Nicholas Wogan
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Education & Work Experience

2023 - Pres. NASA Postdoctoral Program Fellow, Space Science and Astrobiology Division, NASA Ames Research Center, Moffett Field, CA. Advisor: Natasha Batalha.

2017 - 2023 PhD Graduate Student, Dual-title Earth and Space Science and Astrobiology, University of Washington, Seattle, WA. Advisor: David Catling.

2012 - 2016 B.S., Physics major, University of Oregon Honors College, Eugene, OR.

Recent Awards & Honors

2023 The David A. Johnston Award for Research Excellence, Earth and Space Science Department, University of Washington.

2023 NASA Postdoctoral Program Fellowship recipient

2023 Award for best graphic in presentation, Earth and Space Science Gala, University of Washington.

Recent Mentoring & Outreach

2025 This summer, I will mentor a undergraduate-level student at NASA Ames funded through the Habitable Worlds Observatory Intern Program

2024 Mentored Zoe Lu and Divya Bhamidipati, both high school students, through the NASA-Chabot internship program.

2022 - 2023 "Rockin' Out" volunteer. Rockin' Out is a K-12 volunteer-based outreach program at the Department of Earth and Space Sciences at the University of Washington.

Peer-Reviewed Publications (24 total, 6 first-author)

Accepted or under review

2025 Kenneth Gordon, Theodora Karalidi, Kimberly Bott, **Nicholas Wogan** et al. (2025). Polarized Signatures of the Earth Through Time: An Outlook for the Habitable Worlds Observatory. Under Review, *The Astronomical Journal*. DOI:10.48550/arXiv.2410.02194.

2025 Johanna Teske, Natasha Batalha, Nicole Wallack, James Kirk, **Nicholas Wogan** et al. (2025). JWST COMPASS: NIRSpec/G395H Transmission Observations of TOI-776 c, a 2 Rearth M Dwarf Planet. Under Review, *The Astronomical Journal*. DOI:10.48550/arXiv.2502.20501.

2025 Stephen Schmidt, Ryan MacDonald, ..., **Nicholas Wogan** et al. (2025). A Comprehensive Reanalysis of K2-18 b's JWST NIRISS+NIRSpec Transmission Spectrum. Under Review, *The Astronomical Journal*. DOI:10.48550/arXiv.2501.18477.

2025 Sagnick Mukherjee, Jonathan Fortney, **Nicholas Wogan**, David Sing, and Kazumasa Ohno (2025). Effects of Planetary Parameters on Disequilibrium Chemistry

in Irradiated Planetary Atmospheres: From Gas Giants to Sub-Neptunes. Under Review, *The Astrophysical Journal*. DOI:10.48550/arXiv.2410.17169.

Published

2025 Lili Alderson, Sarah Moran, Nicole Wallack, Natasha Batalha, **Nicholas Wogan** et al. (2025). JWST COMPASS: NIRSpec/G395H Transmission Observations of the Super-Earth TOI-776 b. *The Astronomical Journal*. DOI:10.3847/1538-3881/adad64.

2024 Nicholas Scarsdale, **Nicholas Wogan** et al. (2024). JWST COMPASS: The 3-5 μm Transmission Spectrum of the Super-Earth L 98-59 c. *The Astronomical Journal*. DOI:10.3847/1538-3881/ad73cf.

2024 Munazza Alam, Peter Gao, Jea Adams, Nicole Wallack, **Nicholas Wogan** et al. (2024). JWST COMPASS: The First Near- to Mid-infrared Transmission Spectrum of the Hot Super-Earth L 168-9 b. *The Astronomical Journal*. DOI:10.3847/1538-3881/ad8eb5.

2024 **Nicholas Wogan**, David Catling, and Kevin Zahnle (2024). Timing and likelihood of the origin of life derived from post-impact highly reducing atmospheres. *Astrobiology*. DOI:10.1089/ast.2023.0128.

2024 Joshua Krissansen-Totton, **Nicholas Wogan**, Maggie Thompson and Jonathan Fortney (2024). The erosion of large primary atmospheres typically leaves behind substantial secondary atmospheres on temperate rocky planets. *Nature Communications*. DOI:10.1038/s41467-024-52642-6.

2024 Nicole Wallack, Natasha Batalha, ..., **Nicholas Wogan** et al. (2024). JWST COMPASS: A NIRSpec/G395H Transmission Spectrum of the Sub-Neptune TOI-836c. *The Astronomical Journal*. DOI:10.3847/1538-3881/ad3917.

2024 Lili Alderson, Natasha Batalha, ..., **Nicholas Wogan** et al. (2024). JWST COMPASS: NIRSpec/G395H Transmission Observations of the Super-Earth TOI-836b. *The Astronomical Journal*. DOI:10.3847/1538-3881/ad32c9.

2024 Shang-Min Tsai, Hamish Innes, **Nicholas Wogan**, Edward Schwieterman (2024). Biogenic Sulfur Gases as Biosignatures on Temperate Sub-Neptune Waterworlds. *Astrophysical Journal Letters*. DOI:10.3847/2041-8213/ad3801.

2024 **Nicholas Wogan**, Natasha Batalha, Kevin Zahnle, Joshua Krissansen-Totton, Shang-Min Tsai, and Renyu Hu (2024). JWST observations of K2-18b can be explained by a gas-rich mini-Neptune with no habitable surface. *Astrophysical Journal Letters*. DOI:10.3847/2041-8213/ad2616.

2024 Zoe Todd, **Nicholas Wogan**, and David Catling (2024). Favorable Environments for the Formation of Ferrocyanide, a Potentially Critical Reagent for Origins of Life. *ACS Earth and Space Chemistry*. DOI:10.1021/acsearthspacechem.3c00213.

2024 Amber Young, Tyler Robinson, Joshua Krissansen-Totton, Edward Schwieterman, **Nicholas Wogan** et al. (2024). Inferring chemical disequilibrium biosignatures for Proterozoic Earth-like exoplanets. *Nature Astronomy*. DOI:10.1038/s41550-023-02145-z.

2023 **Nicholas Wogan**, David Catling, Kevin Zahnle, and Roxana Lupu (2023). Origin

of life molecules in the atmosphere after big impacts on the early Earth. *Planetary Science Journal*. DOI:10.3847/PSJ/aced83.

2023 Zachary Cohen, Zoe Todd, **Nicholas Wogan**, Roy Black, Sarah Keller, and David Catling (2023). Plausible sources of membrane-forming fatty acids on the early Earth: a review of the literature and an estimation of amounts. *ACS Earth and Space Chemistry*. DOI:10.1021/acsearthspacechem.2c00168.

2022 **Nicholas Wogan**, David Catling, Kevin Zahnle, and Mark Claire (2022). Rapid timescale for an oxic transition during the Great Oxidation Event and the instability of low atmospheric O_2. *Proceedings of the National Academy of Sciences*. DOI:10.1073/pnas.2205618119.

2022 Maggie Thompson, Joshua Krissansen-Totton, **Nicholas Wogan**, Myriam Telus, and Jonathan Fortney (2022). The case and context for atmospheric methane as an exoplanet biosignature. *Proceedings of the National Academy of Sciences*. DOI:10.1073/pnas.2117933119.

2021 Joshua Krissansen-Totton, Max Galloway, **Nicholas Wogan**, Jasmeet Dhaliwal, and
Jonathan Fortney (2021). Waterworlds probably do not experience magmatic outgassing. *The Astrophysical Journal*. DOI:10.3847/1538-4357/abf560.

2021 Joshua Krissansen-Totton, Jonathan Fortney, Francis Nimmo, and **Nicholas Wogan**. Oxygen false positives on habitable zone planets around Sun-like stars. *AGU Advances*. DOI:10.1029/2020AV000294.

2020 **Nicholas Wogan**, Joshua Krissansen-Totton and David Catling. Abundant atmospheric methane from volcanism on terrestrial planets is unlikely and strengthens the case for methane as a biosignature. *Planetary Science Journal*. DOI:10.3847/PSJ/abb99e.

2020 Kevin Zahnle, Roxana Lupu, David Catling, and **Nicholas Wogan**. Creation and evolution of impact-generated reduced atmospheres of early Earth. *Planetary Science Journal*. DOI:10.3847/PSJ/ab7e2c.

2020 **Nicholas Wogan** and David Catling. When is chemical disequilibrium in Earth-like planetary atmospheres a biosignature versus an anti-biosignature? Disequilibria from dead to living worlds. *Astrophysical Journal*. DOI:10.3847/1538-4357/ab7b81.

Selected Presentations

Invited

2025 **Nicholas Wogan**. The photochemistry and climate of foreign atmospheres: Implications for the origin of life on early earth and understanding exoplanets observed by the James Webb Space Telescope. Planetary Science Seminar, California Institute of Technology.

2024 **Nicholas Wogan**. Workshop on the `Photochem` code for simulating exoplanet atmospheres. Theoretical Astrophysics Program Planet Formation Initiative Lectureship, University of Arizona.

2024 **Nicholas Wogan**. Assessing exoplanet habitability with JWST and the Habitable

Worlds Observatory: from the sub-Neptune K2-18b to rocky Earth-like planets. Planetary lunch, University of California Santa Cruz.

2024 **Nicholas Wogan**. The photochemistry of hydrogen-rich atmospheres: From the origin of life on Earth to biosignatures on the K2-18b exoplanet. Institute for Geophysics and Planetary Physics seminar, University of California Santa Cruz.

2022 **Nicholas Wogan**, David Catling, Kevin Zahnle, and Mark Claire. Rapid timescale for an oxic transition during the Great Oxidation Event and the instability of low atmospheric O_2. NASA Goddard Exoplanets Seminar.

2020 **Nicholas Wogan** and David Catling. Atmospheric synthesis of prebiotic molecules on the Hadean Earth. Prebiotic Chemistry and Early Earth Environments Consortium (PCE3), remote conference.

Contributed

2025 **Nicholas Wogan**, Natasha Batalha, Joshua Krissansen-Totton, Kevin Zahnle. On inferring the surface production rate of biogenic gases on rocky exoplanets from telescope spectra. American Astronomical Society Meeting, National Harbor, MD.

2025 **Nicholas Wogan**, Natasha Batalha, Joshua Krissansen-Totton, Kevin Zahnle. A self-consistent photochemical-climate-flux retrieval method for exoplanet characterization and life detection. American Geophysical Union Fall Meeting, Washington, D.C.

2024 **Nicholas Wogan**, Natasha Batalha, Kevin Zahnle, Joshua Krissansen-Totton, Shang-Min Tsai and Renyu Hu. JWST observations of K2-18b can be explained by a gas-rich mini-Neptune with no habitable surface. AbSciCon, Providence, RI.

2024 **Nicholas Wogan**, Natasha Batalha, Kevin Zahnle, Joshua Krissansen-Totton and Shang-Min Tsai. JWST observations of K2-18b can be explained by a gas-rich mini-Neptune composition. Extreme Solar Systems V, Christchurch, New Zealand.

2023 **Nicholas Wogan**, David Catling, Kevin Zahnle, and Roxana Lupu. Origin of life molecules in the atmosphere after big impacts on the early Earth. American Geophysical Union Fall Meeting, San Francisco, CA.

2023 **Nicholas Wogan**, Shawn Domagal-Goldman, Chris Stark, Aki Roberge, Giada Arney, Tyler Robinson. Detecting exo-Earths with the Habitable Worlds Observatory. Habitable Worlds Observatory Conference, Baltimore, MD.

2023 **Nicholas Wogan**, David Catling, Kevin Zahnle, and Mark Claire. Rapid timescale for an oxic transition during the Great Oxidation Event and the instability of low atmospheric O_2. Green Bank Astrobiology Conference, Green Bank, WV.

2022 **Nicholas Wogan**, David Catling and Kevin Zahnle. Atmospheric nitriles for the origin of life from the atmosphere after large asteroid impacts on the Hadean Earth. Latsis Conference, Zurich, Switzerland.

2022 **Nicholas Wogan**, David Catling and Kevin Zahnle. Origin of life chemistry in the atmosphere after large impacts on the early Earth. Astrobiology Science Conference, Atlanta, GA.

2021 **Nicholas Wogan**, David Catling and Kevin Zahnle. Molecules for the origin of life from impact-generated atmospheres on early Earth. Simons Foundation Collaboration on the Origin of Life Annual meeting, remote conference.

2021 **Nicholas Wogan**, David Catling and Kevin Zahnle. Molecules for the origin of life from impact-generated atmospheres on early Earth. Goldschmidt, remote conference.

2019 **Nicholas Wogan** and David Catling. When is chemical disequilibrium in Earth-like planetary atmospheres a biosignature versus an anti-biosignature? Investigating disequilibria from prebiotic to post-biotic worlds. American Geophysical Union Fall Meeting, San Francisco, CA.

Open Source Software

- Photochem: `https://github.com/Nicholaswogan/photochem`. A 1-D photochemical and climate model of planetary atmospheres.
- fortran-yaml-c: `https://github.com/Nicholaswogan/fortran-yaml-c`. A YAML parser and emitter for Fortran.
- ForwardDiff: `https://github.com/Nicholaswogan/ForwardDiff`. Forward mode automatic differentiation for Fortran.
- numbalsoda: `https://github.com/Nicholaswogan/numbalsoda`. A high performance ordinary differential equation solver for Python.