

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 Mentored Jaden Lopez, an undergraduate student at UCSC, through the Lamat Program.
- 2025 Mentored Elizabeth Pawelka, a post-baccalaureate researcher, through the NASA OSTEM 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.

Journal Publications (31 total, 8 first-author)

Under Review

- 2025 **Nicholas Wogan**, Natasha Batalha, Kevin Zahnle, Joshua Krissansen-Totton, David Catling, Eric Wolf, Tyler Robinson, Victoria Meadows and Giada Arney (2025). The Open-Source Photochem Code: A General Chemical and Climate Model for Interpreting (Exo)Planet Observations. Under Review, *The Planetary Science Journal*.
- 2025 Sukrit Ranjan, **Nicholas Wogan** et al. (2025). The Photochemical Plausibility of Warm Exo-Titans Orbiting M-Dwarf Stars. Under Review, *The Astrophysical Journal*.
- 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 Joshua Krissansen-Totton, ..., **Nicholas Wogan** et al. (2025). Wavelength Requirements for Life Detection via Reflected Light Spectroscopy of Rocky Exoplanets. Under Review, *Astrobiology*. DOI:10.48550/arXiv.2507.14771.
- 2025 Jegug Ih, ..., **Nicholas Wogan** et al. (2025). Do Rocky Planets around M Stars Have Atmospheres? A Statistical Approach to the Cosmic Shoreline. Under Review, *AAS*. DOI:10.48550/arXiv.2508.08253.
- Accepted or Published
- 2025 Jea Redai, **Nicholas Wogan** et al. (2025). JWST COMPASS: A NIRSpec G395H Transmission Spectrum of the Super-Earth GJ 357 b. *The Astronomical Journal*. DOI:10.48550/arXiv.2507.07165.
- 2025 Trent Thomas, ..., **Nicholas Wogan** et al. (2025). Statistical Geochemical Constraints on Present-day Water Outgassing as a Source of Secondary Atmospheres on the TRAPPIST-1 Exoplanets. *The Planetary Science Journal*. DOI:10.3847/PSJ/add261.
- 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. *The Astrophysical Journal*. DOI:10.3847/1538-4357/adc7b3.
- 2025 **Nicholas Wogan**, James Mang, Natasha Batalha et al. (2025). The Sonora Substellar Atmosphere Models. V. A Correction to the Disequilibrium Abundance of CO₂ for Sonora Elf Owl. *RNAAS*. DOI:10.3847/2515-5172/add407.
- 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. *The Astrophysical Journal*. DOI:10.3847/1538-4357/adc09c.
- 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. *The Astronomical Journal*. DOI:10.3847/1538-3881/ad975.
- 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 μ m 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 COM-PASS: 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 COM-PASS: 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 O₂. *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 out-

- gassing. *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? Disequilibrium 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 O₂. 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, Kevin Zahnle, Joshua Krissansen-Totton. Towards a universal chemical and climate model of planetary atmospheres for interpreting HWO observations. Towards the Habitable Worlds Observatory: Visionary Science and Transformational Technology, Washington, D.C.
- 2025 **Nicholas Wogan**, Natasha Batalha, Kevin Zahnle, Joshua Krissansen-Totton. To-

- wards a general chemical and climate model of planetary atmospheres for interpreting exoplanet observations. Exoclimes, Montreal, Canada.
- 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.
- 2024 **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 O₂. 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.