YUN-TING CHENG

US Legal Permanent Resident (Green Card holder), Taiwan Citizenship
California Institute of Technology
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PROFESSIONAL EXPERIENCE

California Institute of Technology/Jet Propulsion Laboratory
Research Scientist — Jan 2024 - present

Jet Propulsion Laboratory/California Institute of Technology
Postdoctoral Researcher (Advisor: Dr. Olivier Doré) — 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

analysis algorithms for large-scale structure surveys, photometric redshift, Galactic dust extinction, intensity mapping, extragalactic background light, intra-halo light, cosmic dipole

RESEARCH EXPERIENCE

California Institute of Technology / Jet Propulsion Laboratory — Pasadena, CA

Research Scientist — Jan 2024 - Present

· **SPHEREx Mission**
- Cosmology and the extragalactic background light analysis for SPHEREx mission

Postdoctoral Researcher (Advisor: Dr. Olivier Doré) — Oct 2021 - Jan 2024

· **Data-driven Cosmology from 3D Light Cones**
(collaborators: Benjamin Wandelt, Olivier Doré, Tzu-Ching Chang)
- Developing a data-driven method to constrain cosmology with spectral imaging data

· **Galactic Extinction Modeling**
(collaborators: Brandon Hensley, Olivier Doré, Tzu-Ching Chang)
- Building Galactic dust extinction model from multi-wavelength datasets

· **Extragalactic Radio Dipole**
(collaborators: Adam Lidz, Tzu-Ching Chang)
- Modeling the radio dipole from extragalactic sources

· **Intra-halo Light Signal in the Extragalactic Background**
(collaborators: Jamie Bock)
- Modeling the non-linear clustering and the intro-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 solve the line blending problem in line intensity mapping
- Establishing the formalism of optimal mapping strategy for large-scale structure survey
- Modeling galaxy-intensity mapping cross correlation for SPHEREx

· **CIBER** (Cosmic Infrared Background Experiment)
- Building CIBER analysis pipeline and characterizing noise and systematic effects
- Studying intra-halo light with stacking analysis on CIBER images

· **TIME** (Tomographic Ionized Carbon Intensity Mapping Experiment)
- Simulating the signal and foregrounds for TIME analysis pipeline
- Developing foreground mitigation techniques
- Analyzing TIME instrument data
- Helping with instrument deployment at the ARO 12m telescope

Academia Sinica of Astronomy and Astrophysics (ASIAA) Taipei, Taiwan

Research Assistant (Advisor: Tzu-Ching Chang) May 2014 - Jul 2015
· Developing foreground mitigation technique for line intensity mapping

Summer Student (Advisor: Sheng-Yuan Liu, Yu-Nung Su, I-Ta Hsieh) Jul 2013 - Aug 2013
· Modeling the starless core with radiative transfer

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)
- **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)

TECHNICAL SKILLS

- Statistical Tools: Bayesian statistics, Markov Chain Monte Carlo, Fisher analysis, Sparse Reconstruction, convex optimization, Machine Learning (with experience in CNN and Machine Learning Explainability)
- Programming Languages: Python (Astropy, emcee, Pandas, scikit-learn, TensorFlow, Keras, seaborn), SQL, IDL, Matlab, C++, Fortran, Latex
- Instrumentation: SOLIDWORKS, machine shop trained

STUDENT MENTORING

Gemma (Zhaoyu) Huai, Caltech Physics Graduate Student Jun 2024 - Present
Topic: SPHEREx Comology

Jean Choppin de Janvry (Paris-Saclay University), Caltech visiting Master Student Sep 2024 - Present
Topic: Photometric Redshift for SPHEREx

Jui-Kuan Chan (National Taiwan University), Caltech SURF Jun 2024 - Present
Topic: SPHEREx Photometric Redshift With SOM

Kailai Wang (Cornell University), JPL SURF 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

Caltech Cosmology Journal Club co-organizer Sep 2022 - present
237th AAS meeting oral session chair Jan 2021
Leading physics in-class activities at Gabrielino High School, CA 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.caltch.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, Institut dAstrophysique de Paris/Center for Computational Astrophysics, Flatiron Institute
  bwandelt@iap.fr

PRESENTATIONS

- (**invited talk**) A new era with Line Intensity Mapping Workshop — Heidelberg, Germany, Dec, 2024
- KIPAC Seminar — Stanford, CA, Nov, 2024
- Roman Community Workshop — Caltech, CA, Jul, 2024
- Line Intensity Mapping 2024 Workshop — 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
- ASIAA Seminar — ASIAA, Taiwan, Oct, 2023
- (**invited talk**) Line Intensity Mapping Workshop — MPA, Garching, Germany, Apr, 2023
- LAM Cafe Club — LAM, Marseille, France, Dec, 2022
- LAM CONCERTO Working Group Meeting — LAM, Marseille, France, Dec, 2022
- IAP Universe Seminar — IAP, Paris, France, Nov, 2022
- Caltech ObsCos Seminar — Caltech, CA, Oct, 2022
- Columbia Cosmology Group Seminar — Columbia, NY, Aug, 2022
- NYU CCPP Seminar — NYU, NY, Aug, 2022
- ICAP seminar — (virtual) IAP, Paris, France, Jun, 2022
- Cosmology from Home — (virtual), Jun, 2022
- ASIAA Seminar — ASIAA, Taiwan, May, 2022
- Cross Correlations with CHORD Workshop — (virtual), Oct, 2021
- SUBLIME Workshop — (virtual), Oct, 2021
- IRSIG Webminar — (virtual), Oct, 2021
- KICP Line Intensity Mapping Workshop — (virtual) Chicago, IL, Jul, 2021
- ASIAA Seminar — (virtual) ASIAA, Taiwan, Mar, 2021
- Caltech ObsCos Seminar — (virtual) Caltech, CA, Feb, 2021
- UChicago KICP Seminar — (virtual) Chicago, IL, Jan, 2021
- 237th AAS Meeting — (virtual), 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
- Caltech ObsCos Seminar — (virtual) Caltech, CA, Sep, 2020
- CCAT-prime Science Working Group Meeting — (virtual) Cornell, NY, Sep, 2020
- CCA Flatiron Institute Lunch Talk — (virtual) CCA, 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 — Seattle, WA, Jan, 2019
- Taiwanese Theoretical Astrophysics Workshop — ASIAA, Taiwan, Sep, 2018
- ASIAA Seminar — ASIAA, Taiwan, Sep, 2018
- Caltech ObsCos Seminar — Caltech, CA, Jun, 2018
- Cosmological Signals from Cosmic Dawn to the Present — Aspen, CO, Feb, 2018
- Caltech ObsCos Seminar — Caltech, CA, Dec, 2017
- Caltech ObsCos Seminar — Caltech, CA, Nov, 2016
- Caltech ObsCos Seminar — Caltech, CA, Jun, 2016
- Opportunities and Challenges in Intensity Mapping Workshop — KIPAC, CA, Mar, 2016
- ASROC Annual Meeting (Taiwanese Astronomical Society) — Ilan, Taiwan, May, 2015

PUBLICATIONS

See ADS, Google Scholar, and INSPIRE for the complete publication list

First-author papers (8 published/accepted; 1 submitted)

1. *"Mapping Galactic Dust Emission and Extinction with HI, HII, and H_2"*
   Y.-T. Cheng, B. S. Hensley, T.-C. Chang, and O. Doré; 2024, ApJ submitted; arXiv:2411.12801
2. *"Bayesian Multi-line Intensity Mapping"*
   Y.-T. Cheng, K. Wang, B. D. Wandelt, T.-C. Chang, and O. Doré; 2024, ApJ, 971, 159; arXiv:2403.19740
3. *"Is the Radio Source Dipole from NVSS Consistent with the CMB and ΛCDM?"*
   Y.-T. Cheng, T.-C. Chang, and Adam Lidz; 2023, ApJ, 965, 32; arXiv:2309.02490
4. *"Data-driven Cosmology from Three-dimensional Light Cones"*
   Y.-T. Cheng, B. D. Wandelt, T.-C. Chang, and O. Doré; 2023, ApJ, 944, 151; arXiv:2210.10052
5. *"Near-infrared Extragalactic Background Light Fluctuations on Nonlinear Scales"*
   Y.-T. Cheng, and J. J. Bock; 2022; ApJ 940, 115; arXiv:2207.13712
6. *"Cosmic Near-Infrared Background Tomography with SPHEREx Using Galaxy Cross-Correlations"*
   Y.-T. Cheng, and T.-C. Chang; 2022, ApJ 925, 136; arXiv:2109.10914
7. *"Probing Intra-Halo Light with Galaxy Stacking in CIBER Images"*
   Y.-T. Cheng, et al. (CIBER Collaboration); 2021, ApJ, 919, 69; arXiv:2103.03882
8. *"Phase-Space Spectral Line De-confusion in Intensity Mapping"*
   Y.-T. Cheng, T.-C. Chang, and J. J. Bock; 2020, ApJ, 901, 142; arXiv:2005.05341
9. *"Optimally Mapping Large-Scale Structures with Luminous Sources"*
   Y.-T. Cheng, R. de Putter, T.-C. Chang, and O. Doré; 2019, ApJ, 877, 86; arXiv:1809.06384
10. *"Spectral Line De-Confusion in an Intensity Mapping Survey"*
    Y.-T. Cheng, T.-C. Chang, J. J. Bock, C. M. Bradford, and A. R. Cooray; 2016, ApJ, 832, 165; arXiv:1604.07833

Co-author papers

1. *"Inferred Measurements of the Zodiacal Light Absolute Intensity through Fraunhofer Absorption Line Spectroscopy with CIBER"*
   P. M. Korngut, et al., 2022, ApJ, 926, 133; arXiv:2104.07104
2. *"Probing Cosmic Reionization and Molecular Gas Growth with TIME"*
   G. Sun, T.-C. Chang, et al., 2021, ApJ, 915, 33; arXiv:2012.09160
3. *"Superresolution Reconstruction of Severely Undersampled Point-spread Functions Using Point-source Stacking and Deconvolution"*
   T. Symons, M. Zemcov, et al., 2021, ApJS, 252, 24; arXiv:2102.01094
4. *"Hafnium Films and Magnetic Shielding for TIME, A mm-Wavelength Spectrometer Array"*
   J. Hunacek, et al., 2018, JLTP, 193, 893
5. *"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; arXiv:1601.10095
6. *"Design and fabrication of tes detector modules for the time-pilot [cii] intensity mapping experiment"*
   J. Hunacek, et al., 2016, JLTP, 184, 733

Non-refereed review papers / white papers

1. *"PRIMA General Observer Science Book"*
   A. Moullet, et al., 2023, arXiv:2310.20572 (contributing a line intensity mapping science case for PRIMA)
2. *"Tomography of the Cosmic Dawn and Reionization Eras with Multiple Tracers"*
   T.-C. Chang, et al., 2019, Astro2020 White Paper, arXiv:1903.11744
3. *"Line-Intensity Mapping: 2017 Status Report"*
   E. D. Kovetz, M. P. Viero, et al., 2017, 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