

Tianqing Zhang

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RESEARCH INTERESTS

Weak lensing cosmology | Point Spread Function | Photometric redshift | Bayesian statistics |
Machine learning | Data analysis & visualization | Image processing and simulation

EDUCATION

Carnegie Mellon University (CMU), Pittsburgh, PA

Ph.D. in Physics

Expected July 2023

Thesis: Enabling the Weak Lensing Science of the 2020s, Advisor: Rachel Mandelbaum

M.S. in Physics

May 2021

Duke University, Durham, NC

May 2018

B.S. in Physics (with high distinction); Minor in Mathematics; Minor in Computer Science

Thesis: Measuring the Chromatic Effect of Point Spread Function, Advisor: Christopher Walter

Shanghai Jiao Tong University (SJTU), Shanghai, China

Jun. 2016

B.S. in Physics (International program)

COLLABORATION AFFILIATIONS

LSST Dark Energy Science Collaboration (DESC): Full Member

Hyper-Suprime Cam (HSC) of Subaru Strategic Program (SSP): Survey Member

Rubin Observatory System Integration, Test, and Commissioning (SIT-COM): Member

Rubin Observatory Data Preview 0: DP0 Delegate

RESEARCH PROJECTS

Graduate Researcher, McWilliams Center for Cosmology, CMU 2019-Present

- Impact of Point Spread Function on Weak Lensing Cosmology (HSC, LSST DESC, Rubin Observatory SIT-COM, Nancy Grace Roman Space Telescope); Advisor: Rachel Mandelbaum
- Bayesian Statistically-Principled Method for Redshift Distribution Marginalization in Cosmic Shear; Advisor: Rachel Mandelbaum & Markus M. Rau
- Data Compression and Covariance Inspection for Cosmic Shear; Advisor: Scott Dodelson
- Shear Catalog Emulator with Realistic Systematics; Advisor: Rachel Mandelbaum
- Cosmic Parallax Observation with SDSS and HSC; Advisor: Rupert Croft

Machine Learning Engineer Intern, IBM	2018
➤ Data Augmentation for Watson Chatbot by Variational Auto-Encoder	
Undergraduate Researcher, Duke University	2017-2018
➤ Measuring the Chromatic Effect of Point Spread Function; Advisor: Christopher Walter	
➤ Neutron Beam Imager with 2-d Photomultiplier tubes; Advisor: Calvin Howell	
Undergraduate Researcher, SJTU	2015-2016
➤ Galaxy Morphology in the Next Generation Virgo Cluster Survey; Advisor: Chenze Liu	

SERVICE TO THE PROFESSION

LSST-DESC Collaboration Council	2022-2024
LSST-DESC Membership Committee	2022-2024
LSST-DESC 2022 Summer Meeting Scientific Organizing Committee	2022
McWilliams AstroLunch Seminar Organizer	2022-2023
McWilliams “Impossible Problems” Seminar Series Organizer	2022-2023
McWilliams Software Development Series Organizer	2020-2021
CMU Physics Graduate Program Admission Committee	2021-2022
LSST Data Science Fellowship Program Local Organizer (CMU event)	2019
VP of SJTU Physics Union	2015-2016
President of SJTU Astronomy Club	2015-2016

PUBLICATIONS

Publication list: [Link](#)

First and Second Author:

1. **Zhang, T.**, Mandelbaum, R., “*Impact of Point Spread Function Higher Moments Error on Weak Gravitational Lensing*” 2021, MNRAS. 510, 1978-1993
2. Ferreira, T., **Zhang, T.**, et al., “*Data Compression and Covariance Matrix Inspection: Cosmic Shear*” 2020, PhysRevD. 103.
3. **Zhang, T.**, Mandelbaum, R., et al., “*Impact of Point Spread Function Higher Moments Error on Weak Gravitational Lensing II: A Comprehensive Study*” 2022, MNRAS (in press)
4. **Zhang, T.**, Rau, M., et al., “*Photometric Redshift Uncertainties in Weak Gravitational Lensing Shear Analysis: Models and Marginalization*” 2022, MNRAS. 518, 709-723
5. **Zhang, T.**, Li, X., et al., “*A General Framework for Removing Point Spread Function Additive Systematics in Cosmological Weak Lensing Analysis*” 2022, arxiv: 2212.03257

6. Li, X., **Zhang, T.**, et al., “*Hyper Suprime-Cam Year 3 Results: Cosmology from Cosmic shear Two-point Correlation Functions*” 2023, *arxiv: 2304.00702*

Co-author:

1. Yamamoto, M. et al. (incl. **Zhang, T.**), “Weak Gravitational Lensing Shear Estimation with Metacalibration for the Roman High-Latitude Imaging Survey” 2022, *arxiv:2203.08845*, *MNRAS (in press)*
2. Troxel, M.A. et al. (incl. **Zhang, T.**), “A Joint Roman Space Telescope and Rubin Observatory Synthetic Wide-Field Imaging Survey” 2022, *arxiv: 2209.06829*
3. Mandelbaum, R. et al. (incl. **Zhang, T.**), “PSFs of Coadded Images” 2022, *arxiv: 2209.09253*
4. Rau, M.M., Dalal, R., **Zhang, T.** et al., “Weak Lensing Tomographic Redshift Distribution Inference for the Hyper Suprime-Cam S19A data release” 2022, *arxiv: 2211.16516*
5. Hirata, C.M., et al (incl. **Zhang, T.**), “Simulating image coaddition with the Nancy Grace Roman Space Telescope: I. Simulation methodology and general results” 2023, *arxiv: 2303.08749*
6. Yamamoto, M., et al (incl. **Zhang, T.**), “Simulating image coaddition with the Nancy Grace Roman Space Telescope: II. Analysis of the simulated images and implications for weak lensing” 2023, *arxiv: 2303.08750*
7. Dalal, R., et al., (incl. **Zhang, T.**) “*Hyper Suprime-Cam Year 3 Results: Cosmology from Cosmic Shear Power Spectra*” 2023, *arxiv: 2304.00701*
8. More, S., et al., (incl. **Zhang, T.**) “*Hyper Suprime-Cam Year 3 Results: Measurements of Clustering of SDSS-BOSS Galaxies, Galaxy-Galaxy Lensing and Cosmic Shear*” 2023, *arxiv: 2304.00703*
9. Miyatake, H., et al., (incl. **Zhang, T.**) “*Hyper Suprime-Cam Year 3 Results: Cosmology from Galaxy Clustering and Weak Lensing with HSC and SDSS using the Emulator Based Halo Model*” 2023, *arxiv: 2304.00704*
10. Sugiyama, S., et al., (incl. **Zhang, T.**) “*Hyper Suprime-Cam Year 3 Results: Cosmology from Galaxy Clustering and Weak Lensing with HSC and SDSS using the Minimum Bias Model*” 2023, *arxiv: 2304.00705*

CONFERENCE TALKS AND POSTERS

Talks

- HSC Y3 Cosmology Results Seminar. *DES Weak Lensing Group Meeting, 27 Apr. 2023*

- HSC Y3 Cosmology Results Seminar: Photometric Redshift *DESC Photometric Redshift Group Meeting, 13 Apr. 2023*
- HSC Y3 Cosmology Results Webinar: Source Redshift Distribution Inference. *3 Apr. 2023*
- Weak Lensing Cosmology and its Technical Challenges in the 2020s. *Research Faculty Seminar, University of Pittsburgh, 16 Feb. 2023*
- Why do we care about redshift distribution in cosmic shear for Cosmology? *Cosmology Chalkboard Discussion, Princeton University, 29 Sept.. 2022*
- Point Spread Function in Cosmic Shear: Simulation, Modeling and Marginalization *HSC+PFS+Rubin Group Meeting, Princeton University, 29 Sept.. 2022*
- Bayesian resampling: a statistically-principled method for redshift distribution uncertainty marginalization, *DESC 2022 Summer Meeting, University of Chicago, 6 Aug. 2022*
- A General Framework for PSF Systematics Modeling in Cosmic Shear Analysis, *HSC Weak Lensing Group Meeting, 23 May 2022*
- Pixel to Catalog to Science: the weak lensing image processing and analysis pipeline, *International High-Performance Computing Summer School 2022, Athens, 20 Jun. 2022*
- Impact of Point Spread Function Higher-moments Error on Weak Lensing II, *DESC Collaboration Wide Presentation, 5 May 2022*
- Impact of Point Spread Function Higher-moments Error on Weak Lensing, *DESC 2020 Winter Meeting, University of Arizona, 22 Jan. 2020*
- Data Compression and Covariance Matrices Inspection: Cosmic Shear, *DESC Theory and Joint Probe Group Meeting, 05 Oct. 2019*
- Studies of Reaching and Going Beyond the Seeing Limit of Ground-based Telescopes: Adaptive Optics, *Asia-Pacific Astronomy & Engineering Summit, Hilo Hi, 2 Aug. 2014*

Posters

- Lensed by the atmosphere: PSF systematics in weak lensing analysis, *Rubin Observatory Project & Community Workshop 2022, Tucson, 11 Aug. 2022*
- Image Segmentation with Uncertainty Quantification using Bayesian U-Net, *Carnegie Mellon University, 15 May 2021*
- Data Compression and Covariance Matrices Inspection: Cosmic Shear, *Cosmic Controversies Conference, University of Chicago, 07 Oct. 2019*
- Measuring the Chromatic Effect of Point Spread Function in Optical Wavelength, *Duke University, 17 Apr. 2018*

- Building the Portable Neutron Beam Imager using 2-D Position-Sensitive Photomultiplier Tubes, *Duke University, Duke University, 22 Apr. 2017*

TEACHING & MENTORING

33-141 Physics I for Engineering Students (Fall 2018)

33-228 Electronics (Spring 2019)

33-761 Classical Electrodynamics I (Fall 2019)

Undergraduate research advising: Michael Murphy (CMU)

- Result in co-authorship of a publication (arXiv: 2209.09253)

PUBLIC OUTREACH

Carnegie Mellon High School Astronomy Mentoring Project (2022)

Galaxy.io: an educational multiplayer game (2022)

Shanghai Science & Technology Museum Volunteer (200h, 2015-2016)

AWARDS

Dean's List with Distinction (2018)

Sigma Pi Sigma (2018)

Dean's List with Distinction (2017)

Guanghua Scholarship (top 5% 2016)

Merit Student Scholarship (top 5%, 2015)

Second Diploma of Pacific-Asia Astronomy Olympiad (2012)

First Diploma of China Astronomy Olympiad (2012)

FUNDING PROPOSALS

Rubin Observatory Enabling Science Award (2022)

TECHNICAL SKILLS

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

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

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

Startup Application: *Huddle* (Co-founder & Developer)

REFERENCES

- Rachel Mandelbaum E-mail: rmandelb@andrew.cmu.edu
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Department of Physics, Carnegie Mellon University,
Pittsburgh, PA 15213

- Scott Dodelson E-mail: sdodelso@andrew.cmu.edu
McWilliams Center for Cosmology,
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- Mike Jarvis E-mail: mjarvis@physics.upenn.edu
Department of Physics & Astronomy,
University of Pennsylvania,
Philadelphia, PA 19104