

NICHOLAS A LOMBARDO

PhD Candidate (ABD) in Earth and Planetary Sciences

Department of Earth and Planetary Sciences, Yale University
210 Whitney Ave, New Haven, CT 06511

nicholas.lombardo@yale.edu
nicholaslombardo.github.io

Education

2025	Ph.D.	Earth and Planetary Sciences	Yale University (expected May 2025)
2021	M.Phil.	Earth and Planetary Sciences	Yale University
2017	B.S.	Physics & Mathematics (Minor: Earth Science)	Central Connecticut State University

Additional Training

2024	Mission Design School: Planetary Science (PSSS; Principal Investigator)	10 wk	Caltech JPL
2024	Tracer Mixing in Fluids Across Planetary Scales Summer School	2 wk	UMD

Professional Appointments

2023–present	Part Time Lecturer	Central Connecticut State Univ. Dept. of Physics
2019–present	Grad. Research/Teaching Fellow	Yale University Dept. of Earth and Planetary Sciences
2017–2019	Faculty Research Assistant	UMBC at NASA Goddard Space Flight Center
2013–2016	Tutor	Central Connecticut State Univ. TRiO Office

Mission Involvement

2019–present	Student Associate	<i>Dragonfly</i> Mission to Titan (NASA New Frontiers 4)
2016–2019	Research Assistant	<i>Cassini</i> Composite Infrared Spectrometer Instrument

Group Affiliations

2022–present	Collaborator	JWST Titan Guaranteed Time Observation Team
2018–present	Collaborator	NAI Habitability of Hydrocarbon Worlds Group

University Teaching

Instructor of Record

Fall 2024	17 students	Central CT State Univ. Phys 126 University Physics II
Spring 2024	16 students	Central CT State Univ. Phys 126 University Physics II Laboratory
Spring 2023	17 students	Central CT State Univ. Phys 122 General Physics II Laboratory

Graduate Teaching Fellow

Spring 2025	13 students	Yale Univ. ENV 774 Framing Climate Migration Science/Policy/Ethics
Fall 2023	120 students	Yale Univ. EPS 274 Fossil Fuels and World Energy
Fall 2019	27 students	Yale Univ. G&G 140 Into. to Atmospheric, Ocean, and Climate Change

Honors and Awards (underline – financial awards)

<u>2024</u>	Yale Estwing Hammer Prize – Outstanding Graduate Student in Earth and Planetary Sciences
<u>2019</u>	Yale Geology and Geophysics Bateman Fellowship
2018	NASA Group Achievement Award – Cassini CIRS Investigation Team for Grand Finale Orbits
2018	NASA Group Achievement Award – Cassini CIRS Team for Solstice, F-Ring, and Proximal Orbits
2017	CCSU Physics and Engineering Physics Departmental Honors
2016	CCSU John Bulman Award for Service to the Department of Physics and Engineering Physics
<u>2013</u>	CCSU-NSF Computer Science, Math, and Physics Scholarship (4 years)

Funded Grants and Awards

Research Grants

- 2024 NSF Ast.: *Investigating the Chemical and Dynamical Complexity of Titan's Upper Atmosphere* (Collaborator)
2024 NASA Solar System Observations: *Winds of change: a multi-decade study of Titan's middle atmosphere across seasons* (Collaborator)

Competed Observing Proposals

- 2024 7 hr Atacama Large Mm/sub-mm Array: *Winds of Change: Temporal Variability of Titan's High-Altitude Circulation System* (Co-I; PI: Cordiner)
2023 12 hr Hale Telescope, Palomar Observatory: *Characterizing Titan's stratospheric wind profile via adaptive optics imaging of a stellar occultation* (Collaborator; PI: Marlin)
2022 3 hr Faulkes Telescope N., Las Cumbres Observatory: *Constraining Titan's Stratospheric Winds near Equinox via a Stellar Occultation* (Principal Investigator)
2022 12 hr NASA Infrared Telescope Facility: *Investigating Nitrile Chemistry on Titan* (Co-I; PI: Coustenis)

Travel Grants

- 2022 Europlanet Science Congress Student Travel Grant
2021 Titan Through Time V Student Travel Grant
2019 AAS Division for Planetary Sciences Hartmann Student Travel Grant
2016 CCSU Faculty Student Research Grant & CCSU Alumni Travel Grant

Refereed Publications

- in rev.* Marlin, T. C., Young, E. F., de Kleer, K., Cordiner, M., **Lombardo, N. A.**, de Pater, I., Lora, J. M., Corlies, P., Cosentino, R., Nixon, C. A., Rodriguez, S., Thelen, A., "Zonal Winds in Titan's Middle Atmosphere from a Stellar Occultation Observed with Keck Adaptive Optics", *submitted to PSJ*
- in rev.* **Lombardo, N. A.** & Lora, J. M., "Interaction of Trace Species and Three-Dimensional Circulation in Titan's Middle Atmosphere", *submitted to JGR: Planets*
- in rev.* Wright, L., Teanby, N. A., Irwin, P. G. J., Nixon, C. A., **Lombardo, N. A.**, Mitchell, D., Lora, J. M. "Seasonal Evolution of Titan's Stratospheric Tilt and High-Resolution Temperatures, Zonal Winds, and Polar Vortices", *submitted to PSJ*
- in rev.* Nixon, C. A., Bézard, B.†, Cornet, T.†, Coy, B. P.†, de Pater, I.†, Es-Sayeh, M.†, Hammel, H. B.†, Lellouch, E.†, **Lombardo, N. A.**†, López-Puertas, M.†, Lora, J. M.†, Rannou, P.†, Rodriguez, S.†, Teanby, N. A.†, Turtle, E. P.†, +30 others, "Titan's Atmosphere in Late Northern Summer from JWST and Keck Observations", *under review in Nature Astronomy*, †These authors contributed equally
2024. Bézard, B., Nixon, C. A., Vinatier, S., Lellouch, E., Greathouse, T. K., Jiles, R., **Lombardo, N. A.**, Jolly, A., "The D/H ratio in Titan's acetylene from high spectral resolution IRTF/TEXES observations", *Icarus*, **421**, 116221
2024. Light, S., Gurwell, M., Thelen, A., **Lombardo, N. A.**, Nixon, C. A., "Measurements of Titan's Stratospheric Winds During Equinox with the eSMA", *The Planetary Science Journal*, **5**, 98,
2023. **Lombardo, N. A.** & Lora, J. M., "The Heat and Momentum Budgets of Titan's Middle Atmosphere", *Journal of Geophysical Research: Planets*, **128**, e2023JE00806
2023. Lewis, N. T., **Lombardo, N. A.**, Read, P. T., Lora, J. M., "Equatorial Waves and Superrotation in the Stratosphere of a Titan General Circulation Model", *The Planetary Science Journal*, **4**, 149
2023. Coy, B. P., Nixon, C. A., Rowe-Gurney, N., Achterberg, R. K., **Lombardo, N. A.**, Fletcher, L. N., Irwin, P. G. J. "Spitzer IRS Observations of Titan as a Precursor to JWST MIRI Observations", *The Planetary Science Journal*, **4**, 114

2023. **Lombardo, N. A.** & Lora, J. M., “Influence of Observed Seasonally Varying Composition on Titan’s Stratospheric Circulation”, *Icarus*, **390**, 115291
2022. Steffans, B.L., Nixon, C.A, Sung, K., Irwin, P.G.J., **Lombardo, N.A.**, Pereira, E. “New Constraints on Titan’s Stratospheric n-Butane Abundance”, *The Planetary Science Journal*, **3**, 59
2020. Hewett, D., Bernath, P. F., Wong, A., Billingham, B. E., Zhao, J., **Lombardo, N. A.**, Nixon, C. A., Jennings, D. E. “N₂ and H₂ Broadened Isobutane Infrared Absorption Cross Sections and Butane Upper Limits on Titan”, *Icarus*, **344**, 113460
2019. Nixon, C. A., Ansty, T. M., **Lombardo, N. A.**, Bjoraker, G. L., Achterberg, R. K., Annex, A. M., Rice, M., Romani, P. N., Jennings, D. E., Coustenis, A., Bézard, B., Vinatier, S., Lellouch, E., Teanby, N. A., Cottini, V., Flasar, F. M. “Cassini Composite Infrared Spectrometer Observations of Titan 2004-2017”, *The Astrophysical Journal Supplement Series*, **244**, 14
2019. ***Lombardo, N A.**, Nixon, C. A., Greathouse, T. K., Bézard, B., Jolly, A., Vinatier, S., Teanby, N. A., Richter, M. J., Irwin, P. J. G., Coustenis, A., Flasar, F. M. “Detection of Propadiene on Titan”, *The Astrophysical Journal Letters*, **881**, L33 - *featured on *Sci-News* and *NASA Astrobiology Institute homepage*
2019. **Lombardo, N. A.**, Nixon, C. A., Sylvestre, M., Jennings, D. E., Teanby, N., Irwin, P. G. J., and Flasar, F. M. “Ethane in Titan’s Stratosphere from Cassini CIRS Far- and Mid-Infrared Spectra”, *The Astronomical Journal*, **157**, 160-170
2019. **Lombardo, N. A.**, Nixon, C. A., Achterberg, R. K., Sung, K., Jolly, A., Irwin, P. G. J., and Flasar, F. M. “Spatial and Seasonal Variations in C₃H_x Hydrocarbon Abundance in Titan’s Stratosphere with Cassini CIRS Observations”, *Icarus*, **317**, 454 – 469

Professional Service

University Service

- 2021–2024 Student representative on Yale Earth and Planetary Sciences Colloquium Committee
- 2020–2021 Undergraduate & Graduate Student Mentor, Yale Dept. of Earth and Planetary Sciences
- 2014–2016 President of the Central CT State Univ. Society of Physics Students

Conference Activities

- 2024 Virtual Session Chair: Io; AAS Division for Planetary Sciences 56th Meeting
- 2024 Session Chair: Venus; AAS Division for Planetary Sciences 56th Meeting
- 2024 Science Organizing Committee (SOC) member; AAS Division for Planetary Sciences 56th Meeting
- 2017 Poster Session Lead for the Titan Through Time IV Workshop

Journal Referee

The Astronomical Journal, The Astrophysical Journal, Geophysical Research Letters, The Planetary Science Journal, Yale Undergraduate Research Journal

Proposal Review Panels

Panelist, secretary, and external reviewer for NASA Planetary Science

Invited Colloquia and Seminars

- 2025 *Yuk Lanch Seminar*, Department of Geology and Planetary Science, Caltech
- 2025 Departments of Physics & Astronomy and Earth & Climate Science Joint Seminar, Bates College
- 2024 Department of Earth and Planetary Sciences Seminar, Johns Hopkins University
- 2023 Department of Mathematics Colloquium, Central Connecticut State University
- 2022 Department of Geological Sciences Seminar, Central Connecticut State University
- 2021 Department of Physics and Engineering Physics Seminar, Central Connecticut State University
- 2019 School of Physics and Astronomy Space Physics Seminar, University of Leicester
- 2018 Center for Research in Exploration in Space Science and Tech. Seminar, NASA GSFC
- 2018 Department of Geological Sciences Seminar, Central Connecticut State University

First-Authored Conference and Workshop Talks

2024. **Lombardo, N. A.** & Lora, J. M. “Feedbacks between Idealized Chemical Tracers and Dynamics through Radiative Heating in Titan’s Middle Atmosphere”, 55th Division for Planetary Sciences Meeting
2023. **Lombardo, N. A.**, et al., “Measurement of Hydrogen Isocyanide in Titan’s Lower Stratosphere”, American Geophysical Union
2023. **Lombardo, N. A.** & Lora, J.M. “Simulating the Production of Stratospheric Ice Clouds over Titan’s Winter Pole with the Titan Atmospheric Model”, 54th Division for Planetary Sciences Meeting
2023. **Lombardo, N. A.** & Lora, J. M. “Titan’s Stratospheric Heat and Momentum Budgets”, Titan Through Time VI
2022. **Lombardo, N. A.** & Lora, J.M. “Interaction of Chemical Tracers with Titan’s General Circulation”, American Geophysical Union
2022. **Lombardo, N. A.** & Lora, J. M., “The Energy and Momentum Budgets of Titan’s Stratospheric Polar Vortex”, 53rd Division for Planetary Sciences Meeting
2022. **Lombardo, N. A.** & Lora, J. M., “The Energy and Momentum Balance of Titan’s Stratospheric Polar Vortex as Simulated in a General Circulation Model”, Europlanet Science Congress Meeting
2019. **Lombardo, N. A.**, et al., “Detection of Allene on Titan,” Europlanet Science Congress – Division for Planetary Sciences Joint Meeting
2019. **Lombardo, N. A.**, et al., “Detection of Allene on Titan,” Hydrocarbon Worlds NAI Workshop
2018. **Lombardo, N. A.**, et al., “Using Far-Infrared Observations to Probe Ethane Abundance in Titan’s Lower Stratosphere,” 50th Division for Planetary Sciences Meeting
2018. **Lombardo, N. A.**, et al. “C₃H_X Hydrocarbon Abundance in Titan’s Atmosphere from *Cassini* Infrared Spectra,” 49th Lunar and Planetary Science Conference
2017. **Lombardo, N. A.**, et al. “Abundance Profiles for C₃ Hydrocarbons in Titan’s Atmosphere,” 49th Division for Planetary Sciences Meeting
2015. **Lombardo, N. A.**, et al., “Origin of Photoluminescence in Graphene Oxide”, APS NES Fall

Select First-Authored Conference and Workshop Posters

2024. **Lombardo, N. A.** & Lora, J. M., “Seasonal-Scale Transport of Heat and Momentum in Titan’s Middle Atmosphere”, 24th Conference on Atmospheric & Oceanic Fluid Dynamics
2024. **Lombardo, N. A.** & Lora, J. M. “Interaction of Trace Species with Titan’s General Circulation”, 24th Conference on Atmospheric & Oceanic Fluid Dynamics
2023. **Lombardo, N. A.**, et al., “Measurement of Hydrogen Isocyanide (HNC) in Titan’s Lower Stratosphere”, Titan Through Time VI
2022. **Lombardo, N. A.**, et al., “Variability and Trends in Beaufort Gyre Near-Inertial Wave Activity inferred from Bottom Pressure Measurements, 2003—2021”, Ocean Sciences Meeting
2021. **Lombardo, N. A.** & Lora, J.M., “Dynamical Simulations of Titan’s Stratosphere using Observationally Derived Molecular Abundance and Aerosol Opacity,” Titan Through Time V
2019. **Lombardo, N. A.**, et al., “Detection of Allene in Titan’s Atmosphere,” Astrobiology Science Conf.
2018. **Lombardo, N. A.**, et al., “The Search for Allene in Titan’s Stratosphere using Mid-IR Spectra from the TEXES Instrument on IRTF,” American Geophysical Union, Fall Meeting
2018. **Lombardo, N. A.**, et al., “Comparison of Modeled Alkane Abundances in Titan’s Atmosphere using Different Spectral Windows with *Cassini* CIRS spectra,” Cassini Science Symposium

2018. **Lombardo, N. A.**, et al., “C3 Hydrocarbon Abundance in Titan's Atmosphere with *Cassini* Infrared Spectra”, American Astronomical Society, AAS Meeting #231
2017. **Lombardo, N. A.**, et al., “A Sensitive Search for Allene on Titan”, Titan Through Time IV
2016. **Lombardo, N. A.**, et al., “Synthesis and Characterization of $\text{CoFe}_{2-x}\text{Ni}_x\text{O}_4$ Magnetic Nanoparticles”, APS NES Spring
2016. **Lombardo, N. A.**, et al., “Controllably Inducing and Modeling Optical Response from Graphene Oxide,” APS March Meeting

Broader Impacts

Invited Public Speaker for geology and astronomy at *Bedford Garden Club* (2025), *Ward Pound Ridge Reservation* (2024), *Pound Ridge Land Conservancy* (2023, 2024), *Trailside Nature Museum* (2022)

Judge at the *Westchester Junior Science and Humanities Symposium* (2024)

Guest Instructor for astronomy at the *Trailside Museum Children's Summer Ecology Program* (2023)

Overnight Near-to-Peer Mentor to group of 5 high school students at the GSFC *Boys Night In* (2019)

Volunteer and Exhibitor representing Cassini CIRS and Lunar Reconnaissance Orbiter (LRO); *International Observe the Moon Night* at GSFC (2018-2019); *Awesome-Con* at Washington, DC (2018-2019); *Celebrating Earth Day with NASA at Union Station* (2017-2019); *Space Night* with the Bowie Baysox minor league baseball team (2018); *US Science and Technology Expo* in Washington, DC (2019); *Science Jamboree* at GSFC (2017-2018); *Outer Space in the President's Place* in the Eisenhower Executive Office Building in Washington, DC (2017)

Volunteer Lead Organizer of the CCSU Physics Open House for local high school students (2015, 2016)

Panelist 22nd Annual Science and Technology Brain Trust, US News STEM Solutions Conference (2014)