# Chihway Chang


**CONTACT INFORMATION**

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**RESEARCH INTERESTS**

**Survey science:** cosmology from galaxy surveys, CMB, $H_I$ intensity mapping
**Weak lensing:** wide-field mass reconstruction, cross-correlation
**Galaxy-halo connection:** small-scale physics, galaxy evolution
**Image simulation:** forward modelling of imaging and spectroscopic data
**Instrumentation:** CCD sensor characterization

**EDUCATION**

Physics Department, Stanford University — Ph. D. 2013
Physics Department, National Taiwan University — B. S. 2007

**ACADEMIC APPOINTMENTS**

Assistant Professor, Department of Astronomy and Astrophysics, University of Chicago — 2018 –
KICP Fellow, University of Chicago — 2016 – 2018
Postdoctoral Fellow, Institute of Astronomy, ETH Zurich — 2013 – 2016

**HONOURS AND AWARDS**

Editor's choice in Physical Review Letters — 2015
62nd Meeting of Nobel Laureate, Lindau, Germany — 2012
Presidential Awards, National Taiwan University — 2004 – 2007
Jen-Lin Huang Scholarship — 2005 – 2006

**SERVICE AND LEADERSHIP**

DES Weak Lensing Mass Mapping Analysis Team Coordinator — 2016 – present
LSST DESC Weak Lensing Working Group Coordinator — 2018 – present
Reviewer for MNRAS, ApJ, Nature Astronomy, DES Collaboration — 2014 – present
Mentor for 8+ high school, undergraduate, and graduate students — 2014 – present

**COLLABORATIONS**

The South Pole Telescope (SPT) — 2016 – present
Member of the DES-SPT cross-correlation analysis group.

The Dark Energy Survey (DES) — 2013 – present
Co-convener of the weak lensing mass mapping working group. Member of the science working groups: weak lensing, large-scale structure, simulation.

The Large Synoptics Survey Telescope (LSST) — 2010 – present
Member of the LSST Dark Energy Science Collaboration (DESC). Co-coordinator of the Weak Lensing working group. Coordinator of the DESC weak lensing pipeline project.

**TEACHING AND OUTREACH**

Volunteer at the Adler Planetarium: *Astronomy Conversations* — 2016 – present
Astrophysics I (ETH): *Substitute Lecturer* — Fall 2015, Fall 2014
Astrowoche (ETH): *Teaching Assistant* — Spring 2016, Spring 2015
Cosmological Probes (ETH): *Teaching Assistant and Substitute Lecturer* — Spring 2014
Physics 21 (Stanford), Mechanics and Heat: *Teaching Assistant* — Fall 2011
Physics 23 (Stanford), Electricity and Optics: *Teaching Assistant* — Winter 2007
Physics 41 (Stanford), Light and Heat: *Teaching Assistant* — Fall 2007
SLAC tour guide — 2010 – 2013

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| SELECTED TALKS | Invited talk at COSPAR, Pasadena, CA, USA | Jul 16, 2018 |
| | Invited talk at APS, Columbus, OH, USA | Apr 17, 2018 |
| | UChicago Astro Seminar, Chicago, IL, USA | Feb 27, 2018 |
| | Rutgers Astro Seminar, New Brunswick, NJ, USA | Feb 19, 2018 |
| | Duke Physics Colloquium, Durham, NC, USA | Feb 14, 2018 |
| | University of Pittsburgh Physics Colloquium, Pittsburgh, PA, USA | Jan 30, 2018 |
| | UC Berkeley Physics Colloquium, Berkeley, CA, USA | Jan 23, 2018 |
| | Cosmology Group Meeting, CCA, NY, USA | Nov 9, 2017 |
| | Cosmology Seminar, Princeton/IAS, NJ, USA | Nov 6, 2017 |
| | Fermilab Astro Seminar, Fermilab, IL, USA | October 23, 2017 |
| | Astro/Cosmology Seminar, CMU, PA, USA | October 13, 2017 |
| | Astrophysics and Cosmology Seminar, UIUC, IL, USA | September 20, 2017 |
| | Cosmology Seminar, BNL, NY, USA | September 14, 2017 |
| | Instrumentation Seminar, BNL, NY, USA | September 13, 2017 |
| | The Nonlinear Universe, Smartno, Slovenia | July 20, 2017 |
| | Fermilab 50th User Meeting, Fermilab, IL, USA | June 8, 2017 |
| | KICP Colloquium, KICP, IL, USA | May 31, 2017 |
| | Astronomy Chalk Talk, U of Chicago, IL, USA | January 24, 2017 |
| | Cosmology Seminar, UCL, London, UK | December 21, 2016 |
| | Astronomy Colloquium, UIUC, IL, USA | November 1, 2016 |
| | KICP Friday Seminar, KICP, IL, USA | October 7, 2016 |
| | Cosmology Seminar, KIPAC, CA, USA | May 16, 2016 |
| | Kosmologietag Overview Talk, Bielefeld University, Germany | April 29, 2016 |
| | Astronophysics Colloquium, ASIAA, Taipei, Taiwan | March 28, 2016 |
| | RAS Specialist Discussion Meeting, London, UK | February 12, 2016 |
| | Swiss Python Summit, Rapperswil, Switzerland | February 5, 2016 |
| | Astrophysics Seminar, Rutgers University, NJ, USA | August 11, 2015 |
| | Cosmology Lunch, Princeton University, NY, USA | August 10, 2015 |
| | Fourteenth Marcel Grossmann Meeting (MG14) Rome, Italy | July 17, 2015 |
| | APS April meeting, Baltimore, MD, USA | April 14, 2015 |
| | Weekly Colloquium, IEEC-CSIC, Barcelona, Spain | October 8, 2014 |
| | Astrophysics Seminar, ASIAA, Taipei, Taiwan | September 19, 2014 |
| | Research Seminar Shanghai Jiao Tong University, Shanghai, China | September 9, 2014 |
| | DES-LSST Joint Workshop, Fermilab, IL, USA | March 24, 2014 |
| | Swiss Cosmology Day, ETH Zurich, Switzerland | February 6, 2014 |
| | ETH Research Seminar, ETH Zurich, Zurich, Switzerland | September 19, 2013 |
| | Astrophysics Seminar, JPL, CA, USA | September 2012 |
| | Special Seminar, IPMU, Tokyo, Japan | August 2012 |
| | SnowPAC, Snowbird, CO, USA | March 22, 2012 |

# Publication List

Lead author of 12+ refereed publications in weak gravitational lensing, cross-correlation, and other large-scale cosmology tropics. Contributing author of 47+ publications. Full publication list available at ORCHID and ADS

## Submitted Journal Publications

47. **C. Chang**, M. Wang, S. Dodelson, T. Eifler, C. Heymans et al., *A Unified Analysis of Four Cosmic Shear Surveys*. ArXiv e-prints (2018) 1808.07335.

46. M. Fagioli, ...**C. Chang**... et al., *Forward Modeling of Spectroscopic Galaxy Surveys: Application to SDSS*. ArXiv e-prints (2018) 1803.06343.

45. E. Baxter, Y. Omori, **C. Chang**, T. Giannantonio, D. Kirk et al., *Dark Energy Survey Year 1 Results: Methodology and Projections for Joint Analysis of Galaxy Clustering, Galaxy Lensing, and CMB Lensing Two-point Functions*. ArXiv e-prints (2018) 1802.05257.

44. T. M. C. Abbott, ...**C. Chang**... et al, *The Dark Energy Survey Data Release 1*. ArXiv e-prints (2018) 1801.03181.

43. R. Cawthon, ...**C. Chang**... et al, *Dark Energy Survey Year 1 Results: Calibration of redMaGiC Redshift Distributions in DES and SDSS from Cross-Correlations*. ArXiv e-prints (2018) 1712.07298.

42. **C. Chang**, E. Baxter, B. Jain, C. Sanchez, S. Adhikari et al., *The Splashback Feature around DES Galaxy Clusters: Galaxy Density and Weak Lensing Profiles*. ArXiv e-prints (2017) 1710.06808.

41. C. Davis, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Cross-Correlation Redshifts in the DES – Calibration of the Weak Lensing Source Redshift Distributions*. ArXiv e-prints (2017) 1710.02517.

40. T. M. C. Abbott, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Cosmological Constraints from Galaxy Clustering and Weak Lensing*. ArXiv e-prints (2017) 1708.01530.

39. J. Prat, ...**C. Chang** et al., *Dark Energy Survey Year 1 Results: Galaxy-Galaxy Lensing*. ArXiv e-prints (2017) 1708.01537.

38. M. A. Troxel, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Cosmological Constraints from Cosmic Shear*. ArXiv e-prints (2017) 1708.01538.

37. E. Krause, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Multi-Probe Methodology and Simulated Likelihood Analyses*. ArXiv e-prints (2017) 1706.09359.

## Refereed Journal Publications

36. M. Troxel, E. Krause, **C. Chang**, T. F. Eifler, O. Friedrich et al., *Survey Geometry and the Internal Consistency of Recent Cosmic Shear Measurements*. MNRAS **476**, 4998 (2018) 1804.10663.

35. N. Jeffrey,... **C. Chang**..., et al., *Improving Weak Lensing Mass Map Reconstructions using Gaussian and Sparsity Priors: Application to DES SV*. MNRAS **479**, 2871 (2018) 1801.08945.

34. O. Friedrich, ...**C. Chang**... et al., *Density Split Statistics: Joint Model of Counts and Lensing in Cells*. PRD **98**, 023508 (2018) 1710.05162.

33. D. Gruen, ...**C. Chang**... et al., *Density Split Statistics: Cosmological Constraints from Counts and Lensing in Cells in DES Y1 and SDSS*. PRD **98**, 023507 (2018) 1710.05045.

32. B. Hoyle, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Redshift Distributions of the Weak Lensing Source Galaxies*. MNRAS **478**, 592 (2018) 1708.01532.

31. M. Gatti, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Cross-Correlation Redshifts - Methods and Systematics Characterization*. MNRAS (2018)1709.00992.

30. **C. Chang**, A. Pujol, B. Mawdsley, D. Bacon, J. Elvin-Poole, et al., *Dark Energy Survey Year 1 Results: Curved-Sky Weak Lensing Mass Map*. MNRAS **475**, 3165 (2018) 1708.01535.

29. E. Baxter, **C. Chang**, B. Jain, S. Adhikari, N. Dalal et al., *The Halo Boundary of Galaxy Clusters in the SDSS*. ApJ **841**, 18 (2017) 1702.01722.

28. J. Akeret, **C. Chang**, A. Lucchi, A. Refregier, *Radio Frequency Interference Mitigation using Deep Convolutional Neural Networks*. A&C **18**, 35–39 (2017) 1609.09077.

27. J. Akeret, S. Seehars, **C. Chang**, C. Monstein, A. Amara, A. Refregier, *HIDE & SEEK: End-to-End Packages to Simulate and Process Radio Survey Data*. A&C **18**, 8–17 (2017) 1607.07443.

26. **C. Chang**, C. Monstein, J. Akeret, S. Seehars, A. Refregier et al., *An Integrated System at the Bleien Observatory for Mapping the Galaxy*. MNRAS **464**, 1727–1737 (2017) 1607.07451.

25. N. MacCrann, ...**C. Chang**... et al., *Inference from the Small Scales of Cosmic Shear with Current and Future Dark Energy Survey Data*. MNRAS **465**, 2567–2583 (2017). 1608.01838.

24. L. Clerkin, ...**C. Chang**... et al., *Testing the Lognormality of the Galaxy and Weak Lensing Convergence Distributions from Dark Energy Survey Maps*. MNRAS **466**, 1444–1461 (2017). 1605.02036.

23. T. Kacprzak, ... **C. Chang**..., et al., *Cosmology Constraints from Shear Peak Statistics in Dark Energy Survey Science Verification Data*. MNRAS **463**, 3653–3673 (2016), 1603.05040.

22. B. Nord, ... **C. Chang**..., et al., *SPOKES: An End-to-End Simulation Facility for Spectroscopic Cosmological Surveys*. A&C **15**, 1–15 (2016), 1602.01480.

21. D. Kirk, Y. Omori, A. Benoit-Levy, R. Cawton, **C. Chang** et al., *Cross-correlation of Gravitational Lensing from DES Science Verification, SPT and Planck*. MNRAS **459**, 21 (2016), 1512.04535.

20. A. Pujol, **C. Chang**, E. Gazganaga, A. Amara, A. Refregier et al., *A New Method to Measure Galaxy Bias from the Density and Weak Lensing Fields*. MNRAS **462**, 35–47 (2016) 1601.00160.

19. **C. Chang**, A. Pujol, E. Gazganaga, A. Amara, A. Refregier et al., *Galaxy Bias from the DES Science Verification Data: Combining Galaxy Density Maps and Weak Lensing Maps*. MNRAS **459**, 3203 (2016), 1601.00405.

18. The Dark Energy Survey Collaboration .. **C. Chang**..., et al., *Cosmology from Cosmic Shear with DES Science Verification Data*. PRD **94**, 022001 (2016), 1507.05552.

17. M. Jarvis, ... **C. Chang**..., et al., *The DES Science Verification Weak Lensing Shear Catalogs*. MNRAS **460**, 2245 (2016), 1507.05603.

16. M.R. Becker, ... **C. Chang**..., et al., *Cosmic Shear Measurements with DES Science Verification Data*. PRD **94**, 022002 (2016), 1507.05598.

15. B. Leistedt, ... **C. Chang**..., et al., *Mapping and Simulating Systematics due to Spatially-Varying Observing Conditions in DES Science Verification Data*. ApJS **226**, 24 (2016), 1507.05647.

14. C. Bonnett, ... **C. Chang**..., et al., *Redshift Distributions of Galaxies in the DES Science Verification Shear Catalogue and Implications for Weak Lensing* PRD **94**, 042005 (2016), 1507.05909.

13. C. Bruderer, **C. Chang**, A. Refregier, A. Amara, J. Berge et al., *Calibrated Ultra Fast Image Simulations for the Dark Energy Survey*. ApJ **817**, 25 (2016), 1504.02778.

12. **C. Chang**, C. Monstein, A. Refregier, A. Amara, A. Glauser et al., *Beam Calibration of Radio Telescopes with Drones*. PASP **127**, 1131–1143, (2015), 1505.05885.

11. **C. Chang**, V. Vikram, B. Jain, D. Bacon, A. Amara et al., *Wide-Field Lensing Mass Maps from DES Science Verification Data*. PRL **115**, 051301 (2015), 1505.01871.

10. V. Vikram, **C. Chang**, B. Jain, D. Bacon, A. Amara et al., *Wide-Field Lensing Mass Maps from DES Science Verification Data: Methodology and Detailed Analysis*. PRD **92**, 022006 (2015), 1504.03002.

9. J.R. Peterson, ... **C. Chang**... et al., *Simulation of Astronomical Images from Optical Survey Telescopes using a Comprehensive Photon Monte Carlo Approach*. ApJS **218**, 14 (2015), 1504.06570.

8. **C. Chang**, M.T. Busha, R.H. Wechsler, A. Refregier, A. Amara et al., *Modelling the Transfer Function for the Dark Energy Survey*. ApJ **801**, 73 (2015), 1411.0032.

7. **C. Chang** and B. Jain, *Delensing Galaxy Surveys*. MNRAS **443**, 102 (2014), 1405.1432.

6. R. Mandelbaum, B. Rowe, J. Bosch, **C. Chang**, F. Courbin et al., *The Third Gravitational Lensing Accuracy Testing (GREAT3) Challenge Handbook*. ApJS **212**, 5 (2014), 1308.4982.

5. **C. Chang**, M. Jarvis, B. Jain, S.M. Kahn, D. Kirkby et al., *The Effective Number Density of Galaxies for Weak Lensing Measurements in the LSST Project*. MNRAS **434**, 2121 (2013), 1305.0793.

4. D. Bard, J.M. Kratochvil, **C. Chang**, M. May, S.M. Kahn et al., *Effect of Measurement Errors on Predicted Cosmological Constraints from Shear Peak Statistics with LSST*. ApJ **774**, 49 (2013), 1301.0830.

3. **C. Chang**, S.M. Kahn, J.G. Jernigan, J.R. Peterson, Y. AlSayyad et al., *Spurious Shear in Weak Lensing with LSST*. MNRAS **428**, 2695 (2013), 1206.1378.

2. **C. Chang**, P.J. Marshall, J.G. Jernigan, J.R. Peterson, S.M. Kahn et al., *Atmospheric PSF Interpolation for Weak Lensing in Short Exposure Imaging Data*. MNRAS **427**, 2572 (2012), 1206.1383.

1. J. Singal, R. Schindler, **C. Chang**, P. Czodrowski, and P. Kim, *A Multi-Chamber System for Analyzing the Outgassing, Deposition, and Associated Optical Degradation Properties of Materials in a Vacuum*. Review of Scientific Instruments **81**, 025101 (2010), 0910.4198.

ARXIV E-PRINTS, CONFERENCE PROCEEDINGS, POSTERS

9. The LSST Dark Energy Science Collaboration, *LSST Dark Energy Science Collaboration*. ArXiv e-prints (2012) 1211.0310.

8. J.R. Peterson, ... **C. Chang**..., et al., *LSST Image Simulations*. American Astronomical Society Meeting Abstracts, **219**, (2012).

7. A. Bradshaw, ... **C. Chang**..., et al., *LSST Probes of Dark Energy: New Energy vs New Gravity*. American Astronomical Society Meeting Abstracts, **219**, (2012).

6. R.R. Gibson, ... **C. Chang**..., et al., *A Framework for End to End Simulations of the Large Synoptic Survey Telescope*. Astronomical Data Analysis Software and Systems XX, **442**, p.329, (2011).

5. J. Pizagno, ... **C. Chang**..., et al., *Strong Lenses with LSST: Simulated 10-year Movies of Multiply-Imaged Quasars*. American Astronomical Society Meeting Abstracts, **217**, (2011).

4. **C. Chang**, S.M Kahn, G. Jernigan, J.R. Peterson, A. Rasmussen et al., *Shear Systematics in LSST Simulated Images*. American Astronomical Society Meeting Abstracts, **217**, (2011).

3. G. Jernigan, ... **C. Chang**..., et al., *Strong Lenses with LSST: Simulated 10-year Movies of Multiply-Imaged Quasars*. American Astronomical Society Meeting Abstracts, **217**, (2011).

2. K.S. Krughoff, ... **C. Chang**..., et al., *Strong Lenses with LSST: Simulated 10-year Movies of Multiply-Imaged Quasars*. American Astronomical Society Meeting Abstracts, **217**, (2011).

1. A. Connolly, ... **C. Chang**..., et al., *Simulating the LSST system*. Society of Photo-Optical Instrumentation Engineers (SPIE) Conference Series **7738**, p.1, (2010). SPIE.

## JOURNAL PUBLICATIONS IN PREPARATION

4. Y. Omori, T. Giannantonio, A. Porredon, E. Baxter, **C. Chang** et al., *Dark Energy Survey Year 1 Results: Tomographic Cross-correlations between DES Galaxies and CMB Lensing from SPT+Planck.*

3. Y. Omori, E. Baxter, **C. Chang**, D. Kirk, A. Alarcon et al., *Dark Energy Survey Year 1 Results: Cross-correlation between DES Y1 Galaxy Weak Lensing and SPT+Planck CMB Weak Lensing*.

2. T. M. C. Abbott, ...**C. Chang**... et al., *Dark Energy Survey Year 1 Results: Joint Analysis of Galaxy Clustering, Galaxy Lensing, and CMB Lensing Two-point Functions*.

1. J. Prat, E. Baxter, T. Shin, C. Sanchez, **C. Chang** et al., *Cosmological lensing ratios with DES Y1, SPT and Planck*