

THERESA FISHER
CURRICULUM VITAE

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EDUCATION

Arizona State University, Tempe, AZ
Ph.D in Geoscience December 2023
Dissertation: "Atmospheric Chemical Reaction Networks as Tools for Understanding Planetary Processes and the Influence of Biospheres on Their Host Worlds"

Washington State University, Pullman, WA
M.S. in Environmental Science May 2013
Thesis: "Modeling a Subglacial Ecosystem with Implications for Mars"

University of Virginia, Charlottesville, VA
B.A. in Astronomy, Biology May 2010
Areas of Concentration: Planetary science, astrobiology, evolutionary biology
Senior thesis: "Biosignatures on Mars"

RESEARCH EXPERIENCE

Habitable Worlds Observatory START Team, National Air and Space Administration
Subteam lead, networks and kinetics 2024-2025
Coordinated cross-functional efforts to model and analyze complex chemical and biological systems to synthesize white paper regarding telescope design for the Habitable Worlds Observatory mission

University of Arizona Steward Observatory, Tucson, AZ
Postdoctoral researcher 2023-2025
Performed complex data analysis to identify chemical pathways relevant to prebiotic chemistry and molecular evolution, discovering that the essential ingredients for biochemistry are present on B-type asteroids and CM chondrite meteorites.
Produced technical reports and visualizations to communicate findings to cross-disciplinary teams
Integrated atmospheric modeling capabilities into the Bioverse Survey Simulation Python package, significantly enhancing functionality.
Developed pipeline for inference of atmospheric chemical reaction network topology from spectral data using PyTorch.

Arizona State University School of Earth and Space Exploration, Tempe, AZ
Research Assistant 2016-2023
Developed a Python-based analysis pipeline for chemical reaction network topology, yielding a new potential biosignature for exoplanets.
Processed and interpreted thousands exoplanet atmosphere model outputs from thousands of VULCAN and ATMOS simulations, supporting pipeline development via analysis of large datasets
Developed a model to constrain the amount of photosynthetic biomass possible on an ocean world, in order to develop better thresholds for remote detectability, as part of ASU's NexSS research node.

University of Virginia Department of Astronomy, Charlottesville, VA
Research Assistant 2010
Reduce image data from the January 2005 opposition of Saturn in IRAF, with the ultimate goal of gaining photometric data on the Saturnian Moons
(PI: Ann Verbitser, Research Scientist, UVA Dept. of Astronomy).

NASA Marshall Spaceflight Center, Huntsville, AL
Research Associate 2009
Reduce images from the Hubble Space Telescope via IDL in order to extract spectrographic data concerning the tenuous atmosphere of Europa (PI: Melissa McGrath, Chief Scientist, MSFC/NSSTC).
Part of the highly competitive NASA Academy program.

TEACHING EXPERIENCE

Arizona State University

- Teaching Assistant – “SES 395 Science Communication”** 2023
Graded assignments and facilitated discussion for science communication course specifically for astronomy and planetary science majors
- Teaching Assistant – “SES ASTR 111 Intro to Solar System Astronomy”** 2022
Facilitated discussion and created content for introductory planetary science course for science majors
- Teaching Assistant – “SES 126/128 Exploring the Universe”** 2021
Led labs and assisted students for introductory astronomy course for astronomy and exploration systems design majors
- Teaching Assistant- “Habitable Worlds”** 2020, 2021
Facilitated online astrobiology course and assisted students with assignments via Piazza/InScribe platforms
- Teaching Assistant- “Geology 102/104 online”** 2018-2019
Facilitated online introductory geology courses, graded assignments, and assisted students via Canvas platform and/or email

World Science Festival

- Teaching Fellow - “The Physics of Life”** 2019
Generate teaching material introducing concepts such as network topology and the physics of life to extraordinarily gifted high school students as part of the World Science Scholars program

Facilitate online discussion with students, both via web forum posts and live video conferences

Arizona State University

- Teaching Assistant- “Habitable Worlds”** 2017
Facilitated online astrobiology course and assisted students with assignments via Piazza platform

Washington State University

- Teaching Assistant – “ESRP 101 Introduction to Environmental Science”** 2013-2014
Lead labs, graded assignments, and facilitated small-group discussions during lecture for introductory environmental science course
- Grader** 2012
Graded assignments exams for Introduction to Oceanography

PUBLICATIONS AND PAPERS

PRIMARY CONTRIBUTOR

Fisher, T., Harman, C., Janin, E., Shabram, M., Tsai, S. M., Wogan, N., & Wong, M. (2026). Network and Kinetics-based Biosignatures: Implications for the Putative Habitable World Observatory Design. In *Towards the Habitable Worlds Observatory: Visionary Science and Transformational Technology, Part II: Mission Framework, Technology, Broader Contributions* (J. Lee et al., eds), pp. 67-71, Astronomical Society of the Pacific, San Francisco (in press)

Fisher, T., and Ferriere, R. (2026). Potential Metabolic Viability on Asteroid Chemistry. *Nature Chemistry Communications* **9**, 54

Fisher, T., Janin, E., & Walker, S. I. (2025). A Complex Systems Approach to Exoplanet Atmospheric Chemistry: New Prospects for Ruling Out the Possibility of Alien Life As We Know It. *The Planetary Science Journal* **6**(116)

Fisher, T., Kim, H., Millsaps, C., Line, M., & Walker, S. I. (2022). Inferring Exoplanet Disequilibria with Multivariate Information in Atmospheric Reaction Networks. *The Astronomical Journal*, **164**(2), 57

Walker S. I., Cronin L., Drew A., Domagal-Goldman S., **Fisher T.**, Line M., and Millsaps C. (2020) Probabilistic Biosignature Frameworks. In *Planetary Astrobiology* (V. Meadows et al., eds.), pp. 477–503. Univ. of Arizona, Tucson, DOI: 10.2458/azu_uapress_

Fisher, T., and Schulze-Makuch, D. (2013). Nutrient and population dynamics in a subglacial reservoir: a simulation case study of the Blood Falls ecosystem with implications for astrobiology. *International Journal of Astrobiology* **12**, 304–311.

OTHER WORKS

Grefenstette, N., Chou, L., Colon-Santos, S., **Fisher, T.**, ... & Weng, M. (2022) Chapter 9: Life As We Don't Know It, in *Astrobiology Primer 3.0* special issue, edited by M. Schaible, N. Szeinbaum, and G. Tan. *Astrobiology* **24**(S1), S-186

Sheikh, S., Berea, A., Davis, R., De la Torre, G. G., DeMarines, J., **Fisher, T.**, ... & Wright, J. T. (2021). Technosignatures as a Priority in Planetary Science. *Bulletin of the American Astronomical Society*, **53**(4), 427.

Glaser, D.M., Hartnett, H.E., Desch, S.J., Unterborn, C.T., Anbar, A., Buessecker, S., **Fisher, T.**, Glaser, S., Kane, S.R., Lisse, C.M. and Millsaps, C., (2020). Detectability of Life Using Oxygen on Pelagic Planets and Water Worlds. *The Astrophysical Journal*, **893**(2), 163.

Domagal-Goldman, S., Kiang, N. Y., Parenteau, N., Catling, D. C., DasSarma, S., Fujii, Y., ... & Walker, S. (2018). Life Beyond the Solar System: Remotely Detectable Biosignatures. arXiv preprint arXiv:1801.06714. (White paper submitted to the National Academies of Sciences Study: Astrobiology Science Strategy for the Search for Life in the Universe)

Schwieterman, E. W., Kiang, N. Y., Parenteau, M. N., Harman, C. E., DasSarma, S., **Fisher, T. M.**, ... & Lyons, T. W. (2018). Exoplanet biosignatures: a review of remotely detectable signs of life. *Astrobiology*, **18**(6), 663-708.

INVITED TALKS

Fisher, T. M. (October 2022). *Atmospheric Chemical Reaction Network Topology as a Tool For Understanding Exoplanet Atmospheres*. Presented virtually for the University of Rochester's Astronomy seminar series.

Fisher, T. M., Walker, S. I., Kim, H., Line, M., and C. Millsap. (October 2020). *Atmospheric Chemical Reaction Network Topology as a Potential Technosignature for Exoplanets*. Presented as part of the [Exoplanets@Goddard](#) Technosignatures Seminar Series

PRESENTATIONS

Fisher, T. M. (August 2024). *Are Dyson Spheres Actually Good SETI Targets? A Critique*. Presented at the 1st Assembly of the Order of the Octopus, at Green Bank, WV.

Fisher, T. M. (June 2024). *Biochemical Network Expansion Using Meteorite and Asteroid Samples as a Seed Set*. Presented at the 2024 Astrobiology Science Conference in Providence, RI.

Fisher, T. M. (June 2022). *Detection of Industrial Compounds via Atmospheric Chemical Reaction Network Topology*. Presented at the 1st PSETI Symposium in State College, PA.

Fisher, T. M., Walker, S. I., and H. Kim. (May 2022) *Distinguishing Between Biotic and Abiotic Atmospheres Using Chemical Reaction Network Topology*. Presented at the 2022 Astrobiology Science Conference in Atlanta, GA.

Fisher, T. M., Walker, S. I., Kim, H., Line, M., and C. Millsap. (October 2020). *Statistical Approaches to Characterizing Disequilibria in Exoplanet Atmospheres: Applications for Biosignatures*. Presented at the Arizona Astrobiology Symposium, held virtually

Fisher, T. M., Walker, S. I., Kim, H., Line, M., and A. Drew (June 2019). *Atmospheric Chemical Reaction Network Topology as a Potential Measure of Disequilibrium: Implication for Astrobiology*. Presented at the 2019 Astrobiology Science Conference in Seattle, WA

Fisher, T. M., Walker, S. I., Kim, H., and M. Line (February 2019). *Atmospheric Chemical Reaction Network Topology as a Potential Measure of Disequilibrium*. Presented at the Women in Space Conference in Scottsdale, AZ.

Fisher, T. M., Walker, S. I., Smith, H.B., Line, M.R., Lyons, J.R., Ruiz, C., and H. Kim. (February 2018). *The Topology of Atmospheric Chemical Reaction Networks as a Potential Biosignature for Exoplanets*. Presented at the Women in Planetary Science and Exploration Conference in Toronto, ON.

Fisher, T.M., Walker, S.I., Desch, S. J., Hartnett, H.E., and S. Glaser. (November 2017). *Limitations of Primary Productivity of "Aqua Planets": Implications for Detectability*. Presented at Habitable Worlds 2017: A Systems Science Workshop in Laramie, WY.

Fisher, T.M. and D. Schulze-Makuch. (June 2015). *Modeling the Venusian Atmosphere as Potential Microbial Habitat*. Presented at the 2015 Astrobiology Science Conference in Chicago, IL.

Fisher, T.M. (July 2014). *Preliminary Modeling of the Venusian Atmosphere as Microbial Habitat*. Presented at the 2014 Astrobiology Graduate Conference in Troy, NY

Fisher, T.M. (June 2013). *Controls of Growth in a Subglacial Ecosystem: A Modeling Approach*. Presented at the 2013 Astrobiology Graduate Conference in Montreal, QC

Fisher, T.M. (August 2012). *A Multi-Component Model of a Subglacial Ecosystem with Implications for Mars (and elsewhere)*. Presented at the 2012 Astrobiology Graduate Conference in Pasadena, CA

Fisher, T.M. (April 2012). *A Preliminary Model of a Subglacial Martian Ecosystem*. Presented at the 2012 Astrobiology Science Conference in Atlanta, GA

Fisher, T.M., Verbiscer, A., Herbst, T., Thiele, U., Guijarro, A., Pedraz, S. (October 2010). *Observations of Iapetus near True Opposition*. Presented at the 42nd Annual DPS Meeting in Pasadena, CA

Fisher, T.M. (August 2009). *Observations on the Tenuous Atmosphere of Europa via the Hubble Space Telescope*. Presented to the MSFC NASA Academy in Huntsville, AL

POSTERS

Fisher, T., Walker, S., Line, M., & Kim, H. (2020) "Statistical Assessment of Thermochemical Disequilibria in Exoplanets: Implications for Biosignature Detection." Habitable Worlds 2021, held virtually.

Fisher, T., Walker, S., Line, M., Kim, H., & Millsaps, C. (2020) "New Statistical Measures of Atmospheric Disequilibria and Implications for Detecting Life and Technology." Technoclimates, held virtually

Fisher, T., Walker, S., Line, M., Kim, H., & Millsaps, C. (2020) "New Statistical Measures of Atmospheric Disequilibria and Implications for Detecting Life" Exoplanets III, held virtually

Fisher, T.M, Walker, S.I., Line, M. and H. Kim (2019) "Atmospheric Chemical Reaction Network Topology as a Potential Measure of Disequilibrium." 7th Annual ELSI Symposium, Meguro City, Tokyo.

Fisher, T.M, Walker, S.I., Smith, H.B., Line, M., Lyons, J., and Ruiz, C. (2017) "A Preliminary Investigation into the Use of Network Topology of Exoplanet Chemical Reaction Networks as a Potential Biosignature." 2017 Astrobiology Graduate Conference in Charlottesville, VA

Fisher, T.M. (2011). "Identifying Martian Analogue Environments for Modeling a Potential Martian Ecosystem." 2011 Astrobiology Graduate Conference in Bozeman, MT

Verbiscer, A., Fisher, T.M., and French, R.G. (2010). "The Strongest Opposition Surges: Products of Ejecta Exchange?" 42nd Annual DPS Meeting in Pasadena, CA

Fisher, T.M. "Observations on the Tenuous Atmosphere of Europa via the Hubble Space Telescope." (2009). 2009 MSFC Intern Poster Expo in Huntsville, A

MEMBERSHIPS

Board member, Order of the Octopus early-career SETI research organization (2023-present)

ASU Student Representative, Interim Steering Council of United Campus Workers of Arizona, Local 7065 (2021-2022)

NexSS Science Communication Working Group (2022-2024)

Out in STEM @ ASU (2017-2020)

Board of Advisers member, Out Astronaut (2021-present)

OTHER ACCOMPLISHMENTS

Published fiction author: "Fracture" (with Dave Ring and Marianne Kirby, *Fireside Magazine* Sept. 2020), "Horoscopes from the Trappist-1 Gazette" (*Baffling Magazine*, Issue 3), "The Summoner's Apprentice" (*Analog* May/June 2021), "Spider Plant" (*Life Beyond Us*, edited by Julie Novakova, Spring 2023), "Morning Star Blues" (*Rosalind's Siblings*, edited by Bogi Takács, Fall 2023), "Talk Page" (*Translunar Travelers Lounge*, Issue 10), and "Flammable Contents" (*Baffling Magazine*, Issue 15)

Co-host, *Assigned Scientist at Bachelor's*, a science communication podcast dedicated to interviewing, and highlighting the research of, trans and non-binary scientists

Co-Chair, AbSciCon 2024 Creative Writing Competition

Co-Chair, AbSciCon 2022 Creative Writing Competition

Session chair, Exoplanet Biosignatures in the 2020s and Beyond, 2022 Astrobiology Science Conference, Atlanta

Organizer, 2021 First Annual Assembly of the Order of the Octopus, a grassroots technosignatures conference

Panelist, Allies and Advocates in Astrobiology, 2019 Astrobiology Science Conference, Seattle

Panel Moderator, LGBT+ Issues in STEM, Women in Planetary Science Conference, Toronto (2018)

Participant, NexSS Workshop Without Walls on Exoplanet Biosignatures, Seattle (2016)

Organizer, AbGradCon 2016; chaired Origin of Life and Theory and Computation sessions

Semifinalist, NASA Astrobiology-Famelab Science Communication Competition, Washington D.C. Regional Heat (2013) and AbSciCon/Chicago Regional Heat (2015)

REFERENCES

Dr. Regis Ferriere, regisf@arizona.edu (most recent supervisor)

Dr. Sara Walker, sara.i.walker@asu.edu (dissertation advisor)

Dr. Michael Line, mrline@asu.edu (committee member)