

Matthew C. Brennan

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Education

Harvard University

May 2022 Ph.D. in Earth & Planetary Sciences

March 2020 M.A. in Earth & Planetary Sciences

University of Chicago

June 2017 B.S. with Honors in Geophysical Sciences / B.S. in Environmental Sciences

Research Positions

2017 – 2022 **Graduate Student**

Laboratory for Mineral Physics, Harvard University

Advisor: Dr. Rebecca A. Fischer

Dissertation: “Investigating Planetary Core Formation with Geophysical Modeling and High Pressure Mineralogy”

2016 – now **Synchrotron X-ray user**

GSECARS & HP-CAT, Advanced Photon Source, Argonne National Laboratory

Beamline 12.2.2, Advanced Light Source, Berkley National Laboratory

2015 – 2017 **Laboratory Technician**

Laboratory for Mineral Physics, University of Chicago

Advisor: Dr. Andrew J. Campbell

Thesis: “Molten Iron – Solid Silicate Interactions in Earth's Deep Interior”

2016 **Department of Energy SULI Program Researcher**

Energy Systems Division, Argonne National Laboratory

Supervisor: Dr. May Wu

Project: “Water Use for Power Generation in the United States”

Publications

- In review **“Temperature-dependent Clapeyron slope of the post-spinel transition in Mg_2SiO_4 ”** J. Dong, R. A. Fischer, L.P. Stixrude, M. C. Brennan, K. Daviau, T. Suer, K. M. Turner, Y. Meng, V. B. Prakapenka
- In review **“Investigating E-MORB and OIB petrogenesis using machine learning”** Z.T. Eriksen, S.B. Jacobsen, C. H. Langmuir, J. Dong, M.C. Brennan, J.T. Gu
- 2022 **“Water storage capacity of the Martian mantle through time”** J. Dong, R.A. Fischer, L. Stixrude, C. Lithgow-Bertelloni, Z. T. Eriksen, M.C. Brennan (2022) *Icarus*, 385, 115113.
- 2022 **“Timing of Martian core formation from models of Hf–W evolution coupled with N -body simulations.”** M.C. Brennan, R. A. Fischer, F. Nimmo, D. P. O’Brien (2022) *Geochimica et Cosmochimica Acta*, 316, 295–308.

- 2021 **“High-Pressure deformation of iron–nickel–silicon alloys and implications for Earth’s inner core.”** M.C. Brennan, R. A. Fischer, S. Couper., L. Miyagi, D. Antonangeli,, G. Morard (2021). *Journal of Geophysical Research: Solid Earth*, 126, e2020JB021077.
- 2020 **“Equation of state of TiN at high pressures and temperatures: A possible host for nitrogen in planetary mantles.”** K. Daviau, R. A. Fischer, M. C. Brennan, J. Dong, T. Suer, S. Couper, Y. Meng, V. B. Prakapenka, (2020). *Journal of Geophysical Research: Solid Earth*, 126, e2020JB020074.
- 2020 **“Core formation and geophysical properties of Mars.”** M.C. Brennan, R. A. Fischer, J. C. Irving (2020). *Earth and Planetary Science Letters*, 530, 115923.

Presentations

- 2022 **“High-Pressure Deformation of Iron–Nickel–Silicon Alloys and Implications for Earth’s Inner Core”**
Invited Talk (Materials at Extreme Conditions Group, Stony Brook University)
- 2022 **“A Mineral Physics Perspective on the Martian Core”**
Invited Talk (Planetary Geophysics Group, ETH Zürich)
- 2021 **“A Mechanically Strong Inner Core Implied by Deformation of Silicon-bearing Alloys”**
Poster Presentation (AGU Fall Meeting)
- 2021 **“Deep Mars”**
Invited Talk (Harvard EPS Colloquium)
- 2020 **“High pressure deformation and texturing of Fe–Ni–Si alloys”**
Oral Presentation (COMPRES Annual Meeting)
- 2019 **“Martian Core Formation: Implications from the Hf–W System.”**
Poster Presentation (Goldschmidt Conference)
- 2019 **“Using Core Formation and Geophysical Modelling to Predict the Core Radius and Seismic Properties of Mars.”**
Oral Presentation (Lunar and Planetary Science Conference)
- 2018 **“A Core Formation Model with Implications for the Properties of the Martian Interior.”**
Oral Presentation (AGU Fall Meeting)
- 2018 **“The Composition and Seismic Properties of the Martian Interior.”**
Oral Presentation (Goldschmidt Conference)
- 2017 **“Deep-Earth Partitioning between Molten Iron Alloys and Solid Silicates.”**
Poster Presentation (AGU Fall Meeting)

Teaching

- Fall 2021 **Head Teaching Fellow: EPS 10 (A Brief History of the Earth)**
- Spring 2021 **Teaching Fellow: ASTRON 16 (Stellar and Planetary Astronomy)**
- Fall 2020 **Teaching Fellow: EPS 10 (A Brief History of the Earth)**
- Fall 2019 **Teaching Fellow: EPS 142 (Mineralogy)**

Service and Outreach

2022	Featured speaker “From Blue to Red: How Mars Got and Lost its Water” Science in the News Public Seminar Series
2022	Curatorial assistant Mineral Type Specimens, Harvard Mineralogical & Geological Museum
2021	Guest speaker Cambridge Rindge and Latin School Astronomy Club
2021	Program leader EPS Summer Short-Term Student Program
2020 – now	Peer reviewer <i>Nature Communications, Nature Reviews: Earth & Environment, Physics and Chemistry of Minerals</i>
2020	Panelist “Conducting research and managing your career in the time of pandemic” COMPRES Annual Meeting
2020	Science Education Partner Harvard Museum of Natural History
2018 – 2020	Museum volunteer trainer Harvard Museum of Natural History
2018 – 2019	Graduate Outreach Chair Department of Earth & Planetary Sciences, Harvard University
2018	Volunteer tutor Cambridge School Volunteers, Cambridge Public Schools
2017 – now	Laboratory Safety Officer Department of Environmental Health & Safety, Harvard University
2017 – 2018	Gallery guide Harvard Museum of Natural History

Honors and Awards

2021	Derek Bok Center Teaching Certificate
2019 – 2022	National Science Foundation Graduate Research Fellow
2019 – 2020	Associate Member of Sigma Xi Honor Society
2017	University of Chicago Departmental Honors in Geophysical Sciences
2014 – 2017	University of Chicago Dean's List

Successful Proposals

2021	“Strength and texturing of iron alloys at high pressures and temperatures” Synchrotron Proposal (Beamline 12.2.2, Advanced Light Source)
2019	“Physical properties of iron alloys with implications for inner core anisotropy” Fellowship Proposal (NSF Graduate Research Fellowship)
2018	“Mantle Melting Temperatures of the Earth and Mars” Synchrotron Proposal (GSECARS, Advanced Photon Source)

Skills

Experiment	Diamond anvil cell assembly, loading, laser optics, Raman spectroscopy X-ray diffraction synchrotron and conventional sources, diffraction analysis Scanning electron microscopy sample preparation, FIB, EBSD, EDS Rock preparation field work, lapidary tools, epoxy mounting, polishing, petrography Piston-cylinder press assembly, hydraulics, electronics, thermocouples Optical telescope celestial coordinates, image acquisition, image analysis
Computation	Programming Python (Keras/Tensorflow), MATLAB, Mathematica, L ^A T _E X, HTML, SQL X-ray diffraction DIOPTAS, MAUD, BEARTEX, FIT2D, APEX3, Olex ² Other Adobe Illustrator, ImageJ, MS Office, GIS