

# Evan H. Anders

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  : [evanhandlers](https://github.com/evanhandlers)

## Research Interests

Computational fluid dynamics and its applications to stellar interiors and atmospheres.  
Interactions between stellar convection and stable layers, stratification, rotation, or magnetism.

## Education

May **Ph.D.**, *University of Colorado – Boulder*, Astrophysical & Planetary Sciences.  
2020 Thesis title: “Fundamental Studies of Stratified Stellar Convection: Simulations and Theory”  
Dec. **M.S.**, *University of Colorado – Boulder*, Astrophysical & Planetary Sciences.  
2017  
May **B.S.**, *Whitworth University*, Physics.  
2014

## Research Experience

Sept **Postdoctoral Fellow**, *CIERA, Northwestern University*, Evanston, IL.  
2020–  
Summer **Postdoctoral Researcher**, *LASP*, Boulder, CO.  
2020  
2018– **NASA NESSF Graduate Fellow**, *University of Colorado & LASP*, Boulder, CO.  
2020  
2015– **George Ellery Hale Graduate Fellow**, *NSO & LASP*, Boulder, CO.  
2018  
Summer **Graduate Research Assistant**, *LASP*, Boulder, CO.  
2015  
2013 **NSF Summer Undergraduate Research Fellow**, *LIGO*, Hanford, WA.  
2012 **DOE Summer Undergraduate Laboratory Intern**, *PNNL*, Richland, WA.

## Grants & Fellowships Awarded

- 2020- **CIERA Postdoctoral Fellowship**, Evanston, IL.  
Present Fellowship covers salary and provides \$15,000 yearly research stipend
- 2018- **NASA Earth and Space Science Fellowship**, \$90,000, Boulder, CO.  
2020 Fundamental Studies Into the Solar Convective Conundrum: Do Giant Cells Exist?  
Grant Number 80NSSC18K1199
- 2015- **NSO George Ellery Hale Graduate Fellowship**, Boulder, CO.  
2018 Fellowship covers tuition, fees, and graduate research stipend for three full years.  
Fellowship overview available online at <https://www.nso.edu/students/hale-fellowships/>

## Invited Presentations

- 2021 10. *Stellar convective penetration: parameterized theory and dynamical simulations*  
Virtual. Astro coffee. The Ohio State University. Oct. 27.
9. *Convective Penetration Probably Parameterizes Convective Overshoot*  
Virtual. Stellar Physics Group Presentation. CCA, Flatiron Institute. July 6.
8. *Convective Penetration Probably Parameterizes Convective Overshoot*  
Virtual. Seminar. "Kavli Summer Program in Astrophysics 2021: Fluid dynamics of the Sun and stars." July 5.
7. *Massive Star Variability*  
Virtual. Pre-recorded research intro lecture. "Kavli Summer Program in Astrophysics 2021: Fluid dynamics of the Sun and stars." June 8.
- 2020 6. *Massive Star Variability and other fun with Dedalus*  
CIERA, Northwestern University. CIERA Virtual Happy Hour Short Talk. Nov. 20.
5. *Entropy Rain and the Solar Convective Conundrum: Dilution and Compression of Individual Convective Downflows*  
Nordita, Stockholm. "The Shifting Paradigm of Stellar Convection: From Mixing Length Concepts to Realistic Turbulence Modeling" workshop. Mar. 4.
- 2019 4. *Entropy Rain and the Solar Convective Conundrum: Dilution and Compression of Individual Convective Downflows*  
Princeton University. Star Formation/ISM Rendezvous (SFIR) Seminar. Dec. 4.
3. *Entropy Rain: Dilution and Compression of Thermals in Stratified Domains*  
University of Colorado – Boulder. Applied Math Geophysical and Astrophysical Fluid Dynamics (GAFD) Seminar. Oct. 1.
- 2018 2. *Predicting the Rossby Number in Stratified, Compressible Convection*  
National Solar Observatory. Solar Focus Meeting. Dec. 7.
- 2017 1. *Fundamental studies in stratified convection at low and high Mach Number*  
University of Colorado – Boulder. Applied Math Dynamics Seminar. Nov. 11.

## Publications List

### Peer-reviewed Journal Articles

† - I was a co-first-author on this paper

\* - This paper was led by someone I mentor

- 2022 \*17. *Fuentes, J.R.; Cumming, A.; **Anders, E.H.**. In prep.*  
Layer formation in a stably-stratified fluid cooled from above. Towards an analog for Jupiter and other gas giants.
- †16. *Fraser, A.E.; Joyce, M.; **Anders, E.H.**; Tayar, J.; Cantiello, M. submitted to ApJ. ([Arxiv version](#)).*  
Observed Extra Mixing Trends in Red Giants are Reproduced by the Reduced Density Ratio in Thermohaline Zones.
15. *Jermyn, A.S.; **Anders, E.H.**; Lecoanet, D.; and Cantiello, M. submitted to ApJS.*  
An Atlas of Convection in Main Sequence Stars.
14. *Jermyn, A.S.; **Anders, E.H.**; Lecoanet, D.; and Cantiello, M. Accepted for publication in ApJ. ([Arxiv version](#)).*  
Convective Penetration in Early-Type Stars
13. *Jermyn, A.S.; **Anders, E.H.**; and Cantiello, M. Accepted for publication in ApJ ([Arxiv version](#)).*  
A Transparent Window into Early-Type Stellar Variability
12. ***Anders, E.H.**; Jermyn, A.S.; Lecoanet, D.; Fraser, A.E.; Cresswell, I.G.; Joyce, M.; and Fuentes, J.R. [ApJL 928, L10](#).*  
Schwarzschild and Ledoux are equivalent on evolutionary timescales
11. ***Anders, E.H.**; Jermyn, A.S.; Lecoanet, D.; and Brown, B.P., [ApJ 926, 169](#).*  
Stellar convective penetration: parameterized theory and dynamical simulations
- 2021 \*10. *O'Connor, L.; Lecoanet, D.; and **Anders, E.H.**, [Physical Review Fluids 6, 093501](#).*  
Marginally-Stable Thermal Equilibria of Rayleigh-Bénard Convection
9. *Lecoanet, D.; Cantiello, M.; **Anders, E.H.**; Quataert, E.; Couston, L.; Bouffard, M.; Favier, B.; and Le Bars, M., [MNRAS 508, 1, 132-143](#).*  
Surface Manifestation of Stochastically Excited Internal Gravity Waves
8. *Van Kooten, S.J.; **Anders, E.H.**; and Cranmer, S.R., [ApJ 913, 69](#)*  
A Refined Model of Convectively-Driven Flicker in Kepler Light Curves
7. *Oishi, J.S.; Burns, K.J.; Clark, S.E.; **Anders, E.H.**; Brown, B.P.; Vasil, G.M.; and Lecoanet, D., [JOSS 6\(62\), 3079](#).*  
eigentools: A Python package for studying eigenvalue problems with an emphasis on stability
- 2020 6. ***Anders, E.H.**; Vasil, G.M.; Brown, B.P.; and Korre, Lydia, [Physical Review Fluids 5, 083501](#).*  
Convective dynamics with mixed temperature boundary conditions: why thermal relaxation matters and how to accelerate it
- 2019 5. ***Anders, E.H.**; Lecoanet, D.; and Brown, B.P., [ApJ 884, 65](#).*  
Entropy Rain: Dilution and Compression of Thermals in Stratified Domains

4. **Anders, E.H.**; Manduca, C.M.; Brown, B.P.; Oishi, J.S.; Vasil, G.M., [ApJ 872, 2](#).  
Predicting the Rossby Number in Convective Experiments
- 2018 3. **Anders, E.H.**; Brown, B.P. and Oishi, J. S., [Physical Review Fluids 3, 083502](#).  
Accelerated evolution of convective simulations
- 2017 2. **Anders, E.H.** and Brown, B.P., [Physical Review Fluids 2, 083501](#).  
Convective heat transport in stratified atmospheres at low and high Mach number
- 2016 1. Karki, S.; Tuyenbayev, D.; Kandhasamy, S.; Abbott, B.P.; Abbott, T.D.; **Anders, E.H.**; Berliner, J.; Betzwieser, J.; Cahillane, C.; Canete, L.; Conley, C.; Daveloza, H.P.; De Lillo, N.; Gleason, J.R.; Goetz, E.; Izumi, K.; Kissel, J.S.; Mendell, G.; Quetschke, V.; Rodruck, M.; Sachdev, S.; Sadecki, T.; Schwinberg, P.B.; Sottile, A.; Wade, M.; Weinstein, A.J., West, M.; and Savage, R.L., [Review of Scientific Instruments 87, 114503](#).

The Advanced LIGO photon calibrators

#### Other Publications

- 2022 3. **Anders, E.H.**; Bauer, E.B.; Jermyn, A.S.; Van Kooten, S.J.; Brown, B.P.; Hester, E.W.; Wilkinson, M.; Goldberg, J.A.; Varesano, T.; Lecoanet, D. [ArXiv; April fool's paper](#).

Moosinesq Convection in the Cores of Moosive Stars

- 2022 2. **Anders, E.H.**; Jermyn, A.S.; Lecoanet, D.; Fuentes, J.R.; Korre, L.; Brown, B.P.; Oishi, J.S.; [RNAAS 6, 41](#).

Convective Boundary Mixing Processes

1. Jermyn, A.S.; **Anders, E.H.**; Lecoanet, D.; Cantiello, M.; and Goldberg, J.A.; [RNAAS 6, 29](#).

Measures of Convective Efficiency

#### Awards & Honors

- 2019 **AAS 233 Chambliss Graduate Student Poster Contest**, *Honorable Mention*.
- 2016 **Comprehensive Exam II High Pass**, University of Colorado – Boulder.  
Awarded for the defense of publication-quality research
- 2016 **Carl Hansen Graduate Fellowship, \$1,000**, University of Colorado – Boulder.  
Awarded to a graduate student studying stellar interiors
- 2014 **President's Award for Outstanding Academic Achievement**, Whitworth Univ..  
Awarded to students graduating with 4.0 GPAs

#### Contributed Presentations

- 2021 **APS Division of Fluid Dynamics**, *Talk*, Pheonix, AZ.  
Convective penetration exists and we found it
- KITP Probes of Transport in Stars conference**, *Talk*, Santa Barbara, CA.  
Stellar Convective Penetration: Context, Theory, and Simulations

- 2020 **APS Division of Fluid Dynamics**, *Virtual Talk*, Chicago, IL.  
Convection in the Full Sphere: Predicting the Rossby Number of Mean & Fluctuating Flows  
**American Astronomical Society's 235th Meeting**, *Dissertation Talk*, Honolulu, HI.  
Numerical Explorations in Stellar Convection
- 2019 **APS Division of Fluid Dynamics**, *Talk*, Seattle, WA.  
Dilution and Compression of Thermals in Stratified Domains  
**Compressible Convection Conference**, *Talk*, Newcastle Upon Tyne, UK.  
Entropy Rain: Dilution and Compression of Turbulent Thermals in Stratified Domains  
**Stellar Hydro Days V**, *Poster*, Exeter, UK.  
Accelerating the evolution of atmospheric structure in convective simulations  
**American Astronomical Society's 233rd Meeting**, *Poster*, Seattle, WA.  
Accelerating the evolution of simulated convective atmospheres
- 2018 **APS Division of Fluid Dynamics**, *Talk*, Atlanta, GA.  
Predicting the Rossby number in stratified, compressible convection
- 2017 **APS Division of Fluid Dynamics**, *Talk*, Denver, CO.  
The effects of Mach number and rotation on heat transport in stratified convection  
**Compressible Convection Conference**, *Talk*, Lyon, Fr.  
Convective heat transport in stratified atmospheres at low and high Mach number
- 2016 **APS Division of Fluid Dynamics**, *Talk*, Portland, OR.  
Sustained shear flows in stratified convection  
**AAS Solar Physics Division**, *Poster*, Boulder, CO.  
Boundary Layer Structure in Stratified Convection

## Service

### Departmental Service

- 2022 Member of CIERA Justice, Equity, Diversity, and Inclusion (JEDI) committee
- 2021 Chair of CIERA K12 outreach taskforce
- 2020 Member of CIERA K12 outreach taskforce
- 2019-2020 Member of newly-formed admissions setup committee
- 2018-2019 Voting member of graduate admissions committee
- Graduate student member of exams committee
- 2017-2018 Voting member of graduate admissions committee
- 2016-2017 Voting member of hiring committee for director of Fiske Planetarium
- Graduate student member of search committee for NSO/CU faculty appointment

Graduate student member of exams committee  
2015- Graduate student member of search committee for three-year NSO/CU appointment  
2016

Referee Service  
JFM 2021, 1 total articles  
JAS 2020-2021, 2 total articles  
DIRAC 2020, 1 total grants

## Teaching Experience and Professional Development

### Courses & Labs Taught

Summer **ASTR 2600: Introduction to Scientific Programming**, *Co-Instructor of Record*.  
2017  
2014- **ASTR 1010: Introductory Astronomy I (Lab)**, *Graduate Lab Instructor, 4 sections*.  
2017

### Guest Lectures

2020 **PS361: Nuclear Physics**, *Whitworth University*, "Life and Death of Stars", Dec. 9.  
2015 **ASTR 1010: Intro. Astro. I**, *Univ. of CO*, "Patterns in the Solar System", Mar. 10.

### Teaching Assistantships

2015- **ASTR 1010: Introductory Astronomy I**, *Lecture Teaching Assistant, 2 sections*.  
2016

### Pedagogy Training

2019 **UCSC ISEE Professional Development Program**, *Design Team Leader*.  
Led team over a 100-hour program to design and teach a day-long inquiry activity on buoyancy.  
2017 **UCSC ISEE Professional Development Program**, *Participant*.  
Designed and taught a day-long inquiry activity on exoplanet transits.  
2016- **Lead Graduate Teacher**, *Astro. Department*, University of Colorado, Boulder, CO.  
2017 Led video consultations, ran pedagogy workshops, interfaced with Graduate Teacher Program.

## Outreach

### Long-term programs

2016- **CU STARS**, *Student Coordinator*, University of Colorado, Boulder, CO.  
2019 CU STARS (CU Boulder Science, Technology, and Astronomy RecruitS) visits underserved schools across all of Colorado and gives high school students an opportunity to learn about and engage with space science. Graduate students serve as mentors to undergraduates, help design and improve outreach courses, and ensure outreach visits run smoothly.

- 2014- **Sommers-Bausch Observatory Open House Series**, *Host & Telescope Operator*, University of Colorado, Boulder, CO.  
2017 Operated telescopes and answered questions from the public during free observing nights.

Visualization & Print Media

- 2021 **“Exoplanets” Pathfinder Pamphlet**, CIERA Pathfinder Series, Evanston, IL.

One-day events

- 2021 **Baxter Summer Scholars Astro. Day**, Northwestern University, Evanston, IL.  
2019 **CU Boulder MASP PEAC Science Day**, University of Colorado, Boulder, CO.  
**Sommers-Bausch Observatory Astro. Day**, University of Colorado, Boulder, CO.  
2018 **Sommers-Bausch Observatory Astro. Day**, University of Colorado, Boulder, CO.  
2017 **CU Boulder MASP PEAC Science Day**, University of Colorado, Boulder, CO.  
**Sommers-Bausch Observatory Astro. Day**, University of Colorado, Boulder, CO.

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References

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