marie Skłodowska-Curie Postdoctoral Fellowship Seal of Excellence**
Submitted a proposal that "was recognised as a high-quality project proposal in a highly competitive evaluation process", and could not be funded due to budgetary constraints
(https://afraser3.github.io/files/Seal_of_Excellence.pdf) (link)

2021 **Outstanding Postdoc Spotlight**, UCSC press release
(https://engineering.ucsc.edu/news/outstanding-postdoc-adrian-fraser)

2019 **Callen Award for Excellence in Plasma Theory**, UW-Madison
Annual award given to plasma students by committee selection based on academic record and research contributions

2019 **Karl Guthe Jansky & Alice Knapp Jansky Fellowship for Physics & Astronomy**, University of Wisconsin-Madison, Department of Physics
Annual award given to outstanding graduate student in Physics or Astronomy
(http://www.physics.wisc.edu/awards)

2018 **Exceptional Service Award**, University of Wisconsin-Madison
Campus-wide TA award, nominated by the Physics department
(https://grad.wisc.edu/teaching-assistant-awards/)

2017 **Student Poster Prize**, Sherwood Fusion Theory Conference
(http://www.sherwoodtheory.org/sw2018/poster_awards.php)

2015 **Piore Award**, University of Wisconsin-Madison, Department of Physics
Annual award given for academic achievement in early stage of the Ph.D. program
(http://www.physics.wisc.edu/awards)

2014 **Van Vleck Fellowship**, University of Wisconsin-Madison, Department of Physics
Awarded to incoming Ph.D. students with outstanding undergraduate records
(http://www.physics.wisc.edu/awards)

2013 **Weiser Undergraduate Teaching Award**, University of Oregon, Physics

2013 **Science Literacy Program Scholar**, University of Oregon
Co-instructed PHYS 155, a special topics elective for non-physics majors
(https://scilit.uoregon.edu/)

2011 **Dean's List**, University of Oregon
(https://advising.uoregon.edu/content/academic-honors)

2010-2013 **Scholarships for Oregon Scientists**, University of Oregon
(https://sciencescholars.uoregon.edu/)

Successful Computing Allocation Requests (Co-) Authored

2021	**Momentum transport by shear-flow-driven turbulence in stars**, XSEDE computing resources, NSF (education allocation) Resources awarded: approx. 200,000 CPU-hours PI: **A.E. Fraser**
2018-2019	**Role of Stable Eigenmodes in Shear-flow MHD Turbulence**, XSEDE computing resources, NSF (start-up allocation) **Lead author on proposal**, but not listed as PI due to XSEDE policy Resources awarded: approx. 200,000 CPU-hours PI: P.W. Terry, Co-PIs: **A.E. Fraser**, M.J. Pueschel, E.G. Zweibel
2017-2018 & 2018-2019	**Gyrokinetic Plasma Microturbulence Simulation in Fusion and Basic Plasmas**, XSEDE computing resources, NSF (research allocation) Contributed to proposal, but the lead author was the PI Resources awarded: approx. 6,750,000 (2018-2019) & 11,300,000 (2017-2018) CPU-hours PI: M.J. Pueschel, Co-PIs: **A.E. Fraser**, P.W. Terry, Z.R. Williams, S-.W. Tsao

Invited Talks

Mar 2021	"Capturing negative turbulent viscosity in reduced models of unstable shear flows" - 'Staircase21' KITP meeting
Oct 2019	"Saturation of Shear-flow Turbulence in Magnetized Plasmas" - American Physical Society Division of Plasma Physics Meeting, Fort Lauderdale, Florida
Apr 2019	"Role of Stable Modes in the Saturation and Transport Properties of Shear Flow Turbulence" - Sherwood Fusion Theory Conference, Princeton, New Jersey

Seminars

Apr 2023	"Destabilization of Alfvén waves by periodic shear flows" - Northwestern University, Lecoanet group meeting
Apr 2023	"Missing mixing problems in RGB stars and the role of MHD thermohaline mixing" - CIERA theory seminar
Apr 2023	"Destabilization of Alfvén waves by periodic shear flows" - University of Wisconsin-Madison plasma group talk
Mar 2023	"Magnetized fingering convection in stars: problems with parasitic models" - IRAP (Toulouse, France) Astroplasma seminar
Mar 2023	"Destabilization of transverse waves by periodic shear flows" - University of Exeter GAFD seminar
Mar 2023	"Broad astro-fluid studies enabled by Dedalus" - Whole Sun 2023 meeting (Paris, France)
Feb 2023	"Unexpected instabilities in sinusoidal shear flows with a streamwise magnetic field" - Leeds ECR Spotlight
Jul 2022	"Non-ideal instabilities in sinusoidal shear flows with a streamwise magnetic field" - WHOI GFD Seminar
Apr 2022	"Fingering convection in MHD: problems with parasites, and speculative solutions" - CU-Boulder GAFD Seminar
Nov 2021	"Fingering convection in MHD: problems with parasites, and speculative solutions" - University of Leeds, Fluids and MHD Seminar (Youtube link)
Jun 2021	"MHD effects on thermohaline mixing in stars: the problem with parasites" - UW-Madison Astronomy, Monday Science Seminar series
Jun 2021	"MHD effects on thermohaline mixing in stars: the problem with parasites" - Kavli Summer Program in Astrophysics
Apr 2021	"MHD effects on thermohaline mixing in stars: the problem with parasites" - Flatiron Institute CCA, Stars & Compact Objects group meeting
Oct 2020	"Momentum transport, dissipation, and models built from linear modes in MHD shear flows" - Astronomy Seminar, Stony Brook University
Mar 2019	"Role of Stable Modes in Shear-Flow Turbulence" - Plasma Physics Seminar, University of Maryland
Oct 2018	"Role of Stable Eigenmodes in Kelvin-Helmholtz Turbulence" - Plasma Seminar, IFS, University of Texas at Austin

Contributed Presentations

Nov 2022	American Physical Society Division of Fluid Dynamics Meeting, Indianapolis, IN – contributed oral
Oct 2022	American Physical Society Division of Plasma Physics Meeting, Spokane, WA – poster presentation
Nov 2021	KITP Conference: Transport in Stellar Interiors, Santa Barbara, CA – contributed oral (link)
Nov 2021	American Physical Society Division of Fluid Dynamics Meeting, Phoenix, AZ – contributed oral
Nov 2021	American Physical Society Division of Plasma Physics Meeting, Pittsburg, PA – poster presentation
Nov 2020	American Physical Society Division of Plasma Physics Meeting, remote – poster presentation
Apr 2020	Sherwood Fusion Theory Conference, Santa Rosa, CA – poster presentation *(meeting canceled)*
Nov 2018	American Physical Society Division of Plasma Physics Meeting, Portland, Oregon – poster presentation
Apr 2018	Sherwood Fusion Theory Conference, Auburn, Alabama – poster presentation
Oct 2017	American Physical Society Division of Plasma Physics Meeting, Milwaukee, Wisconsin – poster presentation
May 2017	Sherwood Fusion Theory Conference, Annapolis, Maryland – poster presentation
Oct 2016	American Physical Society Division of Plasma Physics Meeting, San Jose, California – poster presentation
Apr 2016	Sherwood Fusion Theory Conference, Madison, Wisconsin – poster presentation

Teaching Experience

2014-2017	Teaching Assistant, Introductory Physics I & II for Life Sciences, UW *Taught four semesters total; granted ratings of "Excellent" three times and "Very Good" once by TA coordinator; granted campus-wide TA award in 2018*
2010-2014	Co-instructor, instructional lab manager, Undergraduate Teaching Assistant, tutor, mentor, and peer advisor at UO and a local high school *The teaching activities I was involved in at UO were broad and occurred over the span of my time there; I am happy to discuss them in greater detail if asked*

Mentoring

2022-	Co-mentoring CU-Boulder PhD student Whitney Powers on research project on moist convection
2022-	Co-mentoring UCSC undergraduate student Henry Olling, alongside Prof. Patrick Chuang, on research project on water droplet accumulation in turbulent clouds
2021-	As a senior participant at the Kavli Summer Program in Astrophysics 2021 (link), directly supervised Kavli student fellow Imogen Cresswell's research project on shear-flow turbulence in MHD, motivated by small-scale dynamics in stellar interiors - *I continue to mentor Imogen at CU-Boulder on a project involving fingering convection in stellar interiors*
2021-2022	Mentoring UCSC undergraduate student Amishi Sanghi on research project, led to 2022 publication listed below
2019-2020	Peer mentor to Bindesh Tripathi, UW-Madison *(I continue to mentor Bindesh on research)*
2019-2020	Supervised an undergraduate research project: Jack Schroeder, studying how magnetic fields affect coupling to large-scale stable modes in shear flow instabilities

Professional Service

2018-2019	Co-founder and President, Physics Graduate Student Council (PGSC) - *Led department-wide town halls to collaboratively form PGSC, served as president for its first year* - *Worked with department administrators and peers on two $1,000 professional development* ***grants*** *awarded by the university with which we hosted seminar speakers; secured additional $4,000 in support from the department for our first year* - *Worked with department and peers to: restructure graduate student recruitment and orientation; address major concerns regarding the graduate program; secure graduate student representatives on relevant faculty committees; implement peer mentoring* (https://pgsc.physics.wisc.edu/)
2018-2019	Graduate Program Committee Member, UW-Madison Department of Physics *Served as student representative on faculty committee* (https://www.physics.wisc.edu/resources/committee)

Peer reviews: J. Plasma Phys. (2020-present), Phys. Rev. Fluids (2022-present), Phys. Plasmas (2022-present), GAFD (2023-present); NSF ad-hoc proposal review (plasma physics, 2022)
Session chair: KITP "transtar21" conference (link), APS-DFD 2022 meeting
Open-source software contributions: contributed to Dedalus and Eigentools multiple PRs and issues, see my GitHub for details

Other Experience

Spring 2023	Participant at Whole Sun 2023 ERC meeting (Paris/Saclay)
Summer 2022	Participant in WHOI GFD program
Fall 2021	Participant in KITP Program: Probes of Transport in Stars
Summer 2021	Participant in Kavli Summer Program in Astrophysics (KSPA): Fluid Dynamics of the Sun and Stars
Spring 2021	Participant in KITP Program: Layering in Atmospheres, Oceans and Plasmas
Summer 2017	Student in Summer School on Astrophysical Plasmas - Niels Bohr International Academy, Copenhagen, Denmark
2013–2014	Imamura Group, University of Oregon *Worked on analytical and numerical models of accretion disks, including global fluid simulations, linear stability analyses, and radiation transport models*
2011–2013	Torrence Group, University of Oregon *Using Geant4, a Monte Carlo-based particle physics software package, developed and ran a model to test the performance of an electron energy spectrometer originally proposed for use in the International Linear Collider*

Refereed Publications

(Red text highlights undergraduate and/or graduate students I mentored on these projects.)

(Submitted)	**A.E. Fraser** and P. Garaud, *Magnetized fingering convection in stars: problems with parasitic models*, Astrophys. J., arXiv
Dec 2022	**A.E. Fraser**, M. Joyce, E.H. Anders, J. Tayar, and M. Cantiello, *Characterizing Observed Extra Mixing Trends in Red Giants using the Reduced Density Ratio from Thermohaline Models*, Astrophys. J., DOI, arXiv
Oct 2022	**A.E. Fraser**, I.G. Cresswell, and P. Garaud, *Non-ideal instabilities in sinusoidal shear flows with a streamwise magnetic field*, J. Fluid Mech., DOI, arXiv
Sep 2022	B. Tripathi, **A.E. Fraser**, P.W. Terry, E.G. Zweibel, and M.J. Pueschel, *Near-cancellation of up-and down-gradient momentum transport in forced magnetized shear-flow turbulence*, Phys. Plasmas, DOI, arXiv
July 2022	B. Tripathi, **A.E. Fraser**, P.W. Terry, E.G. Zweibel, and M.J. Pueschel, *Mechanism for Sequestering Magnetic Energy at Large Scales in Shear-Flow Turbulence*, Phys. Plasmas, DOI, arXiv
Aug 2022	A. Sanghi, **A.E. Fraser**, E.R. Tian, and P. Garaud, *Magnetized semiconvection and density layers in stars*, Astrophys. J., DOI, arXiv
Mar 2022	E.H. Anders, A.S. Jermyn, D. Lecoanet, **A.E. Fraser**, I.G. Cresswell, M. Joyce, and J.R. Fuentes, *Schwarzschild and Ledoux are equivalent on evolutionary timescales*, Astrophys. J. Lett., DOI, ADS, arXiv
Feb 2021	**A.E. Fraser**, P.W. Terry, E.G. Zweibel, M.J. Pueschel, and J.M. Schroeder, *The impact of magnetic fields on momentum transport and saturation of shear-flow instability by stable modes*, Physics of Plasmas 28, 022309 DOI, ADS → Designated as a Phys. Plasmas **Editor's Pick**
Dec 2018	**A.E. Fraser**, M.J. Pueschel, P.W. Terry, and E.G. Zweibel, *Role of stable modes in driven shear-flow turbulence*, Physics of Plasmas 25, 122303 DOI, ADS → Designated as a Phys. Plasmas **Featured Article** → Selected for an **AIP Scilight** article (https://aip.scitation.org/doi/10.1063/1.5083843) → UW press release (https://news.wisc.edu/taming-turbulence-seeking-to-make-complex-simulations-a-breeze/)
Jun 2017	**A.E. Fraser**, P.W. Terry, E.G. Zweibel, and M.J. Pueschel, *Coupling of damped and growing modes in unstable shear flow*, Physics of Plasmas 24, 062304 DOI, ADS → Designated as a Phys. Plasmas **Editor's Pick**