

Yao-Yuan Mao

Curriculum Vitae

Department of Physics and Astronomy & PITT PACC
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My research focuses on the galaxy–halo connection and its application to cosmological surveys, dark matter searches, and the study of galaxies.

POSITIONS

University of Pittsburgh, August 2016–present
Samuel P. Langley Postdoctoral Fellow, PITT PACC

EDUCATION

Stanford University
Ph.D. Physics, June 2016
Thesis: “Modeling the distribution of dark matter and its connection to galaxies”
Thesis advisor: Risa H. Wechsler
National Taiwan University
B.S. Physics, minor in Atmospheric Sciences, June 2009

AWARDS

2016 Samuel P. Langley PITT PACC Postdoctoral Fellowship
2013 Paul Giddings Fellow, Kavli Institute for Particle Astrophysics and Cosmology
2012 Weiland Family Stanford Graduate Fellow, Stanford University

PUBLICATIONS

42 papers (36 refereed), with 1100+ total citations from 800+ citing papers; h -index = 18.
See a complete list of publications at the end of this CV or at yymao.github.io/publications.

SCIENTIFIC COLLABORATIONS

Council Chair, LSST Dark Energy Science Collaboration (DESC), 2019–present
Member, DECam Local Volume Exploration (DELVE) Survey, 2019–present
Member, Southern Stellar Stream Spectroscopic Survey (S5), 2018–present
External Collaborator, Dark Energy Survey (DES), 2018–present
Council Member, LSST Dark Energy Science Collaboration (DESC), 2017–present
Hack/Sprint Coordinator, LSST Dark Energy Science Collaboration (DESC), 2017–present
Full Member, LSST Dark Energy Science Collaboration (DESC), 2017–present

- Member, Dark Energy Spectroscopic Instrument (DESI), 2016–present
- Member, Magellanic Satellites Survey (MagLiteS), 2016–present
- Member, LSST Dark Energy Science Collaboration (DESC), 2015–present
- Participant, Dark Energy Survey (DES), 2015–2016
- Member, Satellites Around Galactic Analogs (SAGA) Survey, 2013–present

GRANTS AND PROPOSALS (SELECTED)

- 2016 Blanco Telescope 2016A: Magellanic Satellites Survey (12 nights)
Co-I (PIs: K. Bechtol, A. Drlica-Wagner)
- 2015 NSF Collaborative Research: The SAGA Project (2015–2018, \$64K)
Co-I (PIs: M. Geha, R. Wechler)
- 2013 MMT Observatory and Anglo-Australian Telescope: The SAGA Survey
(more than 40 nights in total, spanning 2013–2018)
Co-I (PIs: M. Geha, B. Weiner, N. Kallivayalil)

PRESENTATIONS AND CONFERENCES

(§invited presentations; *contributed presentations; † poster presentations; ◊organizing committee)

- 2019 §Physics Colloquium, Duke University, NC, Feb 11
- §Physics Colloquium, University of Pittsburgh, PA, Jan 14
- 2018 ◊Probing the Nature of Dark Matter with LSST, LLNL, Oct 29–31
- ◊LSST DESC Sprint Week, Royal Observatory of Edinburgh, Oct 22–26
- §Fermilab Astrophysics Seminar, Fermilab, Oct 15
- §LSST DESC Collaboration Meeting, CMU, Jul 24–27
- Aspen Center for Physics, Jun 11–29
- *DESI Collaboration Meeting, Tucson, AZ, May 23–25
- §Mock Durham Workshop: Galaxy Formation for Surveys, Durham U., Apr 16–20
- ◊PITT PACC Workshop: Probing the Nature of Dark Matter with LSST, Mar 5-7
- §KICP Friday Seminar, U Chicago, Jan 26
- *KIPAC Tea Talk, KIPAC/Stanford, Jan 16
- §BCCP Workshop: Modeling the Extragalactic Sky, Berkeley, Jan 10-12
- 2017 ◊LSST DESC Sprint Week, ANL, Dec 4–8
- §LSST DESC Seminar, Nov 17
- ◊Super-PAC: Early Career Workshop in Philosophy of Astrophysics and Cosmology, U of Pittsburgh, Oct 27–29
- §CCAPP Seminar, OSU, Oct 24
- *Astrostatistics Meeting, CMU, Sep 15
- §LSST DESC Collaboration Meeting, Stony Brook U. & BNL, Jul 11–14
- *DESI Collaboration Meeting, LBNL, Jun 19–23

- §Quantifying and Understanding the Galaxy–Halo Connection, KITP, May 15–19
- *LSST DESC Hack Week, Fermilab, Apr 3–7
- *LSST DESC Collaboration Meeting, SLAC, Feb 14–17
- 2016 DESI Collaboration Workshop, OSU, Dec 7–9
 - ◊LSST DESC Hack Week, CMU, Nov 7–11
 - *Astrostatistics Meeting, CMU, Sep 16
 - §Statistical Challenges in Modern Astronomy VI, CMU, Jun 6–10
 - *DES Collaboration Meeting, SLAC, May 9–13
 - *Special Seminar, Academia Sinica Institute of Astronomy and Astrophysics, Mar 24
 - *SnowPAC 2016: The Galaxy–Halo Connection, Mar 13–18
 - *LSST DESC Collaboration Meeting, SLAC, Mar 8–11
 - *KIPAC Tea Talk, Feb 9
 - *Essential Cosmology for the Next Generation 2016, Jan 10–16
- 2015 *Large Scale Seminar, The Institute for Theory and Computation, Harvard–Smithsonian Center for Astrophysics, Nov 17
 - *Brown Bag Lunch, Kavli Institute for Astrophysics and Space Research, Massachusetts Institute of Technology, Nov 16
 - *Galaxy Lunch, Yale University, Oct 28
 - *Informal Astro Seminar, New York University, Oct 23
 - *Astronomy Seminar, Columbia University, Oct 22
 - *Cosmology Seminar, University of California, Berkeley, Oct 13
 - †(re)Solving Galaxies in the Era of Extremely Large Telescopes, GMT Community Science Meeting, Pacific Grove, CA, Oct 1–3
 - *Santa Cruz Galaxy Workshop, University of California, Santa Cruz, Aug 20
 - †Local Group Astrostatistics, MIRA, University of Michigan, Ann Arbor, Jun 1–4
 - §Mitchell Workshop, Texas A&M University, May 21
 - *The Life and Death of Satellite Galaxies Workshop, Lorentz Center, Apr 30
- 2014 *CCAPP Workshop, Ohio State University, Nov 25
 - †Potsdam Thinkshop: Satellite galaxies and dwarfs in the local group, Leibniz-Institut für Astrophysik Potsdam, Aug 25–29
- 2013 *Lunch Talk, Academia Sinica Institute of Astronomy and Astrophysics, Dec 2
 - *KIPAC @ 10, Sep 4
 - Santa Cruz Galaxy Workshop, University of California, Santa Cruz, Aug 12–16
 - *Sussing Merger Trees, West Sussex, UK, Jul 8–13
 - §SCIPP Seminar, University of California, Santa Cruz, Jun 11
 - *Hunting for Dark Matter, Kavli Institute for Theoretical Physics, May 13–Jun 7
 - Closing in on Dark Matter, Aspen Center for Physics, Jan 28–Feb 3
 - Jerusalem Winter School in Theoretical Physics: Early Galaxy Formation in LCDM Cos-

- mology, Israel Institute for Advanced Studies, Dec 31–Jan 10
- 2012 Sackler Colloquia: Dark Matter Universe: On the Threshold of Discovery, Irvine, CA, Oct 18–20
- Santa Cruz Galaxy Workshop, University of California, Santa Cruz, Aug 13–17
- International Summer School on AstroComputing: AstroInformatics, University of California High-Performance AstroComputing Center, Jul 9–20
- *KIPAC Tea Talk, Mar 20

COMMUNITY SERVICE

- Executive Secretary, NASA Astrophysics Theory Program Panel Review
- Referee, The Astrophysical Journal
- Referee, Monthly Notices of the Royal Astronomical Society

DEPARTMENTAL SERVICE

- Co-organizer, Philosophy of Cosmology Seminar, University of Pittsburgh, 2018–present
- Co-organizer, Astro Lunch Seminar, University of Pittsburgh, 2017–present
- Intellectual Life Committee, Kavli Institute for Particle Astrophysics and Cosmology, 2015–2016

TEACHING AND OUTREACH

- University of Pittsburgh
- Speaker, Astronomy on Tap Edinburgh, Fall 2018
 - Organizer, Data Science Workshop, Fall 2018
 - Teacher, LSST DESC Dark Energy School VIII, Spring 2018
 - Guest Lecturer, Galactic & Extragalactic Astronomy (grad course), Spring 2018
 - Speaker, Astronomy on Tap Pittsburgh, Fall 2017
 - Guest Lecturer, Basics of Space Flight (undergrad course), Spring 2017
 - Guest Lecturer, Solar System and Exoplanets (undergrad course), Spring 2017
 - Teacher, Intermediate Python Tutorials, Spring 2017
 - Speaker, Allegheny Observatory Public Lecture, Spring 2017
- Stanford University
- Organizer & Lecturer, KIPAC Computing Boot Camp, Fall 2015
 - Volunteer, KIPAC Open House, 2013–2015
 - Teacher, Stanford ESP Splash! Program, 2010–2014
 - Guest Lecturer, Practical Computing for Scientists (undergrad course), Spring 2014 & Spring 2015
 - Head Teaching Assistant & Guest Lecturer, Electricity and Optics (undergrad course), Winter 2013
 - Teaching Assistant, Computational Physics (undergrad course), Fall 2012
 - Teaching Assistant, Electricity and Optics (undergrad course), Winter 2011

PROGRAMMING SKILLS

Python & [SciPy Stack](#); C/C++; web development (HTML, CSS, JavaScript, PHP); SQL.
Also find a full list of software tools that I developed at yymao.github.io/tools

MEDIA COVERAGE

- 2017 [Yale News](#) *etc.*
featuring our work on the Satellites Around Galactic Analogs (SAGA) Survey
- 2016 [AAS NOVA](#)
featuring our analysis of the destroyed satellites using the zoom-in simulations of Milky Way-size halos
[Stanford News](#), [APOD](#) *etc.*
mentioning the discovery of a dark substructure with ALMA strong lensing
- 2015 [Fermilab](#), [SLAC Today](#) *etc.*
mentioning the new dwarf galaxy candidates discovered by the Dark Energy Survey
- 2013 [SLAC Today](#), [NewScientist](#), *etc.*
mentioning our work on the velocity distribution of dark matter in the Milky Way
- 2012 [Symmetry Magazine](#)
mentioning our work on the “Rhapsody” zoom-in simulations of cluster-size halos

LIST OF PUBLICATIONS

- [42] A. Drlica-Wagner, [Y.-Y. Mao](#) *et al.*, “Probing the Fundamental Nature of Dark Matter with the Large Synoptic Survey Telescope,” [arXiv:1902.01055](#) [ADS]
- [41] E. O. Nadler, [Y.-Y. Mao](#), G. M. Green, R. H. Wechsler, “Modeling the Connection Between Subhalos and Satellites in Milky Way-Like Systems,” *ApJ* (to appear), [arXiv:1809.05542](#) [ADS]
- [40] C. E. Fielder, [Y.-Y. Mao](#), J. A. Newman, A. R. Zentner, T. C. Licquia, “Predictably Missing Satellites: Subhalo Abundance in Milky Way-like Halos,” [arXiv:1807.05180](#) [ADS]
- [39] Z. Zhai, J. L. Tinker, M. R. Becker, J. DeRose, [Y.-Y. Mao](#) *et al.*, “The Aemulus Project III: Emulation of the Galaxy Correlation Function,” [arXiv:1804.05867](#) [ADS]
- [38] T. McClintock, E. Rozo, M. R. Becker, J. DeRose, [Y.-Y. Mao](#) *et al.*, “The Aemulus Project II: Emulating the Halo Mass Function,” [arXiv:1804.05866](#) [ADS]
- [37] J. DeRose, R. H. Wechsler, J. L. Tinker, M. R. Becker, [Y.-Y. Mao](#) *et al.*, “The Aemulus Project I: Numerical Simulations for Precision Cosmology,” [arXiv:1804.05865](#) [ADS]
- 2018 [36] J. L. Tinker, C. Hahn, [Y.-Y. Mao](#), A. R. Wetzel, “Halo histories versus galaxy properties at $z = 0$ - III. The properties of star-forming galaxies,” *MNRAS*, 478, 4487 (2018) [arXiv][ADS]
- [35] J. L. Tinker, C. Hahn, [Y.-Y. Mao](#), A. R. Wetzel, C. Conroy, “Halo histories versus galaxy properties at $z = 0$ II: large-scale galactic conformity,” *MNRAS*, 477, 935 (2018) [arXiv][ADS]

- [34] D. Campbell, F. C. van den Bosch, N. Padmanabhan, Y.-Y. Mao *et al.*, “The galaxy clustering crisis in abundance matching,” *MNRAS*, **477**, 359 (2018) [arXiv][ADS]
- [33] E. O. Nadler, Y.-Y. Mao, R. H. Wechsler, S. Garrison-Kimmel, A. Wetzel, “Modeling the Impact of Baryons on Subhalo Populations with Machine Learning,” *ApJ*, **859**, 129 (2018) [arXiv][ADS]
- [32] Y.-Y. Mao, A. R. Zentner, R. H. Wechsler, “Beyond assembly bias: exploring secondary halo biases for cluster-size haloes,” *MNRAS*, **474**, 5143 (2018) [arXiv][ADS]
- [31] A. Tenneti, Y.-Y. Mao *et al.*, “The radial acceleration relation in disc galaxies in the MassiveBlack-II simulation,” *MNRAS*, **474**, 3125 (2018) [arXiv][ADS]
- [30] Y.-Y. Mao *et al.* (LSST Dark Energy Science Collaboration), “DESCQA: An Automated Validation Framework for Synthetic Sky Catalogs,” *ApJS*, **234**, 36 (2018) [arXiv][ADS]
- [29] J. U. Lange *et al.*, “Brightest galaxies as halo centre tracers in SDSS DR7,” *MNRAS*, **473**, 2830 (2018) [arXiv][ADS]
- 2017 [28] J. L. Tinker, A. R. Wetzel, C. Conroy, Y.-Y. Mao, “Halo histories versus Galaxy properties at $z = 0$ - I. The quenching of star formation,” *MNRAS*, **472**, 2504 (2017) [arXiv][ADS]
- [27] A. S. Villarreal, A. R. Zentner, Y.-Y. Mao *et al.*, “The inmitigable nature of assembly bias: the impact of halo definition on assembly bias,” *MNRAS*, **472**, 1088 (2017) [arXiv][ADS]
- [26] A. P. Hearin *et al.*, “Forward Modeling of Large-scale Structure: An Open-source Approach with Halotools,” *AJ*, **154**, 190 (2017) [arXiv][ADS]
- [25] H. Desmond, Y.-Y. Mao, R. H. Wechsler, R. A. Crain, J. Schaye, “On the galaxy-halo connection in the EAGLE simulation,” *MNRAS*, **471**, L11 (2017) [arXiv][ADS]
- [24] M. Geha, R. H. Wechsler, Y.-Y. Mao *et al.*, “The SAGA Survey. I. Satellite Galaxy Populations around Eight Milky Way Analogs,” *ApJ*, **847**, 4 (2017) [arXiv][ADS]
- [23] Y. Lu, A. Benson, A. Wetzel, Y.-Y. Mao *et al.*, “The Importance of Preventive Feedback: Inference from Observations of the Stellar Masses and Metallicities of Milky Way Dwarf Galaxies,” *ApJ*, **846**, 66 (2017) [arXiv][ADS]
- [22] B. V. Lehmann, Y.-Y. Mao, M. R. Becker, S. W. Skillman, R. H. Wechsler, “The Concentration Dependence of the Galaxy-Halo Connection: Modeling Assembly Bias with Abundance Matching,” *ApJ*, **834**, 37 (2017) [arXiv][ADS]
- 2016 [21] A. Drlica-Wagner *et al.*, “An Ultra-faint Galaxy Candidate Discovered in Early Data from the Magellanic Satellites Survey,” *ApJL*, **833**, L5 (2016) [arXiv][ADS]
- [20] Y. Lu, A. Benson, Y.-Y. Mao *et al.*, “The Connection between the Host Halo and the Satellite Galaxies of the Milky Way,” *ApJ*, **830**, 59 (2016) [arXiv][ADS]
- [19] Y. Wang *et al.*, “Sussing merger trees: stability and convergence,” *MNRAS*, **459**, 1554 (2016) [arXiv][ADS]
- [18] Y. D. Hezaveh, N. Dalal, D. P. Marrone, Y.-Y. Mao *et al.*, “Detection of Lensing Substructure Using ALMA Observations of the Dusty Galaxy SDP.81,” *ApJ*, **823**, 37 (2016) [arXiv][ADS]
- [17] A. J. Deason, Y.-Y. Mao, R. H. Wechsler, “The Eating Habits of Milky Way-mass

- Halos: Destroyed Dwarf Satellites and the Metallicity Distribution of Accreted Stars,” *ApJ*, 821, 5 (2016) [arXiv][ADS]
- 2015 [16] P. Behroozi *et al.*, “Major mergers going Notts: challenges for modern halo finders,” *MNRAS*, 454, 3020 (2015) [arXiv][ADS]
- [15] A. Drlica-Wagner *et al.* (DES Collaboration), “Eight Ultra-faint Galaxy Candidates Discovered in Year Two of the Dark Energy Survey,” *ApJ*, 813, 109 (2015) [arXiv][ADS]
- [14] Y.-Y. Mao, M. Williamson, R. H. Wechsler, “The Dependence of Subhalo Abundance on Halo Concentration,” *ApJ*, 810, 21 (2015) [arXiv][ADS]
- [13] P. A. Thomas *et al.*, “Sussing Merger Trees: A proposed Merger Tree data format,” arXiv:1508.05388 [ADS]
- 2014 [12] J. Lee *et al.*, “Sussing merger trees: the impact of halo merger trees on galaxy properties in a semi-analytic model,” *MNRAS*, 445, 4197 (2014) [arXiv][ADS]
- [11] S. Avila *et al.*, “SUSSING MERGER TREES: the influence of the halo finder,” *MNRAS*, 441, 3488 (2014) [arXiv][ADS]
- [10] Y.-Y. Mao, L. E. Strigari, R. H. Wechsler, “Connecting direct dark matter detection experiments to cosmologically motivated halo models,” *PRD*, 89, 063513 (2014) [arXiv][ADS]
- 2013 [9] C. Srisawat *et al.*, “Sussing Merger Trees: The Merger Trees Comparison Project,” *MNRAS*, 436, 150 (2013) [arXiv][ADS]
- [8] H.-Y. Wu, O. Hahn, R. H. Wechsler, P. S. Behroozi, Y.-Y. Mao, “Rhapsody. II. Subhalo Properties and the Impact of Tidal Stripping From a Statistical Sample of Cluster-size Halos,” *ApJ*, 767, 23 (2013) [arXiv][ADS]
- [7] Y.-Y. Mao, L. E. Strigari, R. H. Wechsler, H.-Y. Wu, O. Hahn, “Halo-to-halo Similarity and Scatter in the Velocity Distribution of Dark Matter,” *ApJ*, 764, 35 (2013) [arXiv][ADS]
- [6] H.-Y. Wu, O. Hahn, R. H. Wechsler, Y.-Y. Mao, P. S. Behroozi, “Rhapsody. I. Structural Properties and Formation History from a Statistical Sample of Re-simulated Cluster-size Halos,” *ApJ*, 763, 70 (2013) [arXiv][ADS]
- 2012 [5] T.-W. Chiu, T.-H. Hsieh, Y.-Y. Mao (TWQCD Collaboration), “Pseudoscalar meson in two flavors QCD with the optimal domain-wall fermion,” *Physics Letters B*, 717, 420 (2012) [ADS]
- 2011 [4] T.-W. Chiu, T.-H. Hsieh, Y.-Y. Mao (TWQCD Collaboration), “Topological susceptibility in two flavors lattice QCD with the optimal domain-wall fermion,” *Physics Letters B*, 702, 131 (2011) [arXiv][ADS]
- 2010 [3] W.-S. Hou, Y.-Y. Mao, C.-H. Shen, “Leading effect of CP violation with four generations,” *PRD*, 82, 036005 (2010) [arXiv][ADS]
- 2009 [2] Y.-Y. Mao, T.-W. Chiu, “Topological susceptibility to the one-loop order in chiral perturbation theory,” *PRD*, 80, 034502 (2009) [arXiv][ADS]
- [1] C.-F. Lee, Y.-Y. Mao, B. Reipurth, “Infall and Rotation Motions in the HH 111 Protostellar System: A Flattened Envelope in Transition to a Disk?” *ApJ*, 694, 1395 (2009) [arXiv][ADS]