Dr. Renyu Hu
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Curriculum Vitae
1 (818) 281 9459
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EMPLOYMENT

2023- Scientist V, NASA Jet Propulsion Laboratory
2019-23 Scientist IV, NASA Jet Propulsion Laboratory
2015-19 Scientist III, NASA Jet Propulsion Laboratory
2013-15 Hubble Fellow, NASA Jet Propulsion Laboratory

EDUCATION

2013 Ph.D., Planetary Sciences, Massachusetts Institute of Technology
"Atmospheric Photochemistry, Surface Features, and Potential Biosignature Gases of Terrestrial Exoplanets," Advisor: Sara Seager
2009 M.S., Astrophysics, Tsinghua University
2009 Diplôme d'Ingénieur (French Engineer's Degree), École Centrale Paris
2007 B.S., Mathematics and Physics, Tsinghua University

RESEARCH INTERESTS

Characterization of atmospheres, surfaces, and geologic histories of rocky exoplanets. Characterization of low-temperature exoplanets from Earth-sized to Jupiter-sized. Atmospheric physics and chemistry in a wide range of planetary environments. Atmospheric evolution of Mars and other rocky planets and exoplanets. Search for potentially habitable planets and biosignatures. Gas and aqueous phase chemical kinetics. Starshade and advanced space instrumentation.

SELECTED AWARDS

2024 JPL Team Award for significant contributions to the Habitable Worlds Observatory
2023 Scialog Fellow, Research Corporation for Science Advancement
2021 JPL Edward Stone Award for outstanding research publication
2020 NASA Early Career Public Achievement Medal
2019 NASA Group Achievement Award for astrophysics large mission studies
2017 JPL Voyager Award for individual achievement
2013-15 NASA Hubble Fellowship
2011-13 NASA Earth and Space Science Fellowship
2012 Barrett Prize, Massachusetts Institute of Technology
2009 Presidential Fellowship, Massachusetts Institute of Technology
2009 Best Master Dissertation, Tsinghua University
2009 Wu You-Xun Prize, Tsinghua University

SPACE MISSION & LEADERSHIP EXPERIENCE

2024- **Co-founder**, NASA Study Analysis Group (SAG26) on exoplanet reflectance spectroscopy for the Habitable Worlds Observatory (HWO)

- Initiate and lead the community study to compare and converge on the practices of the simulation and retrieval of the exoplanet reflectance spectra, with a focus on terrestrial exoplanets relevant to HWO

2023- **Member**, NASA Science, Technology, Architecture Review Team (START) for HWO

- Chartered to quantify the science objectives and inform the technology maturation program of HWO
- **Co-chair** of the "Characterizing Exoplanets" working group (>300 participating scientists, lead the steering committee, oversee the development of 7 key science cases on characterizing exoplanets)
- **Steering Committee** of the "Exoplanet Science Yield" working group

2022- **Principal Investigator**, JPL Strategic Initiative for scientific optimization of missions

- Lead a team of 7 staff scientists and additional postdocs and students to optimize the spectroscopic measurements for HWO

2024 **Group Supervisor**, JPL Exoplanet Discovery and Science Group

- Organized and coordinated the science activities of 16 staff scientists and 6 postdocs. Provided personnel management

2018-24 **Starshade Scientist**, NASA Exoplanet Exploration Program

- Provided project science leadership to the Starshade Technology Development to TRL-5 (S5) project and managed a national-level and community-facing science and industry partnership program
- Led a team of 6 JPL scientists and engineers to develop and conduct the Starshade Exoplanet Data Challenge, and managed the acquisition of two external participating teams through a proposal process

2022- **Collaborator**, Ultraviolet Explorer (UVEX), a Medium-Class Explorer (MIDEX) mission in Phase B

2022-23 **Exoplanet Science Lead**, JPL Uranus flagship mission concept team

- **Co-chair** of the exoplanet working group (>10 external subject matter experts, oversee the development of two key science cases at the intersection between the explorations of Uranus and exoplanets)

2017-21 **Atmospheric Science Lead**, Starshade Rendezvous Probe concept study and Roman Space Telescope starshade accommodation study

2021-23 **Member**, Venus in-situ aerobot mission concept team

- Outlined the atmospheric chemistry, cloud physics, and astrobiology investigations enabled by a maneuverable balloon that would operate at the cloudy layers of the Venusian atmosphere

2018-22 **Member**, TESS Atmospheric Characterization Working Group

2016-21 **Member**, WFIRST (Roman) Coronagraph Science Investigation Teams
2016-17 **Member**, NASA Study Analysis Group (SAG16) on exoplanet biosignatures
2016-17 **Member**, NASA Study Analysis Group (SAG15) on science questions for direct imaging exoplanet missions
2014 **Principal Investigator** for science return of direct-imaging exoplanet missions, NASA Exoplanet Exploration Program

PROFESSIONAL SERVICE

2024 **Member**, JPL Palomar Review Board
2024 **Panel Reviewer**, NSF Astronomy and Astrophysics Research Grants
2023 **External Reviewer**, James Webb Space Telescope Time Allocation Committee
2022 **Chair**, Astrophysics Return to Lab Working Group, Jet Propulsion Laboratory
2021- **Chair**, Astrophysics Colloquium Committee, Jet Propulsion Laboratory
2020 **Panel Reviewer**, Hubble Space Telescope Time Allocation Committee
2016- **Founder**, Exoplanet Lunch Seminar Series, Jet Propulsion Laboratory
2013- **Referee** for Science, Nature, Nature Geoscience, Nature Astronomy, PNAS, ApJ, ApJS, MNRAS, A&A, Astrobiology, Icarus, EPSL, JGR, and GRL
2012- **Panel Reviewer** for NASA's Planetary Atmospheres Program, Mars Data Analysis Program, Mars2020 Participating Scientists Program, Exoplanets Research Program, Exobiology Program, Astrophysics Research and Analysis Program, and Earth and Space Science Fellowship
2018 **Panel Reviewer**, Hubble Space Telescope Time Allocation Committee
2018 **Member**, Organizing Committee of the workshop "Combining high-resolution spectroscopy and high-contrast imaging for exoplanet characterization"
2018 **Member**, Selection Committee of NASA Hubble Postdoctoral Fellowship
2017 **Member**, Selection Committee of NSF Astronomy and Astrophysics Postdoctoral Fellowship
2015 **Panel Reviewer**, Hubble Space Telescope Time Allocation Committee

POSTDOC ADVISING EXPERIENCE

2023- Armen Tokadjian, JPL Postdoc Fellow
2022- Apurva V. Oza, JPL Postdoc Fellow (co-advise with Rosaly Lopes)
2022- Jeehyun Yang, JPL Postdoc Fellow
2022- Aaron Bello-Arufe, JPL Postdoc Fellow
2021-23 Markus Scheucher, JPL Postdoc Fellow (now JPL employee)
2018-22 Mario Damiano, JPL Postdoc Fellow (now JPL employee)

GRADUATE STUDENT ADVISING EXPERIENCE

2022- Kimberly Paragas (Caltech, co-advise with Heather Knutson)
2021-23 Danica Adams (Caltech, co-advise with Yuk Yung). Now prize postdoc at Harvard

2015 Peter Gao (Caltech, co-advise with Yuk Yung). Now staff scientist at the Carnegie Institution for Science

UNDERGRADUATE STUDENT ADVISING EXPERIENCE

2024 Claire Mao (MIT)
2024 Evann Kurzawa (Ecole des Mines de Saint-Étienne)
2023-24 Zachary Burr (Delft University of Technology)
2023 Aidan Robinson (UCLA)
2022-23 Audrey DeVault (Caltech). Now graduate student at MIT
2022 Naylynn Tañón Reyes (Smith College). Now working in the healthcare industry
2020-21 Lexy LeMar (Caltech). Now graduate student at MIT
2018-23 Trent Thomas (UCLA). Now graduate student at U. Washington
2018-19 Héctor Delgado Diaz (Cal State LA). Now graduate student at U. Washington
2018 Luke Peterson (Northwestern University). Now graduate student at CU Boulder
2017-18 Tre'Shunda James (Occidental College). Now postdoc at NASA Goddard
2017 Isabel Angelo (UC Berkeley). Now graduate student at UCLA
2017 George Filippatos (Penn State). Now postdoc at U. Chicago

TEACHING EXPERIENCE

2015- **Guest Lecturer**, California Institute of Technology, Class Ge/Ay 159: Astrobiology (Planetary Evolution and Habitability)
2015 **Co-Instructor**, California Institute of Technology, Class Ge 194: Isotopic Tracers of Mars Atmosphere-Surface Interactions
2014 **Professional Development Program**, Institute for Scientist and Engineer Educators, UC Santa Cruz
2012 **Teaching Certificate Program**, Massachusetts Institute of Technology
2010 **Teaching Assistant,** Tsinghua University**,** Class: Quantum Mechanics

EXTERNAL GRANTS & COMPETITIVE OBSERVATION PROGRAMS

- **Awarded $3.9M since 2015, of which $3.0M as PI or Co-PI**
- **NASA ROSES:** 2 programs as PI, 5 programs as Co-I
- **JWST Observations:** 7 programs (165 hours) as PI and Co-PI, 8 programs (231 hours) as Co-I
- **HST Observations:** 1 program (6 orbits) as PI, 3 programs (241 orbits) as Co-I
- **Spitzer Observations:** 2 programs (176 hours) as Co-I

PI, JWST Cycle 3, Efficient and Detailed Characterization of a Temperate Water World Candidate, 2024-2026, $190K (17 observing hours)
PI, JWST Cycle 3, Detailed Atmospheric Characterization of a Unique Low-Temperature Exo-Saturn, 2024-2026, $247K (25 observing hours)

Co-PI, JWST Cycle 2, Probing the volcanic outgassing activity of a warm sub-Earth planet, 2023-2025, $227K (PI: Mario Damiano, 13 observing hours)
PI, JWST Cycle 1, Deep Characterization of the Atmosphere of a Temperate Sub-Neptune, 2022-2025, $394K (68 observing hours)
PI, JWST Cycle 1, Determining the Atmospheric Composition of the Super-Earth 55 Cancri e, 2022-2024, $236K (16 observing hours)
Co-PI, JWST Cycle 1, Exploring the nature of a temperate exoplanet in the Fulton gap, 2022-2024, $227K (PI: Mario Damiano, 14 observing hours)
Co-PI, JWST Cycle 1, A Search for Signatures of Volcanism and Geodynamics on the Hot Rocky Exoplanet LHS 3844b, 2022-2024 $176K (PI: Laura Kreidberg, 12 observing hours)
PI, NASA Exoplanets Research Program, Thermal Structure, Chemistry, and Observational Signatures of Cold Exoplanet Atmospheres, 2018-2022, $459K
PI, NASA Habitable Worlds, Constraining Early Mars's Atmosphere and Habitability with Isotopic Measurements, 2017-2022, $808K
PI, HST Cycle 24, First Transmission Spectrum of a Cold, Water-Cloud Gas Giant Planet, 2017-2020, $75K (6 observing orbits)

Co-I, JWST Cycle 2, Mapping the atmosphere or surface of a hot ultra-short-period super Earth, 2023-2024, $91K (PI: Michael Zhang, 17 observing hours)
Co-I, JWST Cycle 2, The search for regolith on the airless exoplanet LHS 3844 b, 2023-2024, $64K (PI: Sebastian Zieba, 19 observing hours)
Co-I, HST Cycle 30, The SPACE Program: A Sub-Neptune Planetary Atmosphere Characterization Experiment, 2022-2025, $64K (PI: Laura Kreidberg, 205 observing orbits)
Co-I, JWST Cycle 1, Is it raining lava in the evening on 55 Cancri e? 2022-2024, $98K (PI: Alexis Brandeker, 25 observing hours)
Co-I, JWST Cycle 1, Searching Our Closest Stellar Neighbor for Planets and Zodiacal Emission, 2022-2025, $15K (PI: Charles Beichman, 25 observing hours)
Co-I, JWST Cycle 1, Unveiling the Atmospheric Composition and Haze Formation Rates in the Young, Cool, Super-Puff Kepler-51d, 2022-2024, $40K (PI: Jessica Libby-Roberts, 21 observing hours)
Co-I, JWST Cycle 1, Hot Take on a Cool World: Does Trappist-1c Have an Atmosphere, 2022-2023, $19K (PI: Laura Kreidberg, 18 observing hours)
Co-I, JWST Cycle 1, The First and Only Multi-wavelength Map of an Ultra-short-period sub-Earth, 2022-2023, $18K (PI: Michael Zhang, 13 observing hours)
Co-I, JWST Cycle 1, The first near-infrared spectroscopic phase-curve of a super-Earth, 2022-2023, $16K (PI: Nestor Espinoza, 15 observing hours)
Co-I, JWST Early Release Science, The Transiting Exoplanet Community Early Release Science Program, 2017-2023 (PI: Natalie Batalha, 78 observing hours)
Co-I, NASA Exoplanets Research Program, The Imitation Game: Construction of a Habitable Exoplanet Detection Machine, 2020-2023, $22K (PI: Jonathan Jiang)

Co-I, HST Cycle 28, Confirming a Tentative Detection of an Atmosphere around a Potentially Rocky Planet, 2021-2023, $30K (PI: Thomas Barclay, 8 observing orbits)
Co-I, HST Cycle 27, Searching for Secondary Atmospheres in a System of Benchmark Worlds, 2021-2022, $64K (PI: Thomas Barclay, 28 observing orbits)
Co-I, NASA WFIRST Science Investigation Teams and Adjutant Scientists, Optimizing WFIRST Coronagraph Science, 2016-2021, $114K (PI: Bruce Macintosh)
Co-I, HST Cycle 25, Model Atmospheres and Spectral Irradiance Library of the Exoplanet Host Stars Observed in the MUSCLES Survey, 2018-2020, $86K (PI: Jeffrey Linsky)
Co-I, NASA Planetary Data Archiving, Restoration, and Tools, Restoring and Archiving Voyager 1 Cruise Images of Uranus and Neptune, 2018-2020, $17K (PI: Daniel Wenkert)
Co-I, NASA TESS General Investigator, Characterizing the Super-Earth 55 Cnc e: The TESS Opportunity, 2019 (PI: Diana Dragomir)
Co-I, NASA WFIRST Preparatory Science, Detecting and Characterizing Exoplanets with the WFIRST Coronagraph: Colors of Planets in Standard and Designer Bandpasses, 2015-2018, $74K (PI: Margaret Turnbull)
Co-I, Spitzer Cycle 14, A Test for the Existence of An Atmosphere on a Terrestrial Exoplanet Orbiting a Small Star, 2018 (PI: Laura Kreidberg, 101 observing hours)
Co-I, Spitzer Cycle 9, The First Orbital Phase Curve of a Rocky Exoplanet, 2012 (PI: Brice-Olivier Demory, 75 observing hours)

Science PI, NASA Hubble Postdoctoral Fellowship, Chemical Fingerprints of Alien Worlds – Towards an Evolutionary View of Mars and Terrestrial Exoplanet Atmospheres, 2013-2015, $317K
Science PI, NASA Earth and Space Science Fellowship, Photochemistry of Super Earth Exoplanet Atmospheres, 2011-2013, $60K

INVITED TALKS

Seminars and Colloquia

2025 Ludwig Maximilian University of Munich, Joint Astrophysics Colloquium
2024 Max Planck Institute for Astronomy, Exocoffee
2024 Rocky Worlds Discussion
2024 UC Riverside, Astrobiology Seminar
2023 Tokyo Institute of Technology, Earth-Life Science Institute Seminar
2023 UCLA, Planetary Science Seminar
2023 Caltech, DIX Planetary Science Seminar
2021 University of Arizona, Lunar and Planetary Laboratory Colloquium
2021 NASA Nexus for Exoplanet System Science, CLEVER Planets Seminar
2021 Institute of Planetary Research, German Aerospace Center, Seminar
2021 Northwestern University, Astrophysics Seminar
2021 National Astronomical Observatory of Japan, Seminar
2019 California State University, Los Angeles, Physics and Astronomy Seminar

2019 Max Planck Institute for Astronomy, Origins of Life Seminar
2019 Purdue University, West Lafayette, IN, Department Seminar
2018 Geneva Observatory, Seminar
2018 UCLA, Planetary Science Seminar
2018 University of Florida, Astronomy Seminar
2017 CNRS Orléans, Space Science Seminar
2017 Caltech, Geological and Planetary Sciences Seminar
2017 Academia Sinica, Astronomy Colloquium
2016 California State University, Northridge, Physics and Astronomy Seminar
2016 ETH Zurich, Astrophysics Seminar
2016 University of Bern, Space Research Seminar
2016 Geneva Observatory, Seminar
2016 Arizona State University, Astrobiology Seminar
2014 Caltech, Kliegel Lectures in Planetary Sciences
2014 UCLA, Planetary Seminar
2013 UCLA, iPLEX Lunch Seminar
2013 Caltech, Yuk Lunch Seminar
2012 Harvard-Smithsonian Center for Astrophysics, SSP Seminar
2012 Institute for Advanced Study, Seminar

Invited Conference Talks

2024 Lorentz Center Workshop on Neutral and Ion Photochemistry in Planetary Atmospheres, Leiden, Netherlands
2024 COSPAR Scientific Assembly, Panel on Habitable Worlds Observatory, Busan, South Korea
2024 ISSI Workshop on the Geoscience of (Exo)planets, Bern, Switzerland
2024 Ringberg Castle Workshop on Small Exoplanets, Germany
2023 Scialog Conference on Signatures of Life in the Universe, Tuscon, AZ
2022 Exoplanets in Our Backyard 2, Albuquerque, NM
2022 Chianti International Workshop on Atmospheres, Florence, Italy
2021 Planetary Science and Astrobiology Decadal Survey, Mars Panel
2019 234th Meeting of the American Astronomical Society, St Louis, MO
2019 EGU General Assembly, Vienna, Austria
2018 Defining the Landscape for Precision Radial Velocity (PRV) Science in the 2018-2028 Time Frame, Pasadena, CA
2018 Technology for Direct Detection and Characterization of Exoplanets, Pasadena, CA
2017 Asia Oceania Geosciences Society 14th Annual Meeting, Singapore
2016 NASA Starshade Technology Workshop, Pasadena, CA
2016 Community Astrophysics with WFIRST, Guest Observer and Archival Science, Pasadena, CA
2016 227th Meeting of the American Astronomical Society, Kissimmee, FL

2015 Exoplanetary Atmospheres and Habitability, Nice, France
2015 IAU XXIX General Assembly, Honolulu, HI
2015 Planetary Systems: a Synergistic View, Quy Nhon, Vietnam
2015 Physics of Exoplanets: From Earth-sized to Mini Neptunes, Santa Barbara, CA

MEDIA REPORTS AND PUBLIC OUTREACH

2024 Featured speaker for SETI Live
2024 *A Magma Ocean Fuels This Exoplanet's Atmosphere*, by AGU Eos
2024 *Milestone discovery as JWST confirms atmosphere on an Earth-like exoplanet*, by Nature News
2024 *NASA's Webb Hints at Possible Atmosphere Surrounding Rocky Exoplanet*, NASA press release and media coverage by AP, Reuters, ABC, Scientific American, Space.com, Gizmodo, Astronomy, etc.
2024 *NASA's James Webb Space Telescope could help solve these 5 exoplanet puzzles*, by Science News
2022 *JWST Science Feature Volcanic Worlds*, NASA/STScI press release
2021 *How to Find Hidden Oceans on Distant Worlds? Use Chemistry*, NASA press release
2021 *Where are the water worlds? New tool to find out*, by EarthSky
2021 *The Water on Mars Vanished – This Might Be Where It Went,* by NY Times, National Geographic, and multiple media outlets
2019 *A Rare Look at the Surface of a Rocky Exoplanet*, NASA press release
2018 Science advisor for "Signs of Life", an award-wining planetarium show at the Griffith Observatory, Los Angeles (premiered in May 2022)
2017 *Lava or Not, Exoplanet 55 Cancri e Likely to Have Atmosphere*, by National Geographic
2017 *Our Living Planet Shapes the Search for Life Beyond Earth*, by NASA News
2017 Panel Discussion on the movie "Arrival" at the Los Angeles Public Library
2017 *Signs of Alien Air Herald a New Era of Exoplanet Discoveries*, by Scientific American
2016 *Testing for Methane on Mars*, by Airspacemag.com
2015 *Mystery on Mars: Does Methane Really Indicate Life?* by Space.com
2015 *Mars' Ancient Atmosphere Wasn't Very Thick After All*, by Discovery Channel
2015 *Helium-Filled Exoplanets Likely Float Throughout the Galaxy*, by Discovery Channel and Space.com
2013 *Investigating Exoplanet Surfaces*, by Astrobiology Magazine
2012 *Mars Snowflakes Are as Tiny as Red Blood Cells*, by CBS, Nature, Discovery Channel, National Geographic, and Space.com
2011 *How Astronomers May Hunt for Life on Alien Planets*, by Astrobiology Magazine

PUBLICATIONS

100 refereed publications, 25 first-author papers, h-index = 39 (using NASA ADS)
*student advisee, #postdoc advisee and research group member, ^equal contribution
ADS Library: https://ui.adsabs.harvard.edu/public-libraries/im9iiqF6Se268wGNIdielA
Copies of the papers are available at: https://renyuplanet.github.io/publication.html

Papers under Review

• #Mario Damiano, #Zachary Burr, **Renyu Hu**, Vanessa Bailey, Jennifer Burt, Tiffany Kataria, and Bertrand Mennesson (2024), *Effects of planetary mass uncertainties on the interpretation of the reflectance spectra of Earth-like exoplanets*, **AAS Journals**, under review

• #Zachary Burr, Vincent Kofman, **Renyu Hu**, #Mario Damiano, and Geronimo L. Villanueva (2024), *Effects of Heterogeneous Surfaces and Atmospheric Dynamics on Reflectance Spectroscopy of Earth-like Exoplanets*, **AAS Journals**, under review

• #Aaron Bello-Arufe, #Mario Damiano, Katherine Bennett, **Renyu Hu**, Luis Welbanks, Ryan MacDonald, Darryl Seligman, David Sing, #Armen Tokadjian, #Apurva Oza, and #Jeehyun Yang (2024), *A volcanic atmosphere on the sub-Earth L 98-59 b*, **Science**, under review

• Michael Greklek-McKeon, … **Renyu Hu**, et al. (2024), *Tidally Heated Sub-Neptunes, Refined Planetary Compositions, and Confirmation of a Third Planet in the TOI-1266 System*, **AAS Journals**, under review

• Elsa Ducrot, … **Renyu Hu**, et al. (2024), *No thick atmosphere around TRAPPIST-1 b and c*, **Nature Astronomy**, under review

• Björn Benneke, … **Renyu Hu**, et al. (2024), *JWST Reveals CH_4, CO_2, and H_2O in a Metal-rich Miscible Atmosphere on a Two-Earth-Radius Exoplanet*, **AAS Journals**, under review (arXiv: 2403.03325)

• Thomas Barclay, … **Renyu Hu**, et al. (2024), *The transmission spectrum of the potentially rocky planet L 98-59 c*, **AAS Journals**, under review (arXiv: 2301.10866)

• Christopher D. Parkinson, Stephen W. Bougher, Franklin P. Mills, **Renyu Hu**, Guillaume Gronoff, Jiazheng Li, Amanda Brecht, and Yuk L. Yung (2024), *Venus as an Exoplanet: I. An Initial Exploration of the 3-D Energy Balance for a CO_2 Exoplanetary Atmosphere Around an M-Dwarf Star*, **J. Geophys. Res. Planets**, under review (arXiv: 2205.10958)

Refereed Publications – Major Contributions

2024

[M58] *Danica Adams, #Markus Scheucher, **Renyu Hu**, Bethany Ehlmann, *Trent B. Thomas, Robin Wordsworth, Eva L. Scheller, Rob Lillis, Kayla Smith, Heike Rauer, and Yuk L. Yung

(2024), *Episodic Warm Climates on Early Mars Primed by Crustal Hydration*, **Nature Geoscience**, in press

[M57] #Armen Tokadjian, **Renyu Hu**, and #Mario Damiano (2024), *The Detectability of $CH_4/CO_2/CO$ and N_2O Biosignatures through Reflection Spectroscopy of Terrestrial Exoplanets*, **AJ**, in press (arXiv: 2410.14848)

[M56] #Mario Damiano, Stuart Shaklan, **Renyu Hu**, et al. (2024), *Starshade Exoplanet Data Challenge: What We Learned*, **Journal of Astronomical Telescopes, Instruments, and Systems**, 10, 048001

[M55] #Jeehyun Yang and **Renyu Hu** (2024), *Chemical Mapping of Temperate Sub-Neptune Atmospheres: Constraining the Deep Interior H_2O/H_2 Ratio from the Atmospheric CO_2/CH_4 Ratio*, **ApJ Letters**, 971, L48

[M54] **Renyu Hu**, #Aaron Bello-Arufe, Micheal Zhang, et al. (2024), *A Secondary Atmosphere on the Rocky Exoplanet 55 Cancri e*, **Nature**, 360, 609

[M53] #Mario Damiano, #Aaron Bello-Arufe, #Jeehyun Yang, and **Renyu Hu** (2024), *LHS 1140 b is a potentially habitable water world*, **ApJ Letters**, 968, L22

[M52] Collin Cherubim, Robin Wordsworth, **Renyu Hu**, and Evgenya Shkolnik (2024), *Strong fractionation of deuterium and helium in sub-Neptune atmospheres along the radius valley*, **ApJ**, 967, 139

[M51] #Jeehyun Yang and **Renyu Hu** (2024), *Automated chemical reaction network generation and its application to exoplanet atmospheres*, **ApJ**, 966, 189

[M50] Michael Zhang, **Renyu Hu**, Julie Inglis, et al. (2024), *GJ 367b is a dark, hot, airless sub-Earth*, **ApJ Letters**, 961, L44

2023

[M49] #Mario Damiano, **Renyu Hu**, and Bertrand Mennesson (2023), *Reflected Spectroscopy of Small Exoplanets. III. Probing the UV Band to Measure Biosignature Gases*, **AJ**, 166, 157

[M48] **Renyu Hu**, Fabrice Gaillard, and Edwin Kite (2023), *Narrow loophole for H_2-dominated atmospheres on habitable rocky planets around M dwarfs*, **ApJ Letters**, 948, L20

[M47] *Trent Thomas, **Renyu Hu**, and Daniel Y. Lo (2023), *Constraints on the size and composition of the ancient Martian atmosphere from coupled CO_2-N_2-Ar isotopic evolution models*, **PSJ**, 4, 41

2022

[M46] Steffen Buessecker, Hiroshi Imanaka, Tucker Ely, **Renyu Hu**, Stephen J. Romaniello, and Hinsby Cadillo-Quiroz (2022), *Marine mineral-catalyzed NO and N_2O formation on the anoxic early Earth*, **Nature Geoscience**, 15, 1056

[M45] Robert A. West, Philip Dumont, **Renyu Hu**, Vijay Natraj, James Breckinridge, and Pin Chen (2022), *Spectropolarmetry as a Means to Address Cloud Composition and Habitability for a Cloudy Exoplanetary Atmosphere in the Habitable Zone*, **ApJ**, 940, 183

[M44] #Mario Damiano, **Renyu Hu**, et al. (2022), *A transmission spectrum of the sub-Earth planet L98-59 b in 1.1 – 1.7 μm*, **AJ**, 164, 225

[M43] #Mario Damiano and **Renyu Hu** (2022), *Reflected spectroscopy of small planets II: characterization of terrestrial exoplanets*, **AJ**, 163, 299

[M42] **Renyu Hu** and *Trent Thomas (2022), *A nitrogen-rich atmosphere on ancient Mars consistent with isotopic evolution models*, **Nature Geoscience**, 15, 106

2021

[M41] #Mario Damiano and **Renyu Hu** (2021), *Reflected spectroscopy of small exoplanets I: determining the atmospheric composition of sub-Neptune planets*, **AJ**, 162, 200

[M40] **Renyu Hu**, #Mario Damiano, #Markus Scheucher, Edwin Kite, Sara Seager, and Heike Rauer (2021), *Unveiling shrouded oceans on temperate sub-Neptunes via transit signatures of solubility equilibria vs. gas thermochemistry*, **ApJ Letters**, 921, L8

[M39] **Renyu Hu** (2021), *Photochemistry and Spectral Characterization of Temperate and Gas-Rich Exoplanets*, **ApJ**, 921, 27

[M38] *Danica Adams, Yangcheng Luo, Michael L. Wong, Patrick Dunn, Madeline Christensen, Chuanfei Dong, **Renyu Hu**, and Yuk Yung (2021), *Nitrogen Fixation on Early Mars*, **Astrobiology**, 21, 8

[M37] Eva L. Scheller, Bethany Ehlmann, **Renyu Hu**, *Danica Adams, and Yuk Yung (2021), *Long-Term Drying of Mars by Sequestration of Ocean-Scale Volumes of Water in the Crust*, **Science**, 372, 56

[M36] **Renyu Hu**, Sergi R. Hildebrandt, #Mario Damiano, Stuart Shaklan, Stefan Martin, and Doug Lisman (2021), *Starshade Exoplanet Data Challenge*, **Journal of Astronomical Telescopes, Instruments, and Systems**, 7, 021216

[M35] **Renyu Hu**, Doug Lisman, Stuart Shaklan, Stefan Martin, Phil Willems, and Kendra Short (2021), *Overview and Reassessment of Noise Budget of Starshade Exoplanet Imaging*, **Journal of Astronomical Telescopes, Instruments, and Systems**, 7, 021205

2020

[M34] #Mario Damiano, **Renyu Hu**, and Sergi Hildebrandt (2020), *Multi-orbital-phase and Multiband Characterization of Exoplanetary Atmospheres with Reflected Light Spectra*, **AJ**, 160, 206

[M33] #Mario Damiano and **Renyu Hu** (2020), *ExoREL-R: A Bayesian Inverse Retrieval Framework for Exoplanetary Reflected Light Spectra*, **AJ**, 159, 175

[M32] **Renyu Hu**, *Luke Peterson, and Eric T. Wolf (2020), *O_2- and CO-Rich Atmospheres for Potentially Habitable Environments on TRAPPSIT-1 Planets*, **ApJ**, 888, 122

[M31] Clara Sousa-Silva, Sara Seager, Sukrit Ranjan, Janusz Jurand Petkowski, Zhuchang Zhan, **Renyu Hu**, and William Bains (2020), *Phosphine as a Biosignature Gas in Exoplanet Atmospheres*, **Astrobiology**, 20, 2

2019

[M30] **Renyu Hu** (2019), *Information in the Reflected Light Spectra of Widely Separated Giant Exoplanets*, **ApJ**, 887, 166

[M29] **Renyu Hu** and *Héctor Delgado Diaz (2019), *Stability of Nitrogen in Planetary Atmospheres in Contact with Liquid Water*, **ApJ**, 886, 126

[M28] Megan Mansfield, Edwin S. Kite, **Renyu Hu**, et al. (2019), *Identifying Atmospheres on Rocky Exoplanets through Infrared High Albedo*, **ApJ**, 886, 141

[M27] Laura Kreidberg, ^Daniel Koll, ^Caroline Morley, ^**Renyu Hu**, et al. (2019), *Absence of a Thick Atmosphere on the Terrestrial Exoplanet LHS 3844b*, **Nature**, 573, 87

[M26] **Renyu Hu** (2019), *Predicted Diurnal Variation of the Deuterium to Hydrogen Ratio in Water at the Surface of Mars Caused by Mass Exchange with the Regolith*, **Earth Planet Sci Lett**, 519, 192

[M25] #Yui Kawashima, **Renyu Hu**, and Masahiro Ikoma (2019), *Detectable Molecular Features above Hydrocarbon Haze via Transmission Spectroscopy with JWST: Case Studies of GJ 1214b, GJ 436b, HD 97658b, and Kepler-51b*, **ApJ Letters**, 876, L5

2018

[M24] *Tre'Shunda James and **Renyu Hu** (2018), *Photochemical Oxygen in Non-1 Bar CO_2 Atmospheres of Terrestrial Exoplanets*, **ApJ**, 867, 17

[M23] Chester E. Harman, Ryan Felton, **Renyu Hu**, et al. (2018), *Abiotic O_2 Levels on Planets around F, G, K, and M Stars: Effects of Lightning-Produced Catalysts in Eliminating Oxygen False Positives*, **ApJ**, 866, 56

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