

Tianqing Zhang

Department of Physics and Astronomy | University of Pittsburgh
3941 O'Hara Street, Pittsburgh, PA 15260
✉ tq96zhang@gmail.com

RESEARCH INTERESTS

Weak lensing cosmology — Image processing & simulation — Photometric redshift — Bayesian statistics & Machine learning — Open-source software

EMPLOYMENT

Research Assistant Professor , <i>University of Pittsburgh</i>	<i>September. 2023 – Present.</i>
Graduate Research Assistant , <i>Carnegie Mellon University</i>	<i>Sep. 2018 – Aug. 2023</i>
Machine Learning Engineer internship , <i>IBM</i>	<i>May. 2018 – Aug. 2018</i>

EDUCATION

Carnegie Mellon University, *Pittsburgh, PA*
Ph.D. in Physics *August 2023*
Thesis: Enabling the Weak Lensing Science of the 2020s; Advisors: Rachel Mandelbaum

Duke University, *Durham, NC*
B.S. in Physics (with high distinction), minors in Computer Science, Mathematics *May 2018*
Thesis: Measuring the Chromatic Effect of Point Spread Function, Advisor: Christopher Walter

Shanghai Jiao Tong University (SJTU), *Shanghai, China*
(international program, transferred to Duke)

SERVICE TO THE PROFESSIONS

Deputy Technical Coordinator , <i>LSST DESC</i>	<i>2025-Present.</i>
RAIL Topical Team co-lead , <i>LSST DESC</i>	<i>2024-Present.</i>
Pixels-to-Objects Working Group co-convenor , <i>LSST DESC</i>	<i>2023-2025</i>
Collaboration Council, <i>LSST DESC</i>	<i>2022-2024</i>
Membership Committee, <i>LSST DESC</i>	<i>2022-2024</i>
2024 Sprint Week Tutorial Organizer, <i>LSST DESC</i>	<i>2024</i>
2023 Sprint Week Local Organizing Committee, <i>LSST DESC</i>	<i>2023</i>
2022 Summer Meeting Scientific Organizing Committee, <i>LSST DESC</i>	<i>2022</i>
AstroLunch Seminar Organizer, <i>McWilliams Center of Cosmology</i>	<i>2022-2023</i>
Software Development Series Organizer, <i>McWilliams Center of Cosmology</i>	<i>2020-2021</i>
Graduate Program Admission Committee, <i>Department of Physics, CMU</i>	<i>2021-2022</i>

COLLABORATION AFFILIATIONS

Builder, *LSST Dark Energy Science Collaboration (DESC)*
Research Scientist, *LINCC Frameworks*
Continuing Collaborator, *Hyper-Suprime Cam (HSC)*
Member of PSF and Photo-z Commissioning Team, *Rubin Observatory*
Member, *Dark Energy Spectroscopic Instrument (DESI)*
Member, *Roman Space Telescope Project and Infrastructure Team (Roman PIT)*

PUBLICATIONS

Citation Summary: 21 Published, 10 in press, citation: 898, h-index: 13.

First, second and corresponding Author Publications

- T. ZHANG**, X. Li, S. Sugiyama, R. Mandelbaum, S. More, R. Dalal et al., *Cosmology and Source Redshift Constraints from Galaxy Clustering and Tomographic Weak Lensing with HSC Y3 and SDSS using the Point-Mass Correction Model*, *arXiv e-prints* (2025) [arXiv:2507.01386](#) [[2507.01386](#)]
- T. ZHANG**, S. Sugiyama, S. More, R. Mandelbaum, X. Li, R. Dalal et al., *Modelling Galaxy Clustering and Tomographic Galaxy-Galaxy Lensing with HSC Y3 and SDSS using the Point-Mass Correction Model and Redshift Self-Calibration*, *arXiv e-prints* (2025) [arXiv:2507.01377](#) [[2507.01377](#)]
- T. ZHANG**, H. Almoubayyed, R. Mandelbaum, M. M. Rau, N. Šarčević, C. D. Leonard et al., *Forecasting the Impact of Source Galaxy Photometric Redshift Uncertainties on the LSST 3×2 pt Analysis*, *arXiv e-prints* (2025) [arXiv:2507.01374](#) [[2507.01374](#)]
- The RAIL Team, J. L. van den Busch, E. Charles, J. Cohen-Tanugi, A. Crafford, J. F. Crenshaw et al., *Redshift Assessment Infrastructure Layers (RAIL): Rubin-era photometric redshift stress-testing and at-scale production*, *arXiv e-prints* (2025) [arXiv:2505.02928](#) [[2505.02928](#)]
- T. ZHANG**, X. Li, R. Dalal, R. Mandelbaum, M. A. Strauss, A. Kannawadi et al., *A general framework for removing point-spread function additive systematics in cosmological weak lensing analysis*, *MNRAS* **525** (2023) 2441 [[2212.03257](#)]
- T. ZHANG**, M. M. Rau, R. Mandelbaum, X. Li and B. Moews, *Photometric redshift uncertainties in weak gravitational lensing shear analysis: models and marginalization*, *MNRAS* **518** (2023) 709 [[2206.10169](#)]
- T. ZHANG**, H. Almoubayyed, R. Mandelbaum, J. E. Meyers, M. Jarvis, A. Kannawadi et al., *Impact of point spread function higher moments error on weak gravitational lensing - II. A comprehensive study*, *MNRAS* **520** (2023) 2328 [[2205.07892](#)]
- T. ZHANG**, R. Mandelbaum and LSST Dark Energy Science Collaboration, *Impact of point spread function higher moments error on weak gravitational lensing*, *MNRAS* **510** (2022) 1978 [[2107.05644](#)]
- A. Patel, **T. ZHANG**, C. Avestruz, J. Regier and the LSST Dark Energy Science Collaboration, *Neural Posterior Estimation for Cataloging Astronomical Images with Spatially Varying Backgrounds and Point Spread Functions*, *arXiv e-prints* (2025) [arXiv:2503.00156](#) [[2503.00156](#)]
- X. Li, **T. ZHANG**, S. Sugiyama, R. Dalal, R. Terasawa, M. M. Rau et al., *Hyper Suprime-Cam Year 3 results: Cosmology from cosmic shear two-point correlation functions*, *Phys. Rev. D* **108** (2023) 123518 [[2304.00702](#)]
- T. Ferreira, **T. ZHANG**, N. Chen, S. Dodelson and LSST Dark Energy Science Collaboration, *Data compression and covariance matrix inspection: Cosmic shear*, *Phys. Rev. D* **103** (2021) 103535 [[2010.15986](#)]

Co-authored Papers

- S. Heydenreich, A. Leauthaud, C. Blake, Z. Sun, J. U. Lange, **T. ZHANG** et al., *Lensing Without Borders: Measurements of galaxy-galaxy lensing and projected galaxy clustering in DESI DR1*, *arXiv e-prints* (2025) [arXiv:2506.21677](#) [[2506.21677](#)]
- J. Jefferson, Y. Omori, C. Chang, S. Agarwal, J. Zuntz, M. Asgari et al., *Reanalysis of Stage-III cosmic shear surveys: A comprehensive study of shear diagnostic tests*, *arXiv e-prints* (2025) [arXiv:2505.03964](#) [[2505.03964](#)]
- F. Berlfein, R. Mandelbaum, X. Li, **T. ZHANG**, S. Dodelson and K. Markovic, *Chromatic Effects on the PSF and Shear Measurement for the Roman Space Telescope High-Latitude Wide Area Survey*, *arXiv e-prints* (2025) [arXiv:2505.00093](#) [[2505.00093](#)]
- A. Park, S. Singh, X. Li, R. Mandelbaum and **T. ZHANG**, *Matching cosmic shear analysis in harmonic and real space*, *MNRAS* **540** (2025) 1668 [[2404.02190](#)]
- OpenUniverse, The LSST Dark Energy Science Collaboration, The Roman HLIS Project Infrastructure Team, The Roman RAPID Project Infrastructure Team, The Roman Supernova Cosmology Project

- Infrastructure Team, A. Alarcon et al., *OpenUniverse2024: A shared, simulated view of the sky for the next generation of cosmological surveys*, *arXiv e-prints* (2025) arXiv:2501.05632 [2501.05632]
- G. Merz, X. Liu, S. Schmidt, A. I. Malz, T. ZHANG, D. Branton et al., *DeepDISC-photoz: Deep Learning-Based Photometric Redshift Estimation for Rubin LSST*, *The Open Journal of Astrophysics* **8** (2025) 40 [2411.18769]
- I. Mendoza, A. Torchylo, T. Sainrat, A. Guinot, A. Boucaud, M. Paillasa et al., *The Blending ToolKit: A simulation framework for evaluation of galaxy detection and deblending*, *The Open Journal of Astrophysics* **8** (2025) E14 [2409.06986]
- Q. Hang, B. Joachimi, E. Charles, J. F. Crenshaw, P. Larsen, A. I. Malz et al., *Impact of survey spatial variability on galaxy redshift distributions and the cosmological 3×2 -point statistics for the Rubin Legacy Survey of Space and Time (LSST)*, *MNRAS* **535** (2024) 2970 [2409.02501]
- R. Terasawa, X. Li, M. Takada, T. Nishimichi, S. Tanaka, S. Sugiyama et al., *Exploring the baryonic effect signature in the Hyper Suprime-Cam Year 3 cosmic shear two-point correlations on small scales: The tension remains present*, *Phys. Rev. D* **111** (2025) 063509 [2403.20323]
- M. Yamamoto, K. Laliotis, E. Macbeth, T. ZHANG, C. M. Hirata, M. A. Troxel et al., *Simulating image coaddition with the Nancy Grace Roman Space Telescope - II. Analysis of the simulated images and implications for weak lensing*, *MNRAS* **528** (2024) 6680 [2303.08750]
- C. M. Hirata, M. Yamamoto, K. Laliotis, E. Macbeth, M. A. Troxel, T. ZHANG et al., *Simulating image coaddition with the Nancy Grace Roman Space Telescope - I. Simulation methodology and general results*, *MNRAS* **528** (2024) 2533 [2303.08749]
- S. Sugiyama, H. Miyatake, S. More, X. Li, M. Shirasaki, M. Takada et al., *Hyper Suprime-Cam Year 3 results: Cosmology from galaxy clustering and weak lensing with HSC and SDSS using the minimal bias model*, *Phys. Rev. D* **108** (2023) 123521 [2304.00705]
- S. More, S. Sugiyama, H. Miyatake, M. M. Rau, M. Shirasaki, X. Li et al., *Hyper Suprime-Cam Year 3 results: Measurements of clustering of SDSS-BOSS galaxies, galaxy-galaxy lensing, and cosmic shear*, *Phys. Rev. D* **108** (2023) 123520 [2304.00703]
- R. Dalal, X. Li, A. Nicola, J. Zuntz, M. A. Strauss, S. Sugiyama et al., *Hyper Suprime-Cam Year 3 results: Cosmology from cosmic shear power spectra*, *Phys. Rev. D* **108** (2023) 123519 [2304.00701]
- H. Miyatake, S. Sugiyama, M. Takada, T. Nishimichi, X. Li, M. Shirasaki et al., *Hyper Suprime-Cam Year 3 results: Cosmology from galaxy clustering and weak lensing with HSC and SDSS using the emulator based halo model*, *Phys. Rev. D* **108** (2023) 123517 [2304.00704]
- M. M. Rau, R. Dalal, T. ZHANG, X. Li, A. J. Nishizawa, S. More et al., *Weak lensing tomographic redshift distribution inference for the Hyper Suprime-Cam Subaru Strategic Program three-year shape catalogue*, *MNRAS* **524** (2023) 5109 [2211.16516]
- T. Sunayama, H. Miyatake, S. Sugiyama, S. More, X. Li, R. Dalal et al., *Optical cluster cosmology with SDSS redMaPPer clusters and HSC-Y3 lensing measurements*, *Phys. Rev. D* **110** (2024) 083511 [2309.13025]
- M. A. Troxel, C. Lin, A. Park, C. Hirata, R. Mandelbaum, M. Jarvis et al., *A joint Roman Space Telescope and Rubin Observatory synthetic wide-field imaging survey*, *MNRAS* **522** (2023) 2801 [2209.06829]
- M. Yamamoto, M. A. Troxel, M. Jarvis, R. Mandelbaum, C. Hirata, H. Long et al., *Weak gravitational lensing shear estimation with METACALIBRATION for the Roman High-Latitude Imaging Survey*, *MNRAS* **519** (2023) 4241 [2203.08845]
- R. Mandelbaum, M. Jarvis, R. H. Lupton, J. Bosch, A. Kannawadi, M. D. Murphy et al., *PSFs of coadded images*, *The Open Journal of Astrophysics* **6** (2023) 5 [2209.09253]
-

TALKS

(Invited talks denoted by “†”)

† DESC Meeting Plenary, UIUC, Urbana-Champaign, IL <i>Photometric Redshift of Rubin Observatory Data Preview 1</i>	Jul. 2025
Roman Symposium, STScI, Baltimore, MD <i>RAIL: Open-source platform for Photometric redshift production and research</i>	Jul. 2025
† DESI Lunch, LBL, Berkeley, CA <i>The mystery of redshift distribution systematics in HSC Y3 cosmology and approaches to tackle it</i>	Apr. 2025
Roman PIT workshop, Caltech, Pasadena, CA <i>Developing RAIL: a platform for photometric redshift production and research</i>	Oct. 2024
DESC Forecast Topical Team, online <i>Forecasting the Impact of Photometric Redshift Uncertainties on the LSST 3x2pt Analysis</i>	Oct. 2024
Rubin Community Workshop, SLAC, Menlo Park, CA <i>PSF Requirement for Cosmic Shear with LSST</i>	Aug. 2024
Rubin Community Workshop, SLAC, Menlo Park, CA <i>RAIL Status updates: v1.0 release</i>	Aug. 2024
† LSST Discovery Alliance Monthly Meeting, online <i>Developing RAIL: A platform for LSST photometric redshift production and research</i>	Jul. 2024
† DES Weak Lensing Group Meeting, online <i>HSC Y3 Cosmology Results Seminar</i>	Apr. 2023
DESC Photometric Redshift Group Meeting, online <i>HSC Y3 Cosmology Results Seminar: Photometric Redshift</i>	Apr. 2023
HSC Y3 Cosmology Results Webinar, online <i>Source Redshift Distribution Inference, PSF Systematics Inference</i>	Apr. 2023
† Research Faculty Seminar, University of Pittsburgh, Pittsburgh, PA <i>Weak Lensing Cosmology and its Technical Challenges in the 2020s</i>	Feb. 2023
† Princeton Cosmology Discussion, Princeton University, Princeton, NJ <i>Why do we care about redshift distribution in cosmic shear for Cosmology?</i>	Sept. 2022
Princeton HSC+PFS+Rubin Group Meeting, Princeton University, Princeton, NJ <i>Point Spread Function in Cosmic Shear: Simulation, Modeling and Marginalization</i>	Sept. 2022
International High-Performance Computing Summer School, Athens, Greece <i>Pixel to Catalog to Science: the weak lensing image processing and analysis pipeline</i>	Jun. 2022
HSC Weak Lensing Group Meeting, online <i>Impact of PSF Higher Moments on Cosmic Shear Measurement</i>	May. 2022
DESC Collaboration Wide Presentation, online <i>Impact of Point Spread Function Higher-moments Error on Weak Lensing II</i>	May. 2022
DESC 2020 Winter Meeting, University of Arizona, Tucson, AZ <i>Impact of Point Spread Function Higher-moments Error on Weak Lensing</i>	Jan. 2020
DESC Theory and Joint Probe Group Meeting, University of Arizona, Tucson, AZ <i>Data Compression and Covariance Matrices Inspection: Cosmic Shear</i>	Oct. 2019
Asia-Pacific Astronomy & Engineering Summit, University of Hawaii, Hilo, HI <i>Studies of Reaching and Going Beyond the Seeing Limit of Ground-based Telescopes: Adaptive Optics</i>	Aug. 2014

POSTERS

Rubin Project & Community Workshop 2022, Tucson, AZ <i>Lensed by the atmosphere: PSF systematics in weak lensing analysis</i>	Aug. 2022
Machine Learning Student Poster Session, Carnegie Mellon University, Pittsburgh PA <i>Image Segmentation with Uncertainty Quantification using Bayesian U-Net</i>	May. 2021
Cosmic Controversies Conference, University of Chicago, Chicago IL <i>Data Compression and Covariance Matrices Inspection: Cosmic Shear</i>	Oct. 2019
Undergraduate Research Poster Session, Duke University, Durham NC <i>Measuring the Chromatic Effect of Point Spread Function in Optical Wavelength</i>	Apr. 2018
Undergraduate Research Poster Session, Duke University, Durham NC <i>Building the Portable Neutron Beam Imager using 2-D Position-Sensitive Photomultiplier Tubes</i>	Apr. 2017

TEACHING & MENTORING

Student Supervision/Mentoring (UG=undergrad students, G=graduate students)

- Federico Berlfein (CMU, G): 2023-present, Chromatic PSF of Roman Space Telescope
- Alice Crafford (CMU, UG): 2023-2025, Photometric Redshift with sample incompleteness
- Sean Maloney (Pitt, UG): 2023-present, NASA Space Grant Summer 2024
- Michael Murphy (CMU, UG): 2022, PSFs of coadded images
- Andy Park (CMU, G): 2021-2024, Consistent shear analysis
- Sarah Pelesky (CMU, UG): 2025-present, Photometric redshift in large database
- Mahitha Ramachandran (Pitt, UG): 2023-2024, NASA Space Grant Spring 2024
- Yoquelbin Salcedo Hernandez (Pitt, G): 2024-present, Cross-correlation redshift calibration

Graduate Teaching Assistant

- Physics I for Engineering Students (33-141), Fall 2018
- Electronics (33-228), Spring 2019
- Classical Electrodynamics I (33-761), Fall 2019

MEDIA COVERAGE

New Scientist, <i>Weird cosmic clumping hints our understanding of the universe is wrong</i> https://www.newscientist.com/article/mg26034694-800-weird-cosmic-clumping-hints-our-understanding-of-the-universe-is-wrong/	2023
Live Science, <i>Unexpected cosmic clumping could disprove our best understanding of the universe</i> https://www.livescience.com/space/unexpected-cosmic-clumping-could-disprove-our-best-understanding-of-the-universe	2023
Carnegie Mellon University Stories, <i>Weak Gravitational Lensing Tests the Cosmological Model</i> https://www.cmu.edu/news/stories/archives/2023/april/weak-gravitational-lensing-tests-the-cosmological-model	2023

FUNDING PROPOSALS

Rubin Observatory Enabling Science Award, \$ 2,100	2022
Code Tutorial to Enable Participation, PI, \$ 14,220	2023

PUBLIC OUTREACH

Carnegie Mellon High School Astronomy Mentoring Project,	2022
Galaxy.io: a pedagogical multiplayer game,	2022
SJTU Astronomy Club, <i>Chair</i>	2015-2016
Shanghai Science & Technology Museum Volunteer, <i>200 hours</i>	2015-2016

AWARDS

Dean's List with Distinction, <i>Duke University</i>	2018
Dean's List with Distinction, <i>Duke University</i>	2017
Sigma Pi Sigma, <i>Duke University</i>	2018
Guanghua Scholarship, <i>top 5% of SJTU</i>	2016
Pacific-Asia Astronomy Olympiad, <i>Second Diploma</i>	2012
China Astronomy Olympiad, <i>First Diploma</i>	2012

JOURNAL REFEREE

Monthly Notice of Royal Astronomical Society, Astronomy & Astrophysics, Astronomical Journal, Publications of the Astronomical Society of Australia, Publications of the Astronomical Society of the Pacific

RELEVANT SKILLS

Python: NumPy, PyTorch, Pandas, TensorFlow, Matplotlib, Butler

Other Languages: Java, Swift 3.0, MATLAB, C#, SQL

Tasks: Version Control (git), Parallel Computing (MPI, Multiprocessing), Supervised Learning (PyTorch, TensorFlow), Batch farm systems (SLURM, PBS)

REFERENCES

Dr. Rachel Mandelbaum,
*McWilliams Center for Cosmology,
Department of Physics, Carnegie Mellon University,
Pittsburgh, PA 15213*

E-mail: rmandelb@andrew.cmu.edu

Dr. Jeffrey A. Newman,
*Department of Physics & Astronomy,
University of Pittsburgh,
Pittsburgh, PA 15260*

E-mail: jnewman@pitt.edu

Dr. Michael Jarvis,
*Department of Physics & Astronomy,
University of Pennsylvania,
Philadelphia, PA 19104*

E-mail: mjarvis@physics.upenn.edu

Dr. Masahiro Takada,
*Institute for the Physics of Mathematics of the Universe (IPMU)
The University of Tokyo,
Kashiwa City, Chiba, Japan 277-8582*

E-mail: masahiro.takada@ipmu.jp