Chi Yan

Research Associate

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Current Position

The University of Texas at Austin   **Austin, TX, USA**
Research Associate, Institute for Geophysics, Jackson School of Geosciences   *2024-present*

Education

Johns Hopkins University   **Baltimore, MD, USA**
Ph.D. in Planetary Science   *2016-2021*

  Thesis: The Role of Stable Layers and External Thermal Perturbations on Planetary Dynamos

  Advisor: Dr. Sabine Stanley

University of Toronto   **Toronto, ON, Canada**
M.Sc. in Physics   *2015-2016*

Nanjing University   **Nanjing, JS, China**
B.Sc. in Physics with Honors   *2011-2015*

Research Experience

Institute for Geophysics, University of Texas at Austin   **Austin, TX**
Research Associate (Supervisor: Krista M. Soderlund)   *2024-present*

o Ice Giant Dynamos for Uranus and Neptune

o Basal magma ocean dynamos of early Earth, Venus, and the Moon

Earth & Planets Laboratory, Carnegie Institution for Science   **Washington DC**
Postdoc Fellow (Supervisor: Peter Driscoll, Cian Wilson)   *2023-2024*

o Modeling Thermo-chemical Convection in Earth's Core and Implications for Geodynamo Evolution

Johns Hopkins University   **Baltimore, MD**
Postdoc Fellow (Supervisor: Sabine Stanley)   *2021-2023*

Investigations of Saturn's Interior from Cassini Magnetic Field Observations

Johns Hopkins University   **Baltimore, MD**
Graduate Research Assistant (Advisor: Sabine Stanley)   *2016-2021*

o Mars' present-day magnetic field dichotomy from an ancient hemispheric dynamo

o Saturn's Helium insoluble layer constrained by magnetic data from the Cassini Grand Finale

o The stable layer atop Earth's core indicated by paleomagnetic records

Publications

Manuscripts in Preparation..

Yan, C.*, Soderlund, K. M., Aurnou, J., and Cao, H. Dynamo Mechanism for Excessive M1 Mode Generation. In preparation for submission to *Journal of Fluid Mechanics*

Yan, C.*, Soderlund, K. M., Liu, D., and O'Rourke, J. Basal Magma Ocean Dynamos in the Early History of Terrestrial Planets. In preparation

Sato, M.*, Ushioda, M., Nakada, R., Tamura, Y., Yamamoto, S., Ozawa, K., Takahashi, F., Sakata, R., Seki, K., and **Yan, C.** Strong magnetic anomalies record weak dynamo fields of ancient Mars. In preparation for submission to *Earth and Planetary Science Letters*

Yan, C.*, Kuang, W., Soderlund, K. M., Melin, H., Masters, A., and Airapetian, V. On the detectability of magnetic morphology through aurora observation. In preparation for submission to *Geophysical Research Letters*

Manuscripts Under Review...

Yan, C.*, Soderlund, K. M., Aurnou, J., Cao, H., Masters, A., and Melin, H. A Rapidly Evolving Dynamo Consistent with Uranus' and Neptune's Magnetic Fields, Under review at *Nature Communications Physics*

Peer-Reviewed Publications..

Yan, C.*, Barik, A., Stanley, S., Mittelholz, A., Plesa, A.-C., and Johnson, C.-L. (2025) Mars's hemispheric magnetic field from a full-sphere dynamo, *Geophysical Research Letters*, Vol. 52, No. 3, [link]

(*Media coverage:* UTIG News; Discover; Universe Today; The Watchers)

Gong, Z.*, Evans, D., Zhang, Z., and **Yan, C.** (2023) Mid-Proterozoic geomagnetic field was more consistent with a dipole than a quadrupole, *Geology*, Vol. 51, No. 6, pp. 571–575 [link]

Yan, C.*, Barik, A., Stanley, S., Leung, J., Mittelholz, A., Johnson, C.-L., Plesa, A.-C., and Rivoldini, A. (2023) An ancient Martian dynamo driven by hemispheric heating: effect of thermal boundary conditions, *The Planetary Science Journal*, Vol. 4, No. 11, 14 pp. [link]

Yan, C.* and Stanley, S. (2021) Recipe for a Saturn-like dynamo, *AGU Advances*, Vol. 2, No. 2, [link]

Editor's highlights: Saturn's Dynamo Illuminates its Interior

(*Media coverage:* Science Daily; EurekAlert!; Sky&Telescope; AZoQuantum)

Yan, C.* and Stanley, S. (2018) Sensitivity of the geomagnetic octupole to a stably stratified layer in the Earth's core, *Geophysical Research Letters*, Vol. 45, No. 20, [link]

* denotes corresponding author.

Mission Involvement

InSight Science Team
MAG working group   *2020-2023*

Research Proposal Involvement

NASA Solar System Science (SSS), PI   **In preparation**
Ice Giant Dynamos Resubmission   *April 2026*

NSF CAIG, Co-I   **Submitted**
Accelerating Geodynamo Simulations and Discovery with Physics-informed Spectral   *February 2026*
Graph Network Simulators

NASA Exoplanet Research Program (XRP), Co-I — **Submitted** *February 2026*
Magnetism of Earth- and Super Earth-like (Exo)Planets and Habitable Environments

NSF AAG, PI — **Submitted** *November 2025*
GLOW: Unraveling the Interiors of Early Earth and Mars through the Evolution of Their Dynamos

NSF AAG, PI — **Submitted** *November 2025*
Magnetic Field Generation in Ice Giants: Linking Interior Structure to Observable Field Morphology

NASA Solar System Science (SSS), PI — **Submitted** *September 2025*
Critical Conditions for Martian Dynamo via Numerical Simulation

Blue Sky Proposal (internal), Co-I — **Not selected** *April 2025*
Surrogate Planetary Dynamos with Graph Neural Networks

NASA Solar System Workings (SSW), PI — **Not selected** *March 2025*
Unraveling Ice Giant Magnetic Fields Through Dynamos with Persistent Non-Axisymmetry rated Excellent/Very Good

National Science Foundation, Co-I
Basal Magma Ocean Dynamos of Early Earth, Venus, and the Moon — *2024–2026*

National Science Foundation, Co-I
Thermo-chemical Convection in Earth's Core and Implications for Geodynamo Evolution — *2023–2024*

NASA Cassini Data Analysis Program (CDAP), Co-I
Investigations of Saturn's Interior from Cassini Magnetic Field Observations — *2021–2024*

InSight Science Team (MAG Working Group)
Mars' Core Evolution and Magnetic Field Generation — *2020–2023*

Invited Seminars and Colloquia

Texas A&M University, Department of Geology & Geophysics, Seminar — *April 1, 2026*

Arizona State University, COOKIE Hour Seminar — *October 27, 2025*

University of Tokyo, Group Seminar — *June 6, 2025*

Institute of Science Tokyo, Department Seminar — *June 5, 2025*

Southwest Research Institute, Division 15 Seminar — *October 24, 2024*

University of Texas Institute for Geophysics (UTIG), Seminar — *October 18, 2024*

George Mason University, Department of Atmospheric, Oceanic and Earth Sciences, Seminar *February 1, 2024*

Massachusetts Institute of Technology, Department of Earth, Atmospheric, and Planetary Sciences, Seminar — *November 14, 2023*

German Aerospace Center (DLR), Planetary Physics Department, Seminar — *October 12, 2022*

Oberlin College, Department of Physics and Astronomy, Colloquium — *November 11, 2021*

University of California, Santa Cruz, Departments of Astronomy & Astrophysics and Earth & Planetary Sciences, PLunch Seminar — *May 17, 2021*

Carnegie Institution for Science, Earth & Planets Laboratory, Seminar — *October 20, 2020*

Nanjing University, Department of Astronomy and Space Science, Seminar — *December 2019*

Conference Proceedings

Invited Presentations...

[**19**]: **Yan, C.**, Soderlund, K. M., Cao, H., Aurnou, J. M., Masters, A., and Melin, H., Unraveling Ice Giant Magnetic Fields and Their Secular Variation with Dynamo Models (Oral), *Workshop on Numerical and Theoretical Advances in Geophysical Fluid Dynamics and Nonlinear PDE Systems*, College Station, TX, 2026, **Invited**

[**19**]: **Yan, C.**, Soderlund, K. M., Cao, H., Aurnou, J. M., Masters, A., and Melin, H., Unraveling Ice Giant Magnetic Fields and Their Secular Variation with Dynamo Models (Oral), *AGU Fall Meeting*, New Orleans, LA, 2025, **Invited**

[**18**]: **Yan, C.**, Barik, A., Stanley, S., Plesa, A.-C., Mittelholz, A., and Johnson, C., Mars' Hemispheric Magnetic Fields Learned from Dynamo Simulations (Oral), *AOGS Annual Meeting*, Singapore, 2025, **Invited**

[**17**]: **Yan, C.**, Cao, H., Aurnou, J., and Soderlund, K. M., Magnetic Fields of Ice Giant Planets and Their Secular Variation (Oral), *JpGU Annual Meeting*, Chiba, Japan, 2025, **Invited**

[**16**]: **Yan, C.**, Cao, H., Aurnou, J., and Soderlund, K. M., Fast and Furious: Time Variation of Uranus' & Neptune's Magnetic Field (Oral), *ICDSS*, China, 2025, **Invited**

[**11**]: **Yan, C.**, Barik, A., Stanley, S., Plesa, A.-C., Rivoldini, A., Mittelholz, A., and Johnson, C., Probing Mars' Ancient Magnetic Mysteries with Full-Sphere Dynamo Simulations (Oral), *AGU Fall Meeting*, San Francisco, CA, 2023, [link], **Invited**

[**5**]: **Yan, C.** and Stanley, S., Recipe for a Saturn-like Dynamo (Oral), *AGU Fall Meeting*, San Francisco, CA, 2019, [link], **Invited**

Refereed Conference Presentations..

[**15**]: **Yan, C.**, Cao, H., Aurnou, J., and Soderlund, K. M., Effects of Variable Electrical Conductivity and Density Stratification on Ice Giant Dynamos (Poster), *AGU Fall Meeting*, Washington, DC, 2024

[**14**]: **Yan, C.**, Barik, A., Stanley, S., Plesa, A.-C., Rivoldini, A., Mittelholz, A., and Johnson, C., Hemispheric Magnetic Fields for Mars' Ancient Dynamo (Oral), *Texas Area Planetary Science Meeting*, San Antonio, TX, 2024

[**13**]: **Yan, C.**, Barik, A., Stanley, S., Plesa, A.-C., Rivoldini, A., Mittelholz, A., and Johnson, C., Simulations for Mars' Ancient Dynamo Before and After InSight (Oral), *Mars Interior and Geophysics After InSight*, College Park, MD, 2024

[**12**]: **Yan, C.**, Driscoll, P., and Wilson, C., Effects of Double Diffusive Convection in Planetary Dynamos (eLightning), *AGU Fall Meeting*, San Francisco, CA, 2023, [link]

[**10**]: **Yan, C.**, Barik, A., and Stanley, S., Stable Layers: The Catalyst for Dipole-Dominated Magnetic Fields in Gas Giants (Oral), *AAS Division for Planetary Sciences (DPS 55)*, San Antonio, TX, 2023, [link]

[**9**]: Barik, A., **Yan, C.**, Moore, K., and Stanley, S., Comparison of Jupiter's and Saturn's Magnetic Fields and Implications for Their Interiors (Oral), *AGU Fall Meeting*, Chicago, IL, 2022, [link]

[**8**]: **Yan, C.**, Barik, A., and Stanley, S., The Role of Stably Stratified Layers in Separating Deep and Shallow Dynamos (Oral), *AGU Fall Meeting*, Chicago, IL, 2022, [link]

[**7**]: **Yan, C.**, Barik, A., Stanley, S., Plesa, A.-C., Rivoldini, A., Mittelholz, A., and Johnson, C., Full-Sphere Dynamo Models for Mars' Ancient Magnetic Field (Oral), *AGU Fall Meeting*, New Orleans, LA, 2021, [link]

[**6**]: **Yan, C.**, Barik, A., Plesa, A.-C., Rivoldini, A., and Stanley, S., Sensitivity of the Ancient Martian

Dynamo to Hemispheric CMB Heat Flux Patterns (ePoster), *AGU Fall Meeting*, Online, 2020, [link]

[4]: **Yan, C.** and Stanley, S., Recipe for a Saturn-like Dynamo *Theo Murphy Royal Society Meeting: Revealing Saturn's Deep Interior with Cassini*, London, UK, 2019

[3]: **Yan, C.** and Stanley, S., Sensitivity of the Geomagnetic Octupole to a Stably Stratified Layer in the Earth's Core *Study of Earth's Deep Interior*, Edmonton, Canada, 2018

[2]: **Yan, C.** and Stanley, S., Sensitivity of the Geomagnetic Octupole to a Stably Stratified Layer in the Earth's Core *AGU Fall Meeting*, 2017

[1]: **Yan, C.** and Stanley, S., Sensitivity of the Geomagnetic Octupole to a Stably Stratified Layer in the Earth's Core *Gordon Research Conference: Interior of the Earth*, South Hadley, MA, 2017

Computational Resource Awards

Under Review

ACCESS
PHY260096: Basal Magma Ocean Dynamos for Early Earth, Venus, and the Moon 2026–2027
3,000,000 ACCESS Credits

Awarded

ACCESS
PHY260120: Effect of the extent of dynamo region on magnetic fields 2026–2027
1,500,000 ACCESS Credits (renewed)

ACCESS
PHY240217: Double Diffusive Convection in Planetary Dynamos 2024–2026
1,500,000 ACCESS Credits (renewed)

Lonestar6, Texas Advanced Computing Center
Numerical Models of Ice Giant Dynamos 2024
10,000 Service Units (SUs)

NASA High-End Computing Capacity (HECC)
Investigations of Saturn's Interior from Cassini Magnetic Field Observations 2021–2024
877,000 HECC Service Billing Units (SBUs)

Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS)
Numerical Simulations of Planetary Dynamos 2024
3,000,000 ACCESS Credits

Maryland Advanced Research Computing Center
Investigations of Planetary Dynamos 2016–2021

Teaching Experience

Guest Lectures

University of Texas at Austin *Austin, TX*

GEO366P: Planetary Geology and Geophysics: Introduction to Giant Planets *2024*

University of Texas at San Antonio *San Antonio, TX*

AST.1033.002 Exploration of the Solar System: Introduction to Giant Planets *2024*

Johns Hopkins University *Baltimore, MD*

AS.270.404 Planetary Interiors (Heat Transfer, Core Dynamics)   2022,2021,2019
AS.270.114 Guided Tour: The Planets (Planetary Dynamos)   2020
AS.270.684 Mathematical Methods (Fourier Series)   2020
AS.270.425 Earth and Planetary Fluids (Boundary Layers) (2 lectures)   2019

<u>*Mentoring Experience*</u>

The University of Texas at Austin   *Austin, TX*

o **Melissa Unlu** (undergraduate student, Computer Sciences, 2025): implementation of radially variable electrical conductivity for the couple core-basal magma ocean dynamos

Johns Hopkins University   *Baltimore, MD*

o **Vishnu Srinivasan** (undergraduate student, Physics and Applied Mathematics & Statistics, 2022): sensitivity of Saturn's observed internal magnetic field to various non-axisymmetric field noises

o **Yi Zheng** (summer intern, Maryland Institute College of Art, 2019): illustration on gas giant interiors, helium rainout layers and planetary magnetic fields

AS.270.605 EPS Colloquium, TA   2020
AS.270.114 Guided Tour: The Planets, TA   2020

University of Toronto   *Toronto, ON*

PHY131/132 Introduction to Physics I,II   2015-2016

Outreach and Community Service

o Early Career Panelist at 2nd Texas Area Planetary Science   *2024*
o Scientific Organizing Committee at 2nd Texas Area Planetary Science   *2024*
o *Ask a Scientist* Volunteer at NASA Earth Day   *2023*
o Volunteer for Neighborhood Lecture Events at Carnegie Institute for Science   *2023*
o YouTube Science Outreach Video: The Magnetic Fields of the Solar System   *2019*

Professional Service

o Reviewer for JGR-Planets, Icarus, Science Advances
o Panelist for NASA Mars Data Analysis Program
o External Reviewer for NSF

Skills

Dynamo Codes: *mMoSST*, *MagIC*, *Rayleigh*
Programming: ForTran, Python, C++, MatLab, Base, LaTex
Parallel Programming: MPI, OpenMP
HPC batch schedulers: SLURM, PBS
Language: Chinese (native), English (fluent), Japanese (Conversational)

Media Coverage

- [Molten Martian Core Could Explain Red Planet's Magnetic Quirks](#) *UTIG News, 2025*
- [Mars' Liquid Core May Have Once Powered Only Half of its Magnetic Field](#) *Discover, 2025*
- [Mars Has the Remnants of a Lopsided Magnetic Field](#) *Universe Today, 2025*
- [New model links Mars' molten core to hemispheric magnetic field anomaly](#) *The Watchers, 2025*
- [Mars once had a strong magnetic field, but now only traces remain](#) *earth.com, 2025*
- [Did Mars have a one-sided magnetic field?](#) *Techno-Science.net, 2025*
- [New models reveal Saturn's hidden regions](#) *JHU Hub, 2021*
- [Saturn's Dynamo Illuminates its Interior](#) *EOS Editor's highlight, 2021*
- [Scientists model Saturn's interior, explain planet's unique magnetic field](#) *Science Daily, 2021*
- [Helium Rain on Saturn May Explain Its Unusual Magnetic Field](#) *Planetary News, 2021*

Additional Training

- Carnegie Advancing Inclusive Mentorship *2024*
- Rayleigh Hackathon Workshop *2024*
- JHU Safe Zone Training *2022*
- JHU Teaching Academy – Teaching Institute Certificate Program *2020*
- UofT SciNet – Certificate in Scientific High Performance Computing *2016*

Professional Affiliations

- Division for Planetary Sciences of the American Astronomical Society
- American Geophysical Union
- Japan Geoscienec Union