

YUN-TING CHENG

California Institute of Technology, M.C. 367-17, 1200 E California Blvd, Pasadena, CA 91125

✉ ycheng3@caltech.edu | 🏠 <https://yuntingcheng.github.io/>

US Legal Permanent Resident (Green Card holder), Taiwan Citizenship

PROFESSIONAL EXPERIENCE

California Institute of Technology/Jet Propulsion Laboratory

Research Scientist

Jan 2024 – present

Jet Propulsion Laboratory/California Institute of Technology

Postdoctoral Researcher

Oct 2021 – Jan 2024

EDUCATION

California Institute of Technology

Ph.D. in Physics (Advisor: Prof. Jamie Bock)

Jun 2021

Thesis: [Cosmology and Astrophysics with Intensity Mapping](#)

M.S. in Physics

Jun 2019

National Taiwan University

B.S. in Physics

Jun 2014

RESEARCH INTERESTS

- Development of analysis algorithms in galaxy surveys
- Characterization of observational systematics of large-scale structure surveys
- Photometric redshift inference and validation
- Optimal extraction of spectral-line intensity mapping signals
- Study of the extragalactic background

RESEARCH EXPERIENCE

California Institute of Technology / Jet Propulsion Laboratory

Pasadena, CA

Research Scientist

Jan 2024 – Present

- SPHEREx Mission
 - Characterizing the photometric redshift estimation and systematics
 - Optimizing the multi-tracer analysis for SPHEREx cosmology science
 - Modeling the extragalactic background and line intensity mapping signal for SPHEREx
- Photometric Redshift with Clustering Statistics (collaborators: E. Huff, K. Markovic, I. Szapudi)
 - Developing a novel photometric redshift technique with clustering information

Postdoctoral Researcher (Advisor: Dr. Olivier Doré)

Oct 2021 – Jan 2024

- 3D Light Cones Cosmology (collaborators: B. Wandelt, O. Doré, T.-C. Chang)
 - Developing a Bayesian data-driven technique to optimally constrain cosmology with spectral imaging data
- Galactic Extinction Modeling (collaborators: B. Hensley, O. Doré, T.-C. Chang)
 - Building Galactic dust extinction model from multi-tracer datasets
- Extragalactic Radio Dipole (collaborators: A. Lidz, T.-C. Chang)
 - Modeling the cosmic dipole signal from extragalactic radio sources
- Intra-halo Light Signal in the Extragalactic Background (collaborator: J. J. Bock)
 - Modeling non-linear clustering and intra-halo light in the near-infrared background

Graduate Research Assistant (Advisor: Prof. Jamie Bock)

Sep 2015 – Jun 2021

- Line Intensity Mapping
 - Developing analysis algorithms to tackle line confusion in line intensity mapping surveys
 - Establishing formalism of optimal mapping strategies for large-scale structure surveys
 - Modeling galaxy-intensity mapping cross-correlation for SPHEREx
- CIBER (Cosmic Infrared Background Experiment)
 - Building CIBER analysis pipeline and characterizing observational systematic effects
 - Studying intra-halo light with stacking analysis on CIBER images
- TIME (Tomographic Ionized Carbon Intensity Mapping Experiment)
 - Simulating signal and foregrounds for TIME analysis pipeline
 - Developing foreground mitigation techniques
 - Analyzing TIME instrument data
 - Participating in instrument deployment at the ARO 12m telescope

Academia Sinica of Astronomy and Astrophysics (ASIAA)**Research Assistant** (Advisor: Tzu-Ching Chang)

- Developing foreground mitigation techniques for line intensity mapping

Summer Student (Advisors: Sheng-Yuan Liu, Yu-Nung Su, I-Ta Hsieh)

- Modeling the starless core with radiative transfer

Taipei, Taiwan

May 2014 – Jul 2015

Jul 2013 – Aug 2013

GRANTS

- **NASA Astrophysics Data Analysis Program (ADAP)** 2025 – 2027
Title: Detecting Baryonic Acoustic Oscillations in the WISE galaxy sample
Role: Co-I (PI: Katarina Markovic, JPL)
- **NASA Astrophysics Data Analysis Program (ADAP)** 2025 – 2027
Title: Cosmology with Juno: Extracting the Cosmic Microwave Background Dipole at Low Frequencies and the Nature of the Diffuse Radio Background
Role: Co-I (PI: Tzu-Ching Chang, JPL)

TECHNICAL SKILLS

- **Statistical Tools:** Bayesian statistics, Markov Chain Monte Carlo, Fisher analysis, sparse reconstruction, convex optimization, Machine Learning
- **Programming Languages:** Python (JAX, Astropy, emcee, Pandas, scikit-learn, TensorFlow, Keras, seaborn), SQL, IDL, Matlab, C++, Fortran, LaTeX
- **Instrumentation:** SOLIDWORKS, trained in machine shop techniques

STUDENT MENTORING

- Jean Choppin de Janvry, Paris-Saclay University, Caltech Visiting Master Student Sep 2024 – Mar 2025
Topic: Photometric Redshift for SPHEREx
- Gemma (Zhaoyu) Huai, Caltech Physics Graduate Student Jun 2024 – Present
Topic: SPHEREx Cosmology
- Jui-Kuan Chan, National Taiwan University, Caltech SURF Program Jun 2024 – Present
Topic: SPHEREx Photometric Redshift With SOM
- Kailai Wang, Cornell University, JPL SURF Program Jun 2023 – Aug 2023
Topic: Bayesian Multi-line Intensity Mapping
- Abby Williams, NYU/Caltech, Caltech Post-baccalaureate Student Jun 2023 – Present
Topic: Small-scale Nonlinear Effects in Cross Correlations

SERVICE AND OUTREACH

- The Chinese University of Hong Kong Study Tour Program, Lecturer Jul 2025
- Caltech Cosmology Journal Club, Co-organizer Sep 2022 – present
- 237th AAS Meeting, Oral Session Chair Jan 2021
- Gabrielino High School, CA, Physics In-Class Activities Leader Jan 2020 – Sep 2022
- 233rd AAS Meeting, Poster Judge Jan 2019
- Journal referee: *Astrophysical Journal (ApJ)*, *Astrophysical Journal Letters (ApJL)*, *Journal of Cosmology and Astroparticle Physics (JCAP)*, *Monthly Notices of the Royal Astronomical Society (MNRAS)*

AWARDS AND HONORS

- Balzan Cosmological Studies Travel Award Oct 2022
- Taiwan-Caltech Ministry of Education Fellowship Sep 2015 – Aug 2019
- Dean's Award of College of Science, National Taiwan University Jun 2014

REFERENCES

- **James J. (Jamie) Bock**
Professor, California Institute of Technology/Jet Propulsion Laboratory
jjb@astro.caltech.edu
- **Tzu-Ching Chang**
Research Scientist, Jet Propulsion Laboratory/California Institute of Technology
tzu-ching.chang@jpl.nasa.gov/tzu@caltech.edu
- **Olivier P. Doré**
Research Scientist, Jet Propulsion Laboratory/California Institute of Technology
olivier.p.dore@jpl.nasa.gov/odore@caltech.edu
- **Abigail T. Crites**
Assistant Professor, Cornell University
atc72@cornell.edu
- **Benjamin D. Wandelt**
Professor, Johns Hopkins University
wandelt@jhu.edu

PRESENTATIONS

Invited conference talks

- Cosmology on the Steep Rise Workshop Sexten, Italy, Feb, 2025
- A new era with Line Intensity Mapping Workshop Heidelberg, Germany, Dec, 2024
- Line Intensity Mapping Workshop MPA, Garching, Germany, Apr, 2023

Invited institution seminars

- ASIAA Colloquium ASIAA, Taiwan, Dec, 2024
- University of Bonn/MPIfRA Colloquium Bonn, Germany, Dec 2024
- KIPAC Seminar Stanford, CA, Nov, 2024
- ASIAA Seminar ASIAA, Taiwan, Oct, 2023
- LAM Cafe Club LAM, Marseille, France, Dec, 2022
- IAP Universe Seminar IAP, Paris, France, Nov, 2022
- NYU CCPP Seminar NYU, NY, Aug, 2022
- ICAP seminar (virtual) IAP, Paris, France, Jun, 2022
- ASIAA Seminar ([video](#)) ASIAA, Taiwan, May, 2022
- IRSIG Webminar (virtual), Oct, 2021
- ASIAA Seminar (virtual) ASIAA, Taiwan, Mar, 2021
- UChicago KICP Seminar (virtual) Chicago, IL, Jan, 2021
- Berkeley BCCP Seminar (virtual) Berkeley, CA, Dec, 2020
- CCA Flatiron Institute Cosmology Group Meeting (virtual) CCA, NY, Oct, 2020
- OSU CCAPP Seminar (virtual) OSU, OH, Oct, 2020
- JHU Cosmology/GW Journal Club (virtual) JHU, MD, Oct, 2020
- UPenn Astronomy Seminar (virtual) UPenn, PA, Sep, 2020
- CCA Flatiron Institute Lunch Talk (virtual) CCA, NY, Sep, 2020
- ASIAA Seminar ASIAA, Taiwan, Sep, 2018

Contributed talks

- Line Intensity Mapping 2025 Annecy, France, Jun, 2025
- PRIMA and the Future of Far-Infrared Science Caltech, CA, May, 2025
- Roman Community Workshop ([video](#)) Caltech, CA, Jul, 2024
- Line Intensity Mapping 2024 Workshop ([video](#)) UIUC, IL, Jun, 2024
- Diffuse Cosmic Backgrounds and the Low Surface Brightness Universe Aspen, CO, Apr, 2024
- Caltech ObsCos Seminar Caltech, CA, Feb, 2024
- 243rd AAS Meeting New Orleans, LA, Jan, 2024
- JPL Postdoc Seminar JPL, Pasadena, CA, Nov, 2023
- Probing the Universe at High Resolution Conference ASIAA, Taiwan, Nov, 2023
- LAM CONCERTO Working Group Meeting LAM, Marseille, France, Dec, 2022
- Caltech ObsCos Seminar Caltech, CA, Oct, 2022
- Columbia Cosmology Group Seminar Columbia, NY, Aug, 2022
- Cosmology from Home ([video](#)) (virtual), Jun, 2022
- Cross Correlations with CHORD Workshop (virtual), Oct, 2021
- SUBLIME Workshop (virtual), Oct, 2021
- KICP Line Intensity Mapping Workshop (virtual) Chicago, IL, Jul, 2021
- Caltech ObsCos Seminar (virtual) Caltech, CA, Feb, 2021
- 237th AAS Meeting (virtual), Jan, 2021
- Caltech ObsCos Seminar (virtual) Caltech, CA, Sep, 2020
- CCAT-prime Science Working Group Meeting (virtual) Cornell, NY, Sep, 2020
- Caltech ObsCos Seminar Caltech, CA, Feb, 2020
- L2S2 : Lines in the Large Scale Structure Conference Marseille, France, Jul, 2019
- Caltech ObsCos Seminar Caltech, CA, Jun, 2019
- Caltech ObsCos Seminar Caltech, CA, May, 2019

- 233rd AAS Meeting
 - Taiwanese Theoretical Astrophysics Workshop
 - Caltech ObsCos Seminar
 - Cosmological Signals from Cosmic Dawn to the Present
 - Caltech ObsCos Seminar
 - Caltech ObsCos Seminar
 - Caltech ObsCos Seminar
 - Opportunities and Challenges in Intensity Mapping Workshop
 - ASROC Annual Meeting (Taiwanese Astronomical Society)
- Seattle, WA, Jan, 2019
 - ASIAA, Taiwan, Sep, 2018
 - Caltech, CA, Jun, 2018
 - Aspen, CO, Feb, 2018
 - Caltech, CA, Dec, 2017
 - Caltech, CA, Nov, 2016
 - Caltech, CA, Jun, 2016
 - KIPAC, CA, Mar, 2016
 - Ilan, Taiwan, May, 2015

PUBLICATIONS

See [ADS](#), [Google Scholar](#), and [INSPIRE](#) for the complete publication list

First-author (10 published/accepted; 1 under review)

1. *Feature Intensity Mapping: Polycyclic Aromatic Hydrocarbon Emission from All Galaxies Across Cosmic Time*
Y.-T. Cheng, B. S. Hensley, T.S.-Y. Lai, 2025, ApJ submitted, [ADS](#), [[arXiv:2506.13863](#)]
2. *Mapping Galactic Dust Emission and Extinction with HI, HII, and H₂*
Y.-T. Cheng, B. S. Hensley, T.-C. Chang, & O. Doré, 2025, ApJ, 985, 15, [ADS](#), [[arXiv:2411.12801](#)]
3. *Bayesian Multi-line Intensity Mapping*
Y.-T. Cheng, K. Wang, B. D. Wandelt, T.-C. Chang, & O. Doré, 2024, ApJ, 971, 159, [ADS](#), [[arXiv:2403.19740](#)]
4. *Is the Radio Source Dipole from NVSS Consistent with the CMB and Λ CDM?*
Y.-T. Cheng, T.-C. Chang, & A. Lidz, 2023, ApJ, 965, 32, [ADS](#), [[arXiv:2309.02490](#)]
5. *Data-driven Cosmology from Three-dimensional Light Cones*
Y.-T. Cheng, B. D. Wandelt, T.-C. Chang, & O. Doré, 2023, ApJ, 944, 151, [ADS](#), [[arXiv:2210.10052](#)]
6. *Near-infrared Extragalactic Background Light Fluctuations on Nonlinear Scales*
Y.-T. Cheng & J. J. Bock, 2022, ApJ, 940, 115, [ADS](#), [[arXiv:2207.13712](#)]
7. *Cosmic Near-Infrared Background Tomography with SPHEREx Using Galaxy Cross-Correlations*
Y.-T. Cheng & T.-C. Chang, 2022, ApJ, 925, 136, [ADS](#), [[arXiv:2109.10914](#)]
8. *Probing Intra-Halo Light with Galaxy Stacking in CIBER Images*
Y.-T. Cheng et al. (CIBER Collaboration), 2021, ApJ, 919, 69, [ADS](#), [[arXiv:2103.03882](#)]
9. *Phase-Space Spectral Line De-confusion in Intensity Mapping*
Y.-T. Cheng, T.-C. Chang, & J. J. Bock, 2020, ApJ, 901, 142, [ADS](#), [[arXiv:2005.05341](#)]
10. *Optimally Mapping Large-Scale Structures with Luminous Sources*
Y.-T. Cheng, R. de Putter, T.-C. Chang, & O. Doré, 2019, ApJ, 877, 86, [ADS](#), [[arXiv:1809.06384](#)]
11. *Spectral Line De-Confusion in an Intensity Mapping Survey*
Y.-T. Cheng, T.-C. Chang, J. J. Bock, C. M. Bradford, & A. R. Cooray, 2016, ApJ, 832, 165, [ADS](#), [[arXiv:1604.07833](#)]

Contributing author

1. *The SPHEREx Sky Simulator: Science Data Modeling for the First All-Sky Near-Infrared Spectral Survey*
B. P. Crill, et al., 2025, ApJ submitted, [ADS](#), [[arXiv:2505.24856](#)]
2. *The Potential of the SPHEREx Mission for Characterizing PAH 3.3 μ m Emission in Nearby Galaxies*
E. Zhang, A. L. Faisst, et al., 2025, ApJ submitted, [ADS](#), [[arXiv:2503.21876](#)]
3. *CIBER 4th flight fluctuation analysis: Measurements of near-IR auto- and cross-power spectra on arcminute to sub-degree scales*
R. M. Feder, et al., 2025, ApJ submitted, [ADS](#), [[arXiv:2501.17933](#)]
4. *CIBER 4th flight fluctuation analysis: Pseudo-power spectrum formalism, improved source masking and validation on mocks*
R. M. Feder, et al., 2025, ApJ submitted, [ADS](#), [[arXiv:2501.17932](#)]
5. *Inferred Measurements of the Zodiacal Light Absolute Intensity through Fraunhofer Absorption Line Spectroscopy with CIBER*
P. M. Korngut, et al., 2022, ApJ, 926, 133, [ADS](#), [[arXiv:2104.07104](#)]
6. *Probing Cosmic Reionization and Molecular Gas Growth with TIME*
G. Sun, T.-C. Chang, et al., 2021, ApJ, 915, 33, [ADS](#), [[arXiv:2012.09160](#)]
7. *Superresolution Reconstruction of Severely Undersampled Point-spread Functions Using Point-source Stacking and Deconvolution*
T. Symons, M. Zemcov, et al., 2021, ApJS, 252, 24, [ADS](#), [[arXiv:2102.01094](#)]
8. *Hafnium Films and Magnetic Shielding for TIME, A mm-Wavelength Spectrometer Array*
J. Hunacek, et al., 2018, JLTP, 193, 893, [ADS](#)

9. *A Foreground Masking Strategy for [C II] Intensity Mapping Experiments Using Galaxies Selected by Stellar Mass and Redshift*
G. Sun, L. Moncelsi, M. P. Viero, et al., 2018, ApJ, 856, 107, [ADS](#), [[arXiv:1601.10095](#)]
10. *Design and fabrication of TES detector modules for the TIME-Pilot [C II] Intensity Mapping Experiment*
J. Hunacek, et al., 2016, JLTP, 184, 733, [ADS](#)

White paper / review paper contributions

1. *PRIMA General Observer Science Book*
A. Moullet, et al., 2023, [ADS](#), [[arXiv:2310.20572](#)]
2. *Tomography of the Cosmic Dawn and Reionization Eras with Multiple Tracers*
T.-C. Chang, et al., 2019, Astro2020 White Paper, [ADS](#), [[arXiv:1903.11744](#)]
3. *Line-Intensity Mapping: 2017 Status Report*
E. D. Kovetz, M. P. Viero, et al., 2017, [ADS](#), [[arXiv:1709.09066](#)]

Conference proceedings

1. *A status update on TIME: a mm-wavelength spectrometer designed to probe the Epoch of Reionization*
A. Crites, et al., 2020, [SPIE](#), [114530G](#)
2. *Detector modules and spectrometers for the TIME-Pilot [CII] intensity mapping experiment*
J. Hunacek, et al., 2016, [SPIE](#), [99140L](#)