JEEHYUN YANG

Postdoctoral Scholar

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Department of Astronomy and Astrophysics, The University of Chicago

RESEARCH INTERESTS

Exoplanet Atmosphere Modeling and Characterization

Chemical Reaction Kinetics

Polycyclic Aromatic Hydrocarbon (PAH) Chemistry

Archean Earth's atmosphere and the Great Oxidation Event (GOE)

Atmospheric engineering of Martian and Venusian atmospheres

Habitable worlds and the Origin of life

EMPLOYMENTS

The University of Chicago *Chicago, IL, USA*

Postdoctoral Scholar | Department of Astronomy & Astrophysics 2025–present

Advisor: Prof. Eliza M.-R. Kempton

California Institute of Technology *Pasadena, CA, USA*

Staff Scientist | Division of Geological and Planetary Sciences 2025

Advisor: Prof. Yuk L. Yung

Jet Propulsion Laboratory *Pasadena, CA, USA*

JPL Postdoctoral Fellow | Planetary Sciences Section 2022 - 2025

Advisor: Dr. Murthy S. Gudipati & Dr. Renyu Hu

EDUCATION

Massachusetts Institute of Technology *Cambridge, MA, USA*

Ph.D. in *Physical Chemistry* | Department of Chemical Engineering 2022

Thesis: Experiment and modeling combined kinetic study of bottom-up polycyclic aromatic hydrocarbon formations

Advisor: Prof. William H. Green Jr.

Hokkaido University *Sapporo, Hokkaido, Japan*

B.E. in *Sustainable Resources Engineering* | School of Engineering 2016

Thesis: Experimental study for understanding hydrothermal alteration of iron and chromium oxides using a flow-through system

Advisor: Prof. Tsubasa Otake

GRANTS AND COMPETITIVE OBSERVATION PROGRAMS

(**Co-I**) *Efficient and Detailed Characterization of a Temperate Water World Candidate*
Program: *James Webb Space Telescope (JWST)* Cycle 3 GO 4711
Principal Investigator: Dr. Renyu Hu

(**Co-I**) *Detailed Atmospheric Characterization of a Unique Low-Temperature Exo-Saturn*
Program: *James Webb Space Telescope (JWST)* Cycle 3 GO 5177
Principal Investigator: Dr. Renyu Hu

(**Co-I**) *Probing the volcanic outgassing activity of a warm sub-Earth planet*
Program: *James Webb Space Telescope (JWST)* Cycle 2 GO 3942
Principal Investigator: Dr. Mario Damiano

PUBLICATIONS

18 refereed publications; 8 first-author; 2 second-author ; 3 papers under review

21. Baeyens R, Moses JI, Jasmina Blecic, *et al.*, including **Yang J**, Phase-dependent chemistry of WASP-43 b revealed with a suite of one-, two-, and three-dimensional models *under review at A&A*, 2026

20. **Yang J**, Kempton EMR, Savel AB. Sub-Neptunes as Soot Factories: Deep Atmosphere Hydrocarbon Formation and Quenching as the Origin of Sub-Neptune Aerosol Trends, *ApJL*, 2026, 1003, L16

19. **Yang J**, Adams DJ, Hu R, Yung YL. Novel Chemical Pathways for the Formation of Nucleotide Base Precursors via Benzene π-Bond Addition to HCN, *Icarus*, 2026, 456, 117134

18. Ghosh P, Rani N, **Yang J**, Willacy K, Rimmer PB, and Majumdar L. A Comprehensive Sulfur Chemistry Network with Excited S(^{1}D) and SO($^1\Delta$), *ApJ in press*, 2025

17. Bello-Arufe A, Hu R, Zilinskas M, **Yang J**, *et al.* Methane on the temperate exo-Saturn TOI-199 b, *AJ in press*, 2026

16. **Yang J**, Hyder A, Hu R, Lunine JI. Coupled 1D Chemical Kinetic–Transport and 2D Hydrodynamic Modeling Supports a modest 1–1.5× Supersolar Oxygen Abundance in Jupiter's Atmosphere *PSJ*, 2026, 7, 2

15. Hu R, **Yang J**, *et al.* A water-rich interior in the temperate sub-Neptune K2-18 b revealed by JWST *in revision at ApJ*, 2025

14. **Yang J**, Yung YL. A building block approach to Gibbs free energy trends in organic compounds detected in asteroid Bennu *Astrobiology*, 2025, 25, 12, 855–860

13. Oza A, Gebek A, zu Westram MM *et al.*, including **Yang J**, Volcanic satellites tidally venting Na, K, SO_2 in Optical & Infrared Light *MNRAS*, 2025, 546, 1

12. Bello-Arufe A, Damian M, Bennet K *et al.* including **Yang J**, A volcanic atmosphere on the sub-Earth L 98-59 b *ApJL*, 2025, 980, L26

11. **Yang J**, Hu R. Chemical mapping of temperate sub-Neptune atmospheres: Constraining the deep-interior H_2O/H_2 using the atmospheric CO_2/CH_4 *ApJL*, 2024, 971, L48

10. Damiano M, Bello-Arufe A, **Yang J**, Hu R. LHS 1140 b is potentially habitable world *ApJL*, 2024, 968, L22

9. Benneke B, Roy P-A, Coulomb L-P *et al.*, including **Yang J**, JWST Reveals CH_4, CO_2, and H_2O in a Metal-rich Miscible Atmosphere on a Two-Earth-Radius Exoplanet *in revision at ApJL*, 2024

8. **Yang J**, Hu R. Automated chemical reaction network generation and its application to exoplanet atmospheres *ApJ*, 2024, 966, 2, 189

7. Powell D, Feinstein AD, Lee EKH *et al.*, including **Yang J**, Detection of SO_2 in the Mid-Infrared Transmission Spectrum of WASP-39b *Nature*, 2024, 626, 979–983

6. Tsai S-M, Lee EKH, Powell D, *et al.*, including **Yang J**, Photochemically-produced SO_2 in the atmosphere of WASP-39b *Nature*, 2023, 617, 483–487

5. **Yang J**, Gudipati MS, Henderson BL, Fleury B. High-fidelity reaction kinetic modeling of hot-Jupiter atmospheres incorporating thermal and UV-photochemistry enhanced by metastable CO ($a^3\Pi$) *ApJ*, 2023, 947, 1, 26

4. Ohmoto Y., **Yang J**, Nishikata M *et al.* Low-temperature hydrothermal synthesis of chromian spinel from Fe-Cr hydroxides using a flow-through reactor *Minerals*, 2022, 12, 9, 1110

3. **Yang J**, Smith MC, Prendergast BM, Chu T-C, Green WH. $C_{14}H_{10}$ Polycyclic Aromatic Hydrocarbons Formation by Acetylene Addition to Naphthalenyl Radicals Observed *Phys. Chem. Chem. Phys.*, 2021, 23, 14325–14339

2. Chu T-C, Smith MC, **Yang J**, Liu M, Green WH. Theoretical study on the HACA chemistry of naphthalenyl radicals and acetylene: the formation of $C_{12}H_8$, $C_{14}H_8$, and $C_{14}H_{10}$ species *Int. J. Chem. Kinet.*, 2020, 52, 11, 752–768

1. Smith MC, Liu G, Buras ZJ, Chu T-C, **Yang J** and Green WH. Direct Measurement of Radical-Catalyzed C_6H_6 Formation from Acetylene and Validation of Theoretical Rate Coefficients for C_2H_3+C_2H_2 and C_4H_5 + C_2H_2 Reactions *J. Phys. Chem. A*, 2020, 124, 14, 2871–2884

INVITED TALKS

(Webinar) Max Planck Institute for Astronomy, Heidelberg, Germany, Exocoffee	2026
(Seminar) Ulsan National Institute of Science and Technology, Korea, Department of Physics	2026
(Seminar) The Ohio State University, Columbus, OH, Exoplanet Group Meeting	2026
(Seminar) The Pennsylvania State University, University Park, PA, CEWH Seminar	2026
(Seminar) Purdue University, West Lafayette, IN, Planetary Seminar	2026
(Seminar) Argonne National Laboratory, Lemont, IL, CSE Seminar	2025
(Webinar) Korea Aerospace Research Institute, Korea, KARI SES Seminar Series	2025
(Symposium) Hokkaido University, Japan, The 8th ICReDD International Symposium	2024
(Seminar) National Astronomical Observatory of Japan, Japan, NAOJ Planet Seminar	2024
(Colloquium) Kyung Hee University, Korea, Department of Astronomy and Space Science	2024
(Colloquium) Korea Astronomy and Space Science Institute, Korea	2024
(Seminar) Boston University, Boston, MA , Planet Lunch Seminar	2024
(Seminar) Massachusetts Institute of Technology, Cambridge, MA , Planetary Lunch Seminar	2024
(Seminar) University of Maryland, College Park, MD, PALS seminar	2024
(Seminar) Columbia University, New York, NY, Astronomy and Astrophysics Department	2024
(Seminar) Princeton University, Princeton, NJ , Exoplanet Discussion Group	2024
(Seminar) California Institute of Technology, Pasadena, CA, Yuk Lunch Seminar	2024
(Webinar) The University of Arizona, Tucson, AZ, Prof. Sukrit Ranjan group seminar	2024
(Seminar) California Institute of Technology, Pasadena, CA, Yuk Lunch Seminar	2023
(Webinar) California Institute of Technology, Pasadena, CA, Yuk Lunch Seminar	2021

CONFERENCES

Yang J, Savel AB, Kempton, EMR. Explaining Sub-Neptune Aerosol Trends with Deep Interior PAH Formation **Oral presentation** at *11th AAS Topical Conference Series Exoplanet Atmospheres*, Denver, Colorado, USA, March 2026

Yang J, Hu R. Water-rich Sub-Neptune Interiors and Abiotic Organosulfur Formation: Evidence from K2-18 b JWST Observations **Poster presentation** at *The Great Lakes Exoplanet Area Meeting*, The University of Wisconsin-Madison, Wisconsin, USA, November 2025

Yang J, Adams DJ, Hu R, Yung YL. Novel Chemical Pathways for the Formation of Nucleotide Base Precursors via Benzene $\pi-$Bond Addition to HCN **Poster presentation** at *The Origins Federation Third Annual Origins of Life Conference*, The University of Chicago, Illinois, USA, September 2025

Yang J. Atmospheric CO_2/CH_4 as a probe of deep H_2O/H_2 in sub-Neptunes: Evidence from K2-18 b and abiotic organosulfur chemistry **Oral presentation** at *From Transits to Trends: the Next Decade of Long-Period Exoplanets*, University of New Mexico, New Mexico, USA, August 2025

Yang J, Hu R. Constraining the deep-interior H_2O/H_2 of temperate sub-Neptune exoplanets using the atmospheric CO_2/CH_4 observation **Oral presentation** at *The 245rd Meeting of the American Astronomical Society*, National Harbor, Maryland, USA, January 2025

Yang J, Hu R. Automated chemical reaction network generation and its application to exoplanet atmospheres **Oral presentation** at *The 3rd Boston Area Planetary Science Meeting*, Cambridge, Massachusetts, USA, September 2024

Yang J, Kite ES, Mao C, Kerber L, Hu R. Vertical Ozone Distribution in an Oxygen-Rich Scenario of Martian Atmosphere: Insights from One-Dimensional Photochemical Modeling **Poster presentation** at *The Tenth International Conference on Mars*, Pasadena, California, USA, July 2024

Yang J, Hu R. Automated chemical reaction network generation and its application to exoplanet atmosphere **Oral presentation** at *The 243rd Meeting of the American Astronomical Society*, New Orleans, Louisiana, USA, January 2024

Yang J, Hu R. Automated chemical reaction network generation and its application to exoplanet atmospheres **Poster presentation** at *Exoclimes VI*, University of Exeter, UK, June 2023

Yang J, Gudipati MS, Henderson BL, Fleury B. Metastable $CO(a^3\Pi)$-aided photochemistry in H_2- or N_2-dominated exoplanet atmospheres **Oral presentation** at *The 242nd Annual Meeting of the American Astronomical Society*, Albuquerque, New Mexico, USA, June 2023

Yang J, Smith MC, Chu T-C, Green WH. Experimental Investigation of Naphthyl radical Hydrogen Abstraction Acetylene Addition (HACA) Mechanism **Oral presentation** at *American Chemical Society Virtual National Fall Meeting and Expo*, Virtual, August 2020

Yang J, Smith MC, Chu T-C, Green WH. Experimental Investigation of Naphthyl radical Hydrogen Abstraction Acetylene Addition (HACA) Mechanism **Oral presentation** at *38th Northeast Regional Meeting on Kinetics and Dynamics*, Cambridge, Massachusetts, USA, January 2020

Yang J, Hull A, Field R, Ono S. Mass Independent Sulfur Isotope Fractionation during Elemental Sulfur Photolysis **Poster presentation** at *2018 Goldschmidt Conference*, Boston, Massachusetts, USA, August 2018

Yang J, Hull A, Field R, Ono S. Mass Independent Sulfur Isotope Fractionation during Carbonyl Sulfide Photolysis **Oral presentation** at *2018 International Symposium on isotopomers*,
Baton Rouge, Lousiana, USA, March 2018

Otake T, **Yang J**, Ohtomo Y, Sato T. Experimental study for the Formation of Chromian Spinel under Low-Temperature Hydrothermal Conditions using a Flow-Through Apparatus **Oral presentation** at

2016 The Geochemical Society of Japan, Osaka City University, Japan, Sep 2016

Yang J, Otake T, Sato T. Experimental Study to Understand the Hydrothermal Alteration of Iron and Chromium Hydroxides in a Flow-Through System **Oral presentation** at *2016*, *Goldchmidt Conference* Yokohama, Japan, June 2016

PROFESSIONAL SERVICES

External Reviewer for *JWST* Cycle 3, 4 GO & AR 2023–2024

Peer-review Referee for *JPCA, A&A, JGR: Atmospheres, PSJ, ApJ, ApJL* 2021–present

ADVISING EXPERIENCE

(Graduate) Jingyu Wang (UA) 2025

(Graduate) Rahul Arora (UA) 2025

(Undergraduate) Claire Mao (MIT) 2024

(Undergraduate) Calden Ball (SBU) 2022

HONORS, AWARDS AND SPECIAL ACTIVITIES

2019 OTEFE Award ($2,000). Opportunity to Earn Future Education Scholarship, USA 2019

Whiteman Fellowship, Massachusetts Institute of Technology, USA 2017-18

MIT Presidential Fellowship, Massachusetts Institute of Technology, USA 2016-17

Valedictorian, School of Engineering, Hokkaido University, Japan 2016

William Wheeler Prize (The highest honor in the department), Hokkaido University, Japan 2016

Nitobe Award ($2,000). Hokkaido University, Japan 2011

10th Korea-Japan Joint Government Scholarship (Full tuition fee + $1,000/month) 2009-13, 2015-16

TEACHING EXPERIENCE

University of Texas, El Paso El Paso, TX, USA
Guest Lecturer *2026*

· GEOL 1314 Introduction to Historical Geology

Massachusetts Institute of Technology Cambridge, MA, USA
Teaching Assistant *2019-2020*

· 12.335 / 12.835 Experimental Atmospheric Chemistry

Hokkaido University Sapporo, Hokkaido, Japan
Teaching Assistant *2015-2016*

· Construction and interpretation of the topographic and geological map

Hokkaido University Sapporo, Hokkaido, Japan
Temporary Lecturer *2015-2016*

· General Physics
· General Chemistry

MAINTENANCE AND OPERATION OF THE DEVICES

Time-of-flight Mass Spectrometry

Isotope-Ratio Mass Spectrometry

Quadrupole Mass Spectrometry

Two-dimensional Gas Chromatography-Mass Spectrometry

Fourier Transform Infrared Radiation

Laser Spectroscopy using Nd: YAG laser and diode laser

High-temperature and ultra-high vacuum technique

Automation of temperature and pressure-controlling system