

# Xu, Yufan - CV

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- RESEARCH INTERESTS
- Liquid metal magnetohydrodynamics
  - Liquid metal application in fusion
  - Geophysical and astrophysical fluid dynamics
  - Planetary and stellar magnetic field generation

EDUCATION **University of California, Los Angeles** Jun 2023

Ph.D., Geophysics and Space Physics, completed Jun 2023

- Thesis Topic: *Laboratory Experiments on Planetary Core Dynamics: Magnetoconvection and Rotating Magnetoconvection*
- Advisor: Prof. Jonathan M. Aurnou

M.S., Geophysics and Space Physics, Jun 2019

**University of Wisconsin-Madison** Jun 2017

B.S., Applied Mathematics, Engineering, and Physics (AMEP), Jun 2017

- Honor Thesis: *Hardening of Metals Using Plasma Immersion Ion Implantation (PIII)*
- Advisor: Prof. Cary B. Forest

RESEARCH EXPERIENCE **Associate Research Physicist** Jun 2023 –

Princeton Plasma Physics Lab, Princeton, NJ

- Spearheaded design of Lithium Experimental Application Platform (LEAP) concept under DOE LDRD program as a testing bed for liquid lithium Plasma-facing Components (PFCs) for fusion devices and reactors.
- Session leader of DIII-D tokamak experiment (MP 2024-14-02): Explore ELM-free enhanced pedestal access via low-Z impurity powder injection with adaptive RMP control
- Conducted laboratory experiments and numerical simulations of liquid metal surface wave instability for liquid metal PFC design.

**Graduate Researcher** Aug 2017 – Jun 2023

Department of Earth, Planetary, and Space Sciences (EPSS), UCLA

- Developed theoretical and experimental models for thermoelectric magnetoconvection. Proposed novel core-mantle coupling mechanisms
- Characterized heat transfer and behavior regimes in liquid metal magnetoconvection
- Designed, prototyped, and upgraded the data acquisition system, diagnostics, and mechanical parts on the UCLA RoMag device
- Led laboratory experimental studies of planetary dynamo processes. Experimentally investigated liquid metal rotating convection, rotating magnetoconvection and magnetostrophic modes

## Undergraduate Research Assistant

Jun 2014 – May 2017

Department of Physics, University of Wisconsin-Madison

- Carried out mechanical, electrical, and electronic works on the water cooling support system for the Madison Plasma Dynamo Experiment
- Participated in Plasma Couette Experiment and led individual research on plasma immersion ion implantation

## TEACHING & MENTOR EXPERIENCE

**Teaching Assistant:** EPSS, UCLA; six quarters

- Introduction to Oceanography (EPS SCI 15) Spring 2020, 2021, 2022  
Instructor: Prof. David Jewitt; Prof. Edwin Schauble
- Astrobiology (EPS SCI 3) Fall 2020  
Instructor: Prof. Jean-Luc Margot; Prof. Tina Treude
- Introduction to Computing for Geoscientists (EPS SCI 71) Fall 2018  
Instructor: Prof. Jonathan M. Aurnou
- Earthquakes (EPS SCI 8) Spring 2018  
Instructor: Prof. Gilles Peltzer

## Mentorship

- Andrea P. Hernandez-Diaz (SULI program at PPPL) Summer 2024  
XRF high-Z calibration for liquid metal centrifuge
- Atria Aidun (SULI program at PPPL) Summer 2024  
Lithium droplet tracking at LTX- $\beta$
- Luc Harbers (Andlinger Center Princeton University Fellowship) Summer 2024  
Laser profiler measurement for liquid metal surface stability
- Miranda Chang (UCLA undergrad): PID control and CAD Training 2022 - 2023
- Jake Ehret (UCLA undergrad): Mechanics and electronic Training 2019 - 2022

## AWARDS

### Fellowships

- UCLA Dissertation Year Fellowship Sep 2022 – Jun 2023
- UCLA Graduate Student Fellowship Award Sep 2017 – Jun 2022
- Hilldale Undergraduate/Faculty Research Fellowship  
University of Wisconsin - Madison Feb 2015 – Aug 2016

### Departmental Awards

- UCLA EPSS Department Fellowship Award Winter 2021
- UCLA EPSS Department Outreach Award Jun 2021
- UCLA EPSS Department Teaching Award Jun 2020

### Other Awards

- Outstanding Student Presentation Award, AGU 2022 Fall Meeting Feb 2023
- The International Mathematical Contest in Modeling Feb 2016

## CONFERENCES & SEMINARS

- Plasma-Material Interaction (PMI) meeting (invited talk) Jul 2024
- Xi'an Jiaotong University (invited talk) May 2024
- American Physical Society – Division of Plasma Physics (DPP) Nov 2023
- American Physical Society – Division of Fluid Dynamics (DFD) Nov 2023
- Princeton Plasma Physics Laboratory (invited talk) Nov 2022

The 17th Symposium of Study of the Earth's Deep Interior (SEDI)	Jul 2022
2022 Goldschmidt Conference	Jul 2022
EGU General Assembly 2022	May 2022
American Geophysical Union 2021 Fall Meeting	Nov 2021
American Physical Society – Division of Fluid Dynamics (DFD)	Nov 2020
American Physical Society – DFD	Nov 2019
The 13th Southern California Flow Physics Symposium	Apr 2019
The 16th SEDI	Jul 2018
American Physical Society – Division of Plasma Physics (DPP)	Nov 2016
University of Rochester (invited talk)	Sep 2022
Royal Astronomical Society UKSEDI (invited talk)	Nov 2021
- Collaborative study of Earth's core-mantle boundary region	
Nanjing University, China (invited talk)	Dec 2019
Departmental Student Symposium	May 2021
Departmental Geophysics Seminar	Dec 2020
Departmental Planetary Seminar	Feb 2019

**OUTREACH & SERVICES**     **Department Organization**

- Member of Asian cultural Alliance ERG group     2023 -
- VP for event planning – EPSSSO     2020-2021

**Outreach Events**

- Volunteer for Brian Taylor Leadership Institute Tour     Aug 2024
- Volunteer for Plasma Science Expo (PPPL booth) at APS-DPP 2023     Nov 2023
- Volunteer for PPPL's first Community Sustainability Celebration     Sep 2023
- EPSS outreach for Charles Drew University K-12     Mar 2023
- The Annual Exploring Your Universe (EYU)     Nov 2017-2020, 2022
- Booth Member, led experiments for public audiences
- UCLA Day for Geffen Academy Middle School     Apr 2019
- Helped perform experiments for middle school science students

**Documentary Film**

- “The Solar System”, Bigger Bang Productions (BBC)     Apr 2019

**SPINlab Geoscience Film Series**

- “Evaporative Convection in Glorious Time-Lapse”     May 2019
- “OID Film #3: Making ‘Barbasoloscope’ Visualization Fluid”     Jun 2019
- Music production in “Calimero’s Uprising!”     Sep 2019
- “Kinematically-Reversible Magneto-Couette Flow: The Movie!”     Nov 2019
- Professor Dave Explains     Nov 2019
- “Get to Know a UCLA Scientist #1: Geophysicist Jon Aurnou”

**MEMBERSHIP**     American Physical Society – Early Career  
 American Geophysical Union

**SKILLS**     **Data Analysis & Numerical Simulations**

- Julia, MATLAB, Python, Mathematica, Java, L<sup>A</sup>T<sub>E</sub>X.
- Code: Dedalus Project. FreeMHD (OpenFOAM).

## Fabrication & Diagnostics

- LabView, Fusion 360, SolidWorks, Moldex3D, CNC and power tools.
- Thermometry, Ultrasonic Doppler Velocimetry, Magnetometry, Laser profiling.

PEER-  
REVIEWED  
PUBLICATIONS

1. **Xu, Y.**, Abbate, J., David, C., Vogt, T., & Aurnou, J. (2024). Thermovelocimetric Characterization of Liquid Metal Convective Turbulence in a Rotating Cylinder. *International Journal of Heat and Mass Transfer*. Submitted.
2. **Xu, Y.**, Horn, S., & Aurnou, J. (2022). Thermoelectric Precession in Turbulent Magnetoconvection. *Journal of Fluid Mechanics*, 930, A8. [Link]
3. **Xu, Y.**, Horn, S., & Aurnou, J. (2023). Transition from Wall Mode to Multimodal Magnetoconvection in Liquid Gallium *Physics Review Fluids*, 8, 103503. [Link]
4. **Xu, Y.** (2023). Forging Experimental Pathways to Planetary Core Convection. *University of California, Los Angeles*.
5. Grannan, A., Cheng, J., Aggarwal, A., Hawkins, E., **Xu, Y.**, Horn, S., Sanchez-Alvarez, J., & Aurnou, J. (2022). Experimental pub crawl from Rayleigh-Bénard to magnetostrophic convection. *Journal of Fluid Mechanics*, 939, R1. [Link]
6. Abbate, J., **Xu, Y.**, Vogt, T., Horn, S., Julien, K. & Aurnou, J. (2024). Diffusivity-free heat and momentum transfer in liquid metal rotating convection experiments. Submitted.
7. David, C. S., Hester, E. W., **Xu, Y.**, & Aurnou, J. M. (2024). Magneto-Stokes Flow in a Shallow Free-Surface Annulus. *Journal of Fluid Mechanics*.
8. Wynne, B., Saenz, F., Al-Salami, J., **Xu, Y.**, Sun, Z., Hu, C., Hanada, K., Kolemen, E. (2024) FreeMHD: validation and verification of the open-source, multi-domain, multi-phase solver for electrically conductive flows. *Nuclear Fusion*. Submitted.

SELECTED  
CONFERENCE  
PUBLICATIONS

1. **Xu, Y.**, Wynne, B., Saenz, F., Harbers, L., Kolemen, E. (2024). Laboratory and numerical investigations of surface waves in flowing liquid metal plasma-facing components for fusion reactors. *Bulletin of the American Physical Society*
2. **Xu, Y.**, Momozaki, Y., Hvasta, M., Kolemen, E. (2024). Lithium Experimental Application Platform (LEAP): a step forward to reactor-scale liquid metal Plasma-Facing Components studies. *Bulletin of the American Physical Society*
3. Abbate, J., **Xu, Y.**, Vogt, T., Horn, S., Julien, K.A., & Aurnou, J. (2023). Velocity and heat transfer measurements in turbulent liquid metal rotating convection experiments. *Bulletin of the American Physical Society*
4. **Xu, Y.**, Horn, S., & Aurnou, J. (2022). On the hunt for magnetostrophic modes in liquid metal rotating magnetoconvection. *AGU Fall Meeting Abstracts 2022*.
5. Cheng, J., Grannan, A., Aggarwal, A., Hawkins, E., **Xu, Y.**, Horn, S., Sanchez-Alvarez, J., & Aurnou, J. (2022). Experimental Pub Crawl from Rayleigh-Bénard to Magnetostrophic Convection. *AGU Fall Meeting Abstracts 2022*.

6. **Xu, Y.**, Horn, S., & Aurnou, J. (2022). On the possibility of CMB thermoelectric dynamics. *2022 Goldschmidt Conference*.
7. **Xu, Y.**, Horn, S., & Aurnou, J. (2022). A laboratory study of turbulent magnetoconvection: Could thermoelectricity induce asymmetry in geo-magnetic secular variation? *EGU General Assembly 2022*.
8. **Xu, Y.**, Horn, S., & Aurnou, J. (2021). Thermoelectric Liquid Metal Magnetoconvection. *AGU Fall Meeting Abstracts 2021*.
9. **Xu, Y.**, Horn, S., & Aurnou, J. (2020). Laboratory Heat Transfer Measurements of Magnetoconvection (MC) in Liquid Gallium: Near-onset Behaviors. *Bulletin of the American Physical Society*.
10. **Xu, Y.**, Horn, S., & Aurnou, J. (2019). Laboratory Measurement of Non-Rotating Magnetoconvection in Liquid Gallium: Wall-mode Onset and Supercritical Precessional Mode. *Bulletin of the American Physical Society*.
11. **Xu, Y.**, Hawkins, E., Horn, S., & Aurnou, J. (2018). Magnetoconvection: Laboratory Experiments in Liquid Gallium. *The 16th Symposium of SEDI*.
12. **Xu, Y.**, Clark, M., Flanagan, K., Milhone, J., Nonn, P., & Forest, C. (2016). Hardening of Metallic Materials Using Plasma Immersion Ion Implantation (PIII). *Bulletin of the American Physical Society*, 61.

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