Tianqing Zhang

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RESEARCH INTERESTS

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

EMPLOYMENT

Research Assistant Professor, *University of Pittsburgh* *September. 2023 – Present.*

Graduate Research Assistant, *Carnegie Mellon University* *Sep. 2018 – Aug. 2023*

Machine Learning Engineer *internship*, *IBM* *May. 2018 – Aug. 2018*

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

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: 30 Published, 15 in press, citation: 1185, h-index: 15.

First, second and corresponding Author (marked by *) Publications

T. Zhang*, E. Charles, J. F. Crenshaw, S. J. Schmidt, P. Adari, J. Gschwend et al., *Photometric Redshift Estimation for Rubin Observatory Data Preview 1 with Redshift Assessment Infrastructure Layers (RAIL)*, *arXiv e-prints* (2025) arXiv:2510.07370 [2510.07370]

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*, *Phys. Rev. D (in press)* (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*, *Phys. Rev. D (in press)* (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 × 2pt analysis*, MNRAS **545** (2026) staf1829 [2507.01374]

The RAIL Team, J. L. van den Busch, E. Charles*, J. Cohen-Tanugi, A. Crafford, **T. Zhang*** 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*, AJ **170** (2025) 155 [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

LSST Dark Energy Science Collaboration, E. Aubourg, C. Avestruz, M. R. Becker, B. Biswas, R. Biswas et al., *Opportunities in AI/ML for the Rubin LSST Dark Energy Science Collaboration*, *arXiv e-prints* (2026) arXiv:2601.14235 [2601.14235]

A. Crafford, A. I. Malz, **T. Zhang**, R. Mandelbaum, O. Lynn, F. Berlfein et al., *Diagnosing the Effects of Spectroscopic Training Set Imperfection on Photometric Redshift Performance*, *arXiv e-prints* (2026) arXiv:2601.10797 [2601.10797]

J. Choppin de Janvry, S. G. A. Gontcho, U. Seljak, A. Baleato Lizancos, E. Chaussidon, W. d'Assignies et al., *Full calibration of the tomographic redshift distribution from the HSC PDR3 Shape Catalog with DESI*, *arXiv e-prints* (2025) arXiv:2511.18133 [2511.18133]

J. Choppin de Janvry, B. Dai, S. G. A. Gontcho, U. Seljak and **T. Zhang**, *Cosmic Shear constraints from HSC Year 3 with clustering calibration of the tomographic redshift distributions from DESI*, *arXiv e-prints* (2025) arXiv:2511.18134 [2511.18134]

K. Malanchev, M. DeLucchi, N. Caplar, A. I. Malz, A. Alexov, E. Aubourg et al., *Variability-finding in Rubin Data Preview 1 with LSDB*, *arXiv e-prints* (2025) arXiv:2506.23955 [2506.23955]

Y.-H. Zhang, J. Zuntz, I. Moskowitz, E. Gawiser, K. Kuijken, M. Asgari et al., *Improved photometric redshift estimations through self-organising map-based data augmentation*, *arXiv e-prints* (2025) arXiv:2508.20903 [2508.20903]

D. Rana, S. More, H. Miyatake, S. Sugiyama, **T. Zhang** and M. Shirasaki, *Hyper Suprime-Cam Y3 results: photo-z bias calibration with lensing shear ratios and cosmological constraints from cosmic shear*, *arXiv e-prints* (2025) arXiv:2508.21681 [2508.21681]

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*, *The Open Journal of Astrophysics* **8** (2025) 139 [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*, MNRAS **542** (2025) 608 [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]

X. Li, R. Mandelbaum, M. Jarvis, Y. Li, A. Park and **T. Zhang**, *A differentiable perturbation-based weak lensing shear estimator*, MNRAS **527** (2024) 10388 [2309.06506]

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]

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]

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]

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]

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. 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]

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]

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]

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]

TALKS

(Invited talks denoted by "†")

LSST-DA Catalyst Symposium, *Tucson, AZ* — *Nov. 2025*
RAIL and Photometric Redshift of Rubin Observatory Data Preview 1

† AGN Science Collaboration, *Online* — *Oct. 2025*
Photometric Redshift of Rubin Observatory Data Preview 1

† KIPAC Weak Lensing, *SLAC, Menlo Park, CA* — *Oct. 2025*
HSC Tomographic Weak lensing and clustering analysis with point-mass correction model

DESC Seminar, *Online* — *Sept. 2025*
Photometric Redshift of Rubin Observatory Data Preview 1

† DESC Meeting Plenary, *UIUC, Urbana-Champaign, IL* — *Jul. 2025*
Photometric Redshift of Rubin Observatory Data Preview 1

Roman Symposium, *STScI, Baltimore, MD* — *Jul. 2025*
RAIL: Open-source platform for Photometric redshift production and research

† DESI Lunch, *LBL, Berkeley, CA* — *Apr. 2025*
The mystery of redshift distribution systematics in HSC Y3 cosmology and approaches to tackle it

Roman PIT workshop, *Caltech, Pasadena, CA* — *Oct. 2024*
Developing RAIL: a platform for photometric redshift production and research

DESC Forecast Topical Team, *online* — *Oct. 2024*
Forecasting the Impact of Photometric Redshift Uncertainties on the LSST 3x2pt Analysis

Rubin Community Workshop, *SLAC, Menlo Park, CA* — *Aug. 2024*
PSF Requirement for Cosmic Shear with LSST

Rubin Community Workshop, *SLAC, Menlo Park, CA* — *Aug. 2024*
RAIL Status updates: v1.0 release

† LSST Discovery Alliance Monthly Meeting, *online* *Jul. 2024*
Developing RAIL: A platform for LSST photometric redshift production and research

† DES Weak Lensing Group Meeting, *online* *Apr. 2023*
HSC Y3 Cosmology Results Seminar

DESC Photometric Redshift Group Meeting, *online* *Apr. 2023*
HSC Y3 Cosmology Results Seminar: Photometric Redshift

HSC Y3 Cosmology Results Webinar, *online* *Apr. 2023*
Source Redshift Distribution Inference, PSF Systematics Inference

† Research Faculty Seminar, *University of Pittsburgh, Pittsburgh, PA* *Feb. 2023*
Weak Lensing Cosmology and its Technical Challenges in the 2020s

† Princeton Cosmology Discussion, *Princeton University, Princeton, NJ* *Sept. 2022*
Why do we care about redshift distribution in cosmic shear for Cosmology?

Princeton HSC+PFS+Rubin Group Meeting, *Princeton University, Princeton, NJ* *Sept. 2022*
Point Spread Function in Cosmic Shear: Simulation, Modeling and Marginalization

International High-Performance Computing Summer School, *Athens, Greece* *Jun. 2022*
Pixel to Catalog to Science: the weak lensing image processing and analysis pipeline

HSC Weak Lensing Group Meeting, *online* *May. 2022*
Impact of PSF Higher Moments on Cosmic Shear Measurement

DESC Collaboration Wide Presentation, *online* *May. 2022*
Impact of Point Spread Function Higher-moments Error on Weak Lensing II

DESC 2020 Winter Meeting, *University of Arizona, Tucson, AZ* *Jan. 2020*
Impact of Point Spread Function Higher-moments Error on Weak Lensing

DESC Theory and Joint Probe Group Meeting, *University of Arizona, Tucson, AZ* *Oct. 2019*
Data Compression and Covariance Matrices Inspection: Cosmic Shear

Asia-Pacific Astronomy & Engineering Summit, *University of Hawaii, Hilo, HI* *Aug. 2014*
Studies of Reaching and Going Beyond the Seeing Limit of Ground-based Telescopes: Adaptive Optics

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POSTERS

Rubin Project & Community Workshop 2022, *Tucson, AZ* *Aug. 2022*
Lensed by the atmosphere: PSF systematics in weak lensing analysis

Machine Learning Student Poster Session, *Carnegie Mellon University, Pittsburgh PA* *May. 2021*
Image Segmentation with Uncertainty Quantification using Bayesian U-Net

Cosmic Controversies Conference, *University of Chicago, Chicago IL* *Oct. 2019*
Data Compression and Covariance Matrices Inspection: Cosmic Shear

Undergraduate Research Poster Session, *Duke University, Durham NC* *Apr. 2018*
Measuring the Chromatic Effect of Point Spread Function in Optical Wavelength

Undergraduate Research Poster Session, *Duke University, Durham NC* *Apr. 2017*
Building the Portable Neutron Beam Imager using 2-D Position-Sensitive Photomultiplier Tubes

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TEACHING & MENTORING

Graduate Teaching Assistant

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

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

- **Federico Berlfein (CMU, G)**: 2023-present, *Chromatic PSF of Roman Space Telescope* (*Paper published in MNRAS*)
- **Alice Crafford (CMU, UG)**: 2023-2025, *Photometric Redshift with Sample Incompleteness* (*Paper submitted to MNRAS*)
- **Sean Maloney (Pitt, UG)**: 2023-present, NASA Space Grant Fellowship; *Cosmic Parallax Measurement by GAIA*
- **Michael Murphy (CMU, UG)**: 2022, *PSFs of Coadded Images* (*Paper published in OJAp*)
- **Andy Park (CMU, G)**: 2021-2024, *Consistent Shear Analysis in Real and Fourier spaces* (*Paper published in MNRAS*)
- **Sarah Pelesky (CMU, UG)**: 2025-present, *Photometric Redshift Database for Rubin Observatory* (*Paper in Collaboration review*)
- **Mahitha Ramachandran (Pitt, UG)**: 2023-2024, NASA Space Grant Spring 2024, *Impact of Background Subtraction on Shear Measurement*
- **Yoquelbin Salcedo Hernandez (Pitt, G)**: 2024-present, *Cross-correlation Redshift Calibration by DESI for Rubin Observatory*

MEDIA COVERAGE

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

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FUNDING PROPOSALS

LSST DESC Deputy Technical Coordinator, *PI, $ 48,000* *2025*
Code Tutorial to Enable Participation, *PI, $ 14,000* *2023*
Rubin Observatory Enabling Science Award, *$ 2,000* *2022*

PUBLIC OUTREACH

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

AWARDS

Builder, *DESC* *2025*
Enabling Science Award, *Rubin Observatory* *2022*
Dean's List with Distinction, *Duke University* *2018*
Dean's List with Distinction, *Duke University* *2017*
Sigma Pi Sigma, *Duke University* *2018*
Guanghua Scholarship, *top 5% of SJTU* *2016*
Pacific-Asia Astronomy Olympiad, *Second Diploma* *2012*
China Astronomy Olympiad, *First Diploma* *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

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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,
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Department of Physics, Carnegie Mellon University,
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Dr. Masahiro Takada,
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Dr. Michael Jarvis,
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Philadelphia, PA 19104 *E-mail: mjarvis@physics.upenn.edu*