

Sarah C. Millholland

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RESEARCH INTERESTS Extrasolar planet detection and characterization, planetary dynamics, architectures of planetary systems, orbital resonance

EDUCATION **Yale University, New Haven, CT** July 2016 -
Ph.D. in Astronomy, Expected May 2019
M.S. in Astronomy, May 2018

UC Santa Cruz, Santa Cruz, CA Sept. 2015 - June 2016
pursuit of Ph.D. in Astronomy and Astrophysics

University of Saint Thomas, Saint Paul, MN Sept. 2011 - May 2015
B.S., Physics; B.A., Mathematics, May 2015
Summa Cum Laude, GPA: 4.00

RESEARCH POSITIONS **Yale University, Astronomy Department** July 2016 -
UCSC, Astronomy & Astrophysics Department Sept. 2015 - June 2016
- NSF Graduate Research Fellow
- *Advisor: Prof. Greg Laughlin*

University of St. Thomas, Physics Department 2012-2013, 2015
- *Advisor: Prof. Gerry Ruch*

Harvard-Smithsonian Center for Astrophysics Summer 2014
REU in Solar Physics
- *Advisors: Dr. Antonia Savcheva and Dr. Edward DeLuca*

University of St. Thomas, Physics Department 2014
- *Advisor: Prof. Marty Johnston*

National Oceanic and Atmospheric Administration – Summer 2013
Laboratory for Atmospheric and Space Physics REU
in Solar and Space Physics
- *Advisor: Dr. Naomi Maruyama*

AWARDS - Tinsley Award for the Best Paper by a Yale Astronomy Graduate Student 2018
(for Millholland & Laughlin 2017b)
- DDA/AAS Raynor L. Duncombe Prize for Student Research 2018
- Yale Conference Travel Fellowship 2017
- NSF Graduate Research Fellowship 2017 -
- Summer Sagan Workshop Travel Award 2016
- UCSC Regents Fellowship 2015
- NSF Graduate Research Fellowship Honorable Mention 2015
- Goldwater Scholarship 2014-2015
- Smith Academic Scholarship 2014-2015
- Danger Mathematics Scholarship 2013-2014, 2014-2015
- UST Collaborative Inquiry Research Scholarship 2014
- Walczak Mathematics Scholarship 2013-2014
- B. John Barry Academic Scholarship 2012-2013

- UST Endowed Scholarship 2011-2015
- TEACHING EXPERIENCE
- Teaching Fellow, Planets and Stars, Yale University Spring 2017
 - Teaching Fellow, Physics of Planetary Systems, UCSC Spring 2016
 - Teaching Fellow, Overview of the Universe, UCSC Fall 2016
 - Teaching Assistant, Modern Physics, UST Springs 2014, 2015
 - Observatory Lab Instructor, Introduction to Astronomy, UST and the UST Observatory Fall 2012 - Spring 2015
- MENTORING EXPERIENCE
- Adrian Kulesza, Yale University undergraduate student (research project in “Astrophysics Research Methods”), Spring 2018
 - Rachel Cohen, Yale University undergraduate student (research project in “Astrophysics Research Methods”), Spring 2018
 - Samantha Berek, Yale University undergraduate student (mentored through the “Astro Sib” program), 2018 -
 - Marguerite Epstein-Martin, Yale University undergraduate student (co-advised with Greg Laughlin), 2017 - 2018
- FIRST AUTHOR PAPERS
8. **Millholland, S.** & Batygin, K. “Excitation of Planetary Obliquities Through Planet-Disk Interactions.” 2019, *ApJ*, 876, 119
 7. **Millholland, S.** & Laughlin, G. “Obliquity-Driven Sculpting of Exoplanetary Systems.” 2019, *Nature Astronomy*, arXiv: 1903.01386
 6. **Millholland, S.** & Laughlin, G. “Obliquity Tides May Drive WASP-12b’s Rapid Orbital Decay.” 2018, *ApJL*, 869, L15
 5. **Millholland, S.**, Laughlin, G., Teske, J., et al. “New Constraints on Gliese 876 – Exemplar of Mean-Motion Resonance.” 2018, *AJ*, 155, 106
 4. **Millholland, S.**, Wang, S., & Laughlin, G. “*Kepler* Multi-Planet Systems Exhibit Unexpected Intra-system Uniformity in Mass and Radius.” 2017, *ApJL*, 849, L33
 3. **Millholland, S.** & Laughlin, G. “Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates.” 2017, *AJ*, 154, 83
 2. **Millholland, S.** & Laughlin, G. “Constraints on Planet Nine’s Orbit and Sky Position within a Framework of Mean-motion Resonances.” 2017, *AJ*, 153, 91
 1. **Millholland, S.**, Wang, S., & Laughlin, G. “On the Detection of Non-Transiting Hot Jupiters in Multiple Planet Systems.” 2016, *ApJL*, 823, L7
- CO-AUTHOR PAPERS
4. Adams, A. D., **Millholland, S.**, & Laughlin, G. “Signatures of Obliquity in Thermal Phase Curves of Hot Jupiters.” 2019, submitted to *AAS Journals*
 3. Wang, S., Jones, M., Shporer, A., et al., including **Millholland, S.** “HD 202772Ab: A Transiting Hot Jupiter Around a Bright, Mildly Evolved Star in a Visual Binary Discovered by TESS.” 2019, *AJ*, 157, 51
 2. Becker, J. C., Khain, T., Hamilton, S. J., et al., including **Millholland, S.** “Discovery and Dynamical Analysis of an Extreme Trans-Neptunian Object with a High Orbital Inclination.” 2018, *AJ*, 156, 81
 1. Janvier, M., Savcheva, A., Pariat, E., Tassev, S., **Millholland, S.**, Bommier, V., McCauley, P., McKillop, S., Dougan, F. “Evolution of Flare Ribbons, Electric Currents and Quasi-separatrix Layers During an X-class Flare.” 2016, *A&A*, 591, A141

TALKS
(* = INVITED)

1. “The Role of Obliquities in Sculpting Short-Period Exoplanets.” Star and Planet Formation Seminar, University of Michigan, Ann Arbor, MI, March 2019
2. “Obliquity Tides and their Role in Understanding the Kepler Planet Period Ratio Distribution.” Kepler & K2 Science Conference V, Glendale, CA, March 2019
3. “The Role of Obliquities in Sculpting Short-Period Exoplanets.” Princeton Extrasolar Planet Discussion Group, Princeton University, Princeton, NJ, February 2019
4. * “The Role of Obliquities in Sculpting Short-Period Exoplanets.” Penn State Center for Exoplanets & Habitable Worlds Seminar, Penn State University, State College, PA, February 2019
5. “The Surprising Role of Obliquity Tides in Short-Period Exoplanets.” Boston Area Exoplanet Science Meeting #5, Boston University, Boston, MA, January 2019
6. “Consequences of Large Planetary Obliquities in Extrasolar Systems.” 2018 Connecticut Exoplanets Meeting, Wesleyan University, Middletown, CT, July 2018
7. “Obliquity-Driven Sculpting of Exoplanetary Systems.” Emerging Researchers in Exoplanet Science (ERES) IV, Pennsylvania State University, State College, PA, June 2018
8. “On f for 9.” Planet Nine Workshop, California Institute of Technology, Pasadena, CA, May 2018
9. “On the Obliquities of Planets in Close-in, Coplanar Systems.” Division of Dynamical Astronomy Meeting, San Jose, CA, April 2018
10. * “Data-Driven Dynamics of Planetary Systems.” Extrasolar Planets Seminar, NASA Goddard Space Flight Center, Greenbelt, MD, April 2018
11. * “Planet Formation Puzzles Near and Far.” Planetary Science Seminar, California Institute of Technology, Pasadena, CA, December 2017
12. * “Gliese 876 as an Exemplar.” Stars & Planets Seminar, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, November 2017
13. “New Constraints on the Multi-Resonant Planetary System, Gliese 876.” Numerical Integration Methods in Planetary Science, University of Toronto at Scarborough, Toronto, Ontario, August 2017
14. “Constraints on Planet Nine in a Mean-Motion Resonant Framework.” Numerical Integration Methods in Planetary Science, University of Toronto at Scarborough, Toronto, Ontario, August 2017
15. “Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates.” Kepler & K2 Science Conference IV, NASA Ames Research Center, Moffett Field, CA, June 2017
16. “Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates.” Emerging Researchers in Exoplanet Science (ERES) III, Yale University, New Haven, CT, June 2017
17. “Supervised Learning Detection of Sixty Non-Transiting Hot Jupiter Candidates.” 2017 Connecticut Exoplanets Meeting, Wesleyan University, Middletown, CT, May 2017

18. “Constraints on Planet Nine in a Mean-Motion Resonant Framework.” 2017 Aspen Winter Conference, Formation and Dynamical Evolution of Exoplanets, Aspen, CO, March 2017
19. “Constraints on Planet Nine in a Mean-Motion Resonant Framework.” Exoplanet Pizza Lunch, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, March 2017

POSTERS

1. Adams, A., **Millholland, S.** & Laughlin, G. “Detecting Planet Obliquity in Thermal Phase Curves.” Summer Sagan Workshop, Pasadena, CA, July 2018
2. **Millholland, S.** & Laughlin, G. “Obliquity-Driven Sculpting of Exoplanetary Systems.” Exoplanets II Conference, Cambridge, UK, July 2018
3. **Millholland, S.**, Laughlin, G., Butler, P., et al. “New Dynamical Constraints on the Multi-Resonant System, GJ 876.” Summer Sagan Workshop, Pasadena, CA, July 2016
4. **Millholland, S.**, Laughlin, G., Burt, J., et al. “A Search for Non-Transiting Hot Jupiters with Transiting Super-Earth Companions.” Exoplanets I Conference, Davos, Switzerland, July 2016
5. **Millholland, S.** & Ruch, G. “An Analysis of the Fixed Star Approximation in Transit Light Curve Models.” IAU General Assembly, Meeting #29, id.2255909, Honolulu, HI, August 2015
6. **Millholland, S.**, Savcheva, A. & DeLuca, E., “Magnetic Field Modeling of Complex, Flare Producing Active Regions.” American Geophysical Union Fall Meeting, abstract #SH13A-4079, San Francisco, CA, December 2014
7. **Millholland, S.**, Maruyama, N., Maute, A., et al. “Modeling Sudden Stratospheric Warming Events Using the Ionosphere-Plasmasphere Electrodynamics Model.” American Geophysical Union Fall Meeting, abstract #SA23A-2034, San Francisco, CA, December 2013
8. **Millholland, S.** & Ruch, G., “Modeling and Fitting Exoplanet Transit Light Curves.” AAS Meeting #221, id.343.10, Long Beach, CA, January 2013

BLOG POSTS

- “Tilting Planets and Sculpting Orbits”, guest post by S. Millholland at *Nature Research Behind the Paper*, March 2019. ([Click here to follow link.](#))

OUTREACH TALKS AND PUBLICATIONS

1. Talk at the Institute for Learning in Retirement, Albertus Magnus College, New Haven, CT, October 2018
2. “Chaos in Outer Space”, Yale Young Global Scholars Research Showcase (<http://globalscholars.yale.edu>), Yale University, New Haven, CT, June & July 2018
3. “The Hunt for Planet Nine”, Public Talks on Current Astronomy Research at Yale, Leitner Family Observatory & Planetarium, New Haven, CT, February 2018
4. “The Search for Planet Nine”, Pathways Summer Scholars Program Science Café (<http://pathwayssummerscholars.yale.edu>), Yale University, New Haven, CT, July 2017
5. “What and Where is Planet Nine?”, Yale Young Global Scholars Research Showcase (<http://globalscholars.yale.edu>), Yale University, New Haven, CT, July 2017

6. “Keys to Alien Worlds: how astronomers find extrasolar planets”, Pathways Summer Scholars Enrichment Workshop (<http://pathwayssummerscholars.yale.edu>). One-hour interactive introduction to exoplanet detection and characterization. Yale University, New Haven, CT, July 2017
7. “The Hunt for Planet Nine”, Yale Open Labs Science Café (<http://theopenlabs.org>), Yale University, New Haven, CT, April 2017
8. Invited panelist, 9th Annual Women in Leadership Conference, Yale University, New Haven, CT, February 2017
9. “The Search for Planet Nine”, a publication for the Hartford Courant News in Education series, *Science Matters!*, Hartford, CT, January 2017
10. “Exoplanet Exploration: How Astronomers are Uncovering the Mysteries of Alien Worlds”, LAMAT REU Program, UCSC, Santa Cruz, CA, July 2016
11. “Reading Scientific Literature”, LAMAT REU Program, UCSC, Santa Cruz, CA, June 2016
12. “Exoplanets: The Search for Another Earth”, Public Observing Night, University of St. Thomas Observatory, St. Paul, MN, March 2013
13. “Exoplanets: Methods of Detection and Characterization”, Minnesota Optical Society Meeting, St. Paul, MN, March 2013

TUTORING EXPERIENCE	- Head Tutor (i.e. tutor and supervisor of other student tutors), Mathematics Resource Center, UST	2015
	- Tutor of Mathematics and Physics, Mathematics Resource Center, UST	Feb. 2012 - May 2015
	- Private Tutor of Mathematics and Physics	Sept. 2013 - May 2015
PROFESSIONAL ACTIVITIES & SERVICE	- Referee for AJ, MNRAS	2017 - present
	- Scientific Organizing Committee Member, Emerging Researchers in Exoplanet Science (ERES) Conference IV	Jan. 2019 - June 2019
	- Reviewer for the OPTICON trans-national telescope access program (http://www.astro-opticon.org)	March 2019
	- Scientific & Local Organizing Committee Member, Emerging Researchers in Exoplanet Science (ERES) Conference III (http://eres-yale.science)	March 2017 - June 2017
	- Organizer of the UCSC astronomy prospective student visit	Sept. 2015 - March 2015
LEADERSHIP & SELECTED OUTREACH	- Organizer of Yale Open Labs Science Café Talk Series (http://theopenlabs.org)	May 2017 - Jan. 2018, Sept. 2018 -
	- Leader of Yale Young Global Scholars Program visits to the Astronomy Department (http://globalscholars.yale.edu)	July 2017, 2018
	- Executive board member of Yale Open Labs	Sept. 2016 - May 2017
	- Public Night Volunteer, Lick Observatory	Summer 2016
	- Astronomy Public Night Leader, UST Observatory	Sept. 2012 - May 2015
	- UST Math Club Vice President	Sept. 2014 - May 2015
- UST Math Club Communications Administrator	Feb. 2013 - May 2014	

- UST Physics Club Co-President Sept. 2012 - Dec. 2013
- UST Student Alumni Council Member Feb. 2012 - May 2013
- UST Women's Choir Board Member Feb. 2012 - Dec. 2013
- UST Volunteers in Action weekly volunteer Sept. 2011 - May 2013