MICHAEL ZHANG
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EDUCATION

Ph.D. in Astrophysics, California Institute of Technology, 2022. Ph.D. advisor H. Knutson.
M.S. in Astrophysics, California Institute of Technology, 2018
B.A. in Astrophysical Sciences *magna cum laude* and Certificate in Applications of Computing, Princeton University, 2014

PUBLICATIONS

11 first author, 3 second author, 5 contributing author articles.
Google Scholar: >1400 citations, h=14, i10=16
Thesis publications marked with *

1. A thermal emission phase curve of the sub-Neptune exoplanet GJ 1214b
   E.M.R. Kempton, **M. Zhang**, J.L. Bean, M.E. Steinrueck, A.A.A. Piette, V. Parmentier
   Submitted to Nature, February 2023
2. Detection of Atmospheric Escape from Four Young Mini Neptunes
   M. Zhang, H.A. Knutson, F. Dai, L. Wang, G.R. Ricker, R.P. Schwarz, C. Mann, K. Collins
   Astronomical Journal 165 62, 2023
3. More Evidence for Variable Helium Absorption from HD 189733b
   M. Zhang, P.W. Cauley, H.A. Knutson, K. France, L. Kreidberg, A. Oklopčić, S. Redfield, et al.
   Astronomical Journal 164 237, 2022
4. Helium Absorption from the Escaping Atmosphere of a Young Mini Neptune *
   M. Zhang, H.A. Knutson, L. Wang, F. Dai, O. Barragán
   Astronomical Journal 163 67, 2022
5. The young HD 73583 (TOI-560) planetary system: Two 10-M⊕ mini-Neptunes transiting a 750-Myr-old, bright, and active K dwarf
   O. Barragán, D.J. Armstrong, D. Gandolfi, I. Carleo, A.A. Vidotto, C. Villarreal D'Angelo, et al.
   MNRAS Volume 514, Issue 2, August 2022, Pages 1606–1627
6. Detection of Ongoing Mass Loss from HD 63433c, a Young Mini Neptune*
   M. Zhang, H.A. Knutson, F. Dai, L. Wang, L. dos Santos, L. Fossati, G. Henry, et al.
   Astronomical Journal 163 68, 2022
7. No escaping helium from 55 Cnc e*
   M. Zhang, H.A. Knutson, L. Wang, F. Dai, A. Oklopčić, R. Hu
   Astronomical Journal 161 181, 2021
8. PLATON II: New Capabilities And A Comprehensive Retrieval on HD 189733b Transit and Eclipse Data*
   M. Zhang, Y. Chachan, E. Kempton, H.A. Knutson, **W. Chang [student]**
   Astrophysical Journal 899 27, 2020
9. The orbit of WASP-12b is decaying
   S.W. Yee, J.N. Winn, H.A. Knutson, K.C. Patra, S. Vissapragada, **M. Zhang**, et al.
   Astrophysical Journal Letters 888 L5, 2020
10. Forward modelling and retrievals with PLATON, a fast open source tool*
    M. Zhang, Y. Chachan, E. Kempton, H.A. Knutson
    Publications of the Astronomical Society of the Pacific 131 034501, 2019
11. The long-term evolution and appearance of Type Iax postgenitor stars
    M. Zhang, J. Fuller, J. Schwab, and R.J. Foley
    Astrophysical Journal 872 29, 2019
12. Mass Loss from the Exoplanet WASP-12b Inferred from Spitzer Phase Curves
    T.J. Bell, **M. Zhang**, P.E. Cubillos, L. Dang, L. Fossati, K.O. Todorov, N.B. Cowan, et al.
    Monthly Notices of the Royal Astronomical Society 489 1995–2013, 2019
13. A Hubble PanCET Study of HAT-P-11b: A Cloudy Neptune with a Low Atmospheric Metallicity
    Y. Chachan, H. Knutson, P. Gao, T. Kataria, I. Wong, G. Henry, B. Benneke, **M. Zhang**, et al.
    Astronomical Journal 158 244, 2019

14. Modules for Experiments in Stellar Astrophysics (MESA): Pulsating Variable Stars, Rotation, Convective Boundaries, and Energy Conservation
B. Paxton, R. Smolec, J. Schwab, A. Gautschy, L. Bildsten, M. Cantiello, A. Dotter, F. Farmer, J.A. Goldberg, A.S. Jermyn, S.M. Kanbur, P. Marchant, A. Thoul, R.H.D. Townsend, W.M. Wolf, **M. Zhang**, F.X. Timmes
Astrophysical Journal Supplement 243 10, 2019
15. Detection of a Westward Hotspot Offset in the Atmosphere of a Hot Gas Giant CoRoT-2b
L. Dang, N.B. Cowan, J.C. Schwartz, E. Rauscher, **M. Zhang**, H.A. Knutson, et al.
Nature Astronomy 2 220–227, 2018
16. Phase curves of WASP-33b and HD 149026b and a New Correlation Between Phase Curve Offset and Irradiation Temperature*
M. Zhang, H.A. Knutson, T. Kataria, J.C. Schwartz, N.B. Cowan, A.P. Showman, et al.
Astronomical Journal, Volume 155, Issue 2, article id. 83, 17 pp. (2018)
17. Precision multi-band photometry with a DSLR camera
M. Zhang, G.Á. Bakos, K. Penev, Z. Csubry, J. D. Hartman, W. Bhatti, M. de Val-Borro
Publications of the Astronomical Society of the Pacific 128 035001, 2016
18. POET: A Model for Planetary Orbital Evolution Due to Tides on Evolving Stars
K. Penev, **M. Zhang**, B. Jackson
Publications of the Astronomical Society of the Pacific 126 553, 2014
19. Stars Get Dizzy After Lunch
M. Zhang, K. Penev
Astrophysical Journal 787 131, 2014

PRESS COVERAGE

Mini-Neptunes may become super-Earths as the exoplanets lose their atmospheres. Article by Science News (2022).

Puffy Planets Lose Atmospheres, Become Super Earths (2022). Joint press release by NASA, Caltech, and Keck Observatory, followed by news articles in Sky & Telescope, Newsweek, Daily Mail, Yahoo News (French), and many more.

SUCCESSFUL PROPOSALS AS PI

Space telescopes:

- Lyman alpha measurements from two mini Neptunes around one star (Hubble Space Telescope General Observer #17221, 2022). 15 orbits.
- Lyman alpha absorption from the only mini Neptune with measured helium outflow (Hubble Space Telescope General Observer #16779, 2021). 15 orbits.
- The First and Only Multi-wavelength Map of an Ultra-short-period Sub-Earth (James Webb Space Telescope General Observer #2508, 2021). 15.7 hours.
- Probing mass loss from two mini-Neptunes orbiting a young solar analogue (Hubble Space Telescope General Observer #16319, 2020). 36 orbits.
- Photoevaporation from small planets orbiting young, active stars (XMM-Newton #088287, 2020). 36 kiloseconds.
- Photoevaporation from small planets orbiting young, active stars (II) (XMM-Newton #090300, 2021). 24 kiloseconds.

Keck telescope (submitted on my behalf by H.A. Knutson):

- Probing mass loss from small planets orbiting young, active stars (2022A). 2.5 nights.
- Probing mass loss from small planets orbiting young, active stars (2021B). 3 nights.
- Probing mass loss from small planets orbiting young, active stars (2021A). 2 nights.
- Probing mass loss from two mini-Neptunes orbiting a young solar analogue (2020B). 2 nights.
- Detecting an Exotic Helium Planet with NIRSPEC (2020B). 0.5 nights.
- Probing the Exosphere and Thermal Emission of a Super Earth (2019B). 2 nights.
- Probing the Atmosphere of a Super Earth (2019A). 1 night.

Las Cumbres Observatory:

- Refining the Ephemeris of Young, Active Stars Hosting Small Planets (2021A). 24 hours.

SUCCESSFUL PROPOSALS AS CO-I

Bold = significant contributions

- **Determining the Atmospheric Composition of the Super-Earth 55 Cancri e** (James Webb Space Telescope General Observer #1952, 2021)
- A Deep Molecular Survey of HD 189733b (James Webb Space Telescope General Observer #1633, 2021)
- Testing Formation Hypotheses for Jupiter and Neptune Using Exoplanetary Analogues (Keck 2021A)
- The Life and Death of Ultra-Hot Jupiter WASP-12b (Hubble Space Telescope General Observer #16236, 2020)
- Are magnetic fields suppressing atmospheric escape on the dayside of the exoplanet HD189733b? (Keck 2020B)
- **Probing the Atmospheric Composition of the Warm Neptune GJ 436b** (Keck 2020A)

EMPLOYMENT

Postdoctoral Scholar at University of Chicago Sept 2022 - Present

- 51 Pegasi b fellowship + Margaret Burbidge fellowship
- Continued astronomical research in exoplanet atmospheres

Postdoctoral Scholar at Caltech Feb 2022 - Aug 2022

- Continued research started as a graduate student

Graduate Student at Caltech Sept 2016 - Feb 2022

- Led comprehensive study of atmospheric escape from two mini Neptunes orbiting a young solar analogue, tying together data from many telescopes (HST, Keck, XMM, CHEOPS, ROSAT, and APT) to understand both star and planet
- Achieved first detection of atmospheric escape from young mini Neptunes in both Lyman alpha and He I 1083 nm lines
- Lead development of PLATON, a forward modelling and retrieval code
- Mentored undergraduate student Wenjun Chang on summer research project
- Wrote successful proposals for time on JWST, Hubble, XMM, Keck, and LCO
- Analyzed phase curves, transit spectra, and emission spectra of exoplanet atmospheres (HST, Spitzer, Keck/NIRSPEC), particularly HD 189733b, 55 Cnc e, WASP-33b, HD 149026b

Software Engineer at Microsoft July 2014 – August 2016

- Worked on a variety of products relating to cloud computing as part of the Data Platform Engineering Systems group, using a wide variety of technologies and languages
- Worked on all aspects of Data Migration Assistant
- Created a Python SDK for DocumentDB, a web portal for Windows Fabric, and the machine learning code used in anomaly detection service
- Wrote MongoDB module of DocumentDB Data Migration Tool, which has tens of thousands of downloads
- Technologies used include: .NET, AngularJS, SQL Server, MongoDB, MySQL
- Languages used include: C#, C++, Python, HTML/CSS/Javascript
- Promoted after one year, half a year earlier than average

Software Developer in Test Intern at Microsoft June 2013 – Aug 2013

- Using MVC4, created website to automate Virtual Hard Disk creation
- Worked on web service behind the portal, and database behind the web service
- Received full-time offer as a result of performance during this internship

Research Assistant at Princeton Sept 2012 – March 2014

- Worked with Professor Sylvian Chassang to create and run economics experiments
- Maintained website for these experiments
- Modelled contract performance in Python

Research intern at Princeton Summer 2011/2012

- Interned in physics department, working on the Atacama B-mode Search cosmology experiment with Prof Suzanne Stags
- Developed software for ABS, currently observing in Chile. Wrote user interfaces as well as libraries for data analysis, simulation, and visualization
- Set up software and hardware for data collection computer
- Worked on designing, simulating, and building microwave filters

TALKS

- Exoplanets IV, 2022
- Invited speaker, UCSC FLASH seminar, 2021
- University of Chicago exoplanet journal club, 2021
- McGill Planet Lunch, 2021
- Planetary and exoplanetary Astronomy Lunch Seminar, University of Maryland, 2021
- Invited speaker, JWST Early Release Science Program, 2021
- Invited speaker, Keck Planet Imager and Characterizer High Resolution Workshop, 2021
- Forward modelling and retrievals with PLATON, American Astronomical Society, 2019
- Modelling and retrievals of exoplanet atmospheres with PLATON, Yuk Yung Lunch Seminar, Caltech, 2018
- The long-term evolution and appearance of Type Iax postgenitor stars, ZTF Workshop, Santa Barbara, 2018
- The long-term evolution and appearance of Type Iax postgenitor stars, EuroWD, Austin, 2018
- Phase curves of WASP-33b and HD 149026b and a New Correlation Between Phase Curve Offset and Irradiation Temperature", American Astronomical Society, 2018

OUTREACH

Active in Caltech Astronomy outreach 2017–Present

Creator and manager of Caltech Astro YouTube channel, now with 300,000 views
Lecture series speaker, *Astronomical Discoveries of the Ancient Greeks*, 2020
Astro on Tap speaker, *The Future of Spaceflight*, 2019
Frequent Q&A panelist or telescope volunteer/captain for monthly Lecture & Stargazing series
Exhibit volunteer at Pasadena AstroFest 2018

Palomar Observatory talk, *The Exceptional Astronomical Discoveries of the Ancient Greeks*, 2021
Caltech Rooftop Observatory co-manager, 2020--present
Pasadena Senior Center lecturer, *The story of astronomy and how it changed the world*, 2019

SERVICE

Canada-France-Hawaii Telescope (CFHT) reviewer, 2021
Reviewer for AJ and ApJL, 2019-
The Telescope Access Program (TAP) proposal reviewer, 2019
Chambliss Poster Judge, American Astronomical Society, 2019

AWARDS

51 Pegasi b Fellowship (2022)
Margaret Burbidge Fellowship (2022)
Hubble Fellowship, declined (2022)
Sigma Xi Book Award for Outstanding Research (Princeton, 2014)
Elected to membership in the Society of Sigma Xi (Princeton, 2014)
Silver medal at International Physics Olympiad (Croatia, 2010)

TEACHING & MENTORING

Summer Undergraduate Research Fellows (SURF) mentor, Caltech (summer 2019)

Mentored freshman undergraduate Caltech student Wenjun Chang, who created database of molecular line lists and a utility to compute opacities. Wenjun was co-author on Zhang et al 2020 (PLATON II paper).

SURF co-mentor (with Erik Petigura), Caltech (summer 2018)

Advised and guided high school student Grant Regen in reducing Hubble transmission spectrum of K2-24b and running retrievals to infer atmospheric parameters.

Teaching Assistant in Optical Instrumentation (instructor: Dimitri Mawet), Caltech (2018)

Tested and improved lab assignments
Led lab sessions
Graded lab notebooks

Teaching Assistant in Cosmology (instructor: George Djorgovski), Caltech (2018)

Taught weekly hour-long recitations
Graded all homeworks and exams