

# Adrian E. Fraser

Hale Postdoctoral Fellow at University of Colorado, Boulder

## Contact Information, Links

Email: [adrian.fraser@colorado.edu](mailto:adrian.fraser@colorado.edu)

Work phone: (303) 492-4068

Personal website [afraser3.github.io](https://afraser3.github.io)

Google Scholar: [scholar.google.com/citations?user=OtBEMssAAAAJ](https://scholar.google.com/citations?user=OtBEMssAAAAJ)

## 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–	<b>Hale Postdoctoral Fellow, University of Colorado, Boulder</b> Applied Mathematics, Astrophysical and Planetary Sciences, and LASP
2020–2022	<b>University of California, Santa Cruz</b> Postdoc, Applied Mathematics PI: Pascale Garaud
2014–2020	<b>University of Wisconsin-Madison</b> Ph.D., Physics (Plasma) Advisors: Paul W. Terry, Ellen G. Zweibel Graduation date: Aug 23, 2020
2010–2014	<b>University of Oregon</b> 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](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](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](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	<p><b>Momentum transport by shear-flow-driven turbulence in stars</b>, XSEDE computing resources, NSF (education allocation)  Resources awarded: approx. 200,000 CPU-hours  PI: <b>A.E. Fraser</b></p>
2018-2019	<p><b>Role of Stable Eigenmodes in Shear-flow MHD Turbulence</b>, XSEDE computing resources, NSF (start-up allocation)  <b>Lead author on proposal</b>, but not listed as PI due to XSEDE policy  Resources awarded: approx. 200,000 CPU-hours  PI: P.W. Terry, Co-PIs: <b>A.E. Fraser</b>, M.J. Pueschel, E.G. Zweibel</p>
2017-2018 & 2018-2019	<p><b>Gyrokinetic Plasma Microturbulence Simulation in Fusion and Basic Plasmas</b>, XSEDE computing resources, NSF (research allocation)  Contributed to proposal, but the lead author was the PI  Resources awarded: approx. 6,750,000 (2018-2019) &amp; 11,300,000 (2017-2018) CPU-hours  PI: M.J. Pueschel, Co-PIs: <b>A.E. Fraser</b>, P.W. Terry, Z.R. Williams, S.-W. Tsao</p>

## Invited Talks

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

## Seminars

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 ( <a href="#">Youtube link</a> )
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” - <a href="#">Kavli Summer Program in Astrophysics</a>
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, Uni- versity 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 ( <a href="#">link</a> )
Nov 2021	American Physical Society Division of Fluid Dynamics Meeting, Phoenix, AZ – con- tributed 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 ( <i>meeting canceled</i> )
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, Wiscon- sin – 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 <i>Taught four semesters total; granted ratings of “Excellent” three times and “Very Good” once by TA coordinator; granted campus-wide TA award in 2018</i>
2010-2014	Co-instructor, instructional lab manager, Undergraduate Teaching Assistant, tutor, mentor, and peer advisor at UO and a local high school <i>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</i>

## 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 ( <a href="#">link</a> ), 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>- I continue to mentor Imogen at CU-Boulder on a project involving fingering convection in stellar interiors</i>
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>I continue to mentor Bindesh on research</i> )
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) <i>- Led department-wide town halls to collaboratively form PGSC, served as president for its first year</i> <i>- Worked with department administrators and peers on two \$1,000 professional development <b>grants</b> awarded by the university with which we hosted seminar speakers; secured additional \$4,000 in support from the department for our first year</i> <i>- 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</i> ( <a href="https://pgsc.physics.wisc.edu/">https://pgsc.physics.wisc.edu/</a> )
2018-2019	Graduate Program Committee Member, UW-Madison Department of Physics <i>Served as student representative on faculty committee</i> ( <a href="https://www.physics.wisc.edu/resources/committee">https://www.physics.wisc.edu/resources/committee</a> )

**Peer reviews:** J. Plasma Phys. (2020-present), Phys. Rev. Fluids (2022-present), Phys. Plasmas (2022-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 (1 PR, 1 issue) and Eigentools (1

PR, 2 issues), see [my GitHub](#)

## Other Experience

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 <i>Worked on analytical and numerical models of accretion disks, including global fluid simulations, linear stability analyses, and radiation transport models</i>
2011–2013	Torrence Group, University of Oregon <i>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</i>

## 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**