

YUN-TING CHENG

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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 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 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)

Research Assistant (Advisor: Tzu-Ching Chang)

· Developing foreground mitigation technique for line intensity mapping

Summer Student (Advisor: 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

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- **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

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- 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 Cosmology	
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.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, Institut d'Astrophysique de Paris/Center for Computational Astrophysics, Flatiron Institute
`bwandelt@iap.fr`

PRESENTATIONS

- (invited talk) Cosmology on the Steep Rise Workshop Sexten, Italy, Feb, 2025
- ASIAA Colloquium ASIAA, Taiwan, Dec, 2024
- University of Bonn/MPIfRA Colloquium Bonn, Germany, Dec 2024
- (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 H₂*”
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 Λ CDM?*”
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. Monceli, 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](#)