

# JEEHYUN YANG

Postdoctoral Scholar

jeehyun@uchicago.edu

Department of Astronomy and Astrophysics, The University of Chicago

## RESEARCH INTERESTS

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Cross-disciplinary characterization of exoplanet atmospheres

Laboratory studies of the evolution of (exo)planetary atmospheres

The evolution of Archean Earth's atmosphere

Atmospheric engineering of Martian and Venusian atmospheres

Search for habitable worlds, biosignatures, and the origin of life

Sulfur photochemistry and its application to planetary atmospheres

## EMPLOYMENTS

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**The University of Chicago**

*Chicago, IL, USA*

Postdoctoral Scholar

2025–present

**California Institute of Technology**

*Pasadena, CA, USA*

Staff Scientist

2025

**Jet Propulsion Laboratory**

*Pasadena, CA, USA*

JPL Postdoctoral Fellow

2022 - 2025

## EDUCATION

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**Massachusetts Institute of Technology**

*Cambridge, MA, USA*

Ph.D. in Physical Chemistry

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

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

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**(Co-I)** *Probing the volcanic outgassing activity of a warm sub-Earth planet*

Program: *James Webb Space Telescope (JWST)* Cycle 2 Guest observers Program 3942

Principal Investigator: Dr. Mario Damiano

**(Co-I)** *Efficient and Detailed Characterization of a Temperate Water World Candidate*

Program: *James Webb Space Telescope (JWST)* Cycle 3 Guest observers Program 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 Guest observers Program 5177

Principal Investigator: Dr. Renyu Hu

## PUBLICATIONS

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**13 refereed publications; 6 first-author papers; 3 second-author paper; 5 submitted papers**

18. Ghosh P, Rani N, **Yang J**, Willacy K, Rimmer PB, and Majumdar L, Excited- and Ground-State Sulfur Reactions with CO<sub>2</sub>: A Missing Link in Venus's Atmospheric Models, *submitted to ApJ*, 2025
17. Bello-Arufe A, Hu R, Zilinskas M, **Yang J**, *et al.* Methane on the temperate exo-Saturn TOI-199 b, *submitted to ApJ*, 2025
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. *in revision in PSJ*, 2025
15. Hu R, **Yang J**, *et al.* A water-rich interior in the temperate sub-Neptune K2-18 b revealed by JWST. *in revision in ApJL*, 2025
14. **Yang J**, Yung YL. A building block approach to Gibbs free energy trends in organic compounds detected in asteroid Bennu. *Accepted in Astrobiology*, 2025
13. Oza A, Gebek A, zu Westram MM *et al.*, including **Yang J**. Volcanic satellites tidally venting Na, K, SO<sub>2</sub> in Optical & Infrared Light. *Accepted in MNRAS*, 2025
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<sub>2</sub>O/H<sub>2</sub> using the atmospheric CO<sub>2</sub>/CH<sub>4</sub>. *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<sub>4</sub>, CO<sub>2</sub>, and H<sub>2</sub>O in a Metal-rich Miscible Atmosphere on a Two-Earth-Radius Exoplanet. *in revision in 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<sub>2</sub> 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<sub>2</sub> 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<sup>3</sup>Π). *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<sub>14</sub>H<sub>10</sub> 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<sub>12</sub>H<sub>8</sub>, C<sub>14</sub>H<sub>8</sub>, and C<sub>14</sub>H<sub>10</sub> species. *Int. J. Chem. Kinet.*, 2020, 52, 11, 752–768

- Smith MC, Liu G, Buras ZJ, Chu T-C, **Yang J** and Green WH. Direct Measurement of Radical-Catalyzed C<sub>6</sub>H<sub>6</sub> Formation from Acetylene and Validation of Theoretical Rate Coefficients for C<sub>2</sub>H<sub>3</sub>+C<sub>2</sub>H<sub>2</sub> and C<sub>4</sub>H<sub>5</sub> + C<sub>2</sub>H<sub>2</sub> Reactions, *J. Phys. Chem. A*, 2020, 124, 14, 2871–2884

## INVITED TALKS

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(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 8 <sup>th</sup> 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

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**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<sub>2</sub>/CH<sub>4</sub> as a probe of deep H<sub>2</sub>O/H<sub>2</sub> 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<sub>2</sub>O/H<sub>2</sub> of temperate sub-Neptune exoplanets using the atmospheric CO<sub>2</sub>/CH<sub>4</sub> 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<sub>2</sub>-or N<sub>2</sub>-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, Louisiana, 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

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External Reviewer for <i>JWST</i> Cycle 3, 4 GO & AR	2023–2024
Peer-review Referee for <i>JPCA</i> , <i>A&amp;A</i> , <i>JGR: Atmospheres</i> , <i>ApJ</i> , <i>ApJL</i>	2021–present

## ADVISING EXPERIENCE

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(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

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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
10 <sup>th</sup> Korea-Japan Joint Government Scholarship (Tuition fee + \$1,000/ month)	2009-13, 2015-16

## TEACHING EXPERIENCE

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**Massachusetts Institute of Technology**

*Teaching Assistant*

Cambridge, MA, USA

2019-2020

- 12.335 / 12.835 Experimental Atmospheric Chemistry

**Hokkaido University**

*Teaching Assistant*

Sapporo, Hokkaido, Japan

2015-2016

- General Physics
- General Chemistry
- Construction and interpretation of the topographic and geological map

## MAINTENANCE AND OPERATION OF THE DEVICES

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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