

# JEEHYUN YANG

Staff Scientist

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Division of Geology and Planetary Sciences, California Institute of Technology

## 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 and origin of life  
Sulfur photochemistry and its application to planetary atmospheres

## EMPLOYMENTS

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<b>California Institute of Technology</b>	<i>Pasadena, CA, USA</i>
Staff Scientist	2025 - Present
<b>Jet Propulsion Laboratory</b>	<i>Pasadena, CA, USA</i>
JPL Postdoctoral Fellow	2022 - 2025

## EDUCATION

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<b>Massachusetts Institute of Technology</b>	<i>Cambridge, MA, USA</i>
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.	
<b>Hokkaido University</b>	<i>Sapporo, Hokkaido, Japan</i>
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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**11 refereed publications; 4 first-author papers; 2 submitted paper**

13. A. Oza, A. Gebek, M. M. zu Westram *et al.*, including **Yang J**, Volcanic Satellites Tidally Venting Na, K, SO<sub>2</sub> in Optical & Infrared Light. *submitted to MNRAS*
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 in press*
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. *Under review 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
1. 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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(Symposium)	Hokkaido University, Japan, The 8 <sup>th</sup> ICRDD 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

<b>(Seminar)</b> Columbia University, New York, NY, Astronomy and Astrophysics Department	2024
<b>(Seminar)</b> Princeton University, Princeton, NJ , Exoplanet Discussion Group	2024
<b>(Seminar)</b> California Institute of Technology, Pasadena, CA, Yuk Lunch Seminar	2024
<b>(Webinar)</b> The University of Arizona, Tucson, AZ, Prof. Sukrit Ranjan group seminar	2024
<b>(Seminar)</b> California Institute of Technology, Pasadena, CA, Yuk Lunch Seminar	2023
<b>(Webinar)</b> California Institute of Technology, Pasadena, CA, Yuk Lunch Seminar	2021

## CONFERENCES

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**Yang J**, Hu R. Constraining the deep-interior  $\text{H}_2\text{O}/\text{H}_2$  of temperate sub-Neptune exoplanets using the atmospheric  $\text{CO}_2/\text{CH}_4$  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 *Exoclines VI*, University of Exeter, UK, June 2023

**Yang J**, Gudipati MS, Henderson BL, Fleury B. Metastable  $\text{CO}(\text{a}^3\Pi)$ -aided photochemistry in  $\text{H}_2$ - or  $\text{N}_2$ -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, 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, *Goldschmidt Conference* Yokohama, Japan, June 2016

## PROFESSIONAL SERVICES

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**External Reviewer** for *JWST* Cycle 3 GO & AR 2023  
**Peer-review Referee** for *JPCA*, *A&A*, *JGR: Atmospheres*, *ApJ*, *ApJL* 2021–present

## ADVISING EXPERIENCE

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(Graduate) Sihe Chen (Caltech) 2024  
 (Undergraduate) Claire Mao (MIT) 2024  
 (Undergraduate) Calden Ball (Stony Brook University) 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** Cambridge, MA, USA  
*Teaching Assistant* 2019-2020

· 12.335 / 12.835 Experimental Atmospheric Chemistry

**Hokkaido University** Sapporo, Hokkaido, Japan  
*Teaching Assistant* 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