

# THADDEUS D. KOMACEK

5734 S. Ellis Ave. Chicago, IL 60637

tkomacek@uchicago.edu • <https://geosci.uchicago.edu/people/tad-komacek/>

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## CURRENT POSITION

**51 Pegasi b Postdoctoral Fellow** • The University of Chicago • 2018-Present

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## EDUCATION

**The University of Arizona** August 2013-May 2018 • Tucson, AZ

Ph.D, Planetary Sciences, Advisor: Prof. Adam Showman

**The University of Chicago** 2009-2013 • Chicago, IL

B.S. Geophysical Sciences with Honors, B.A. Physics with a Specialization in Astrophysics

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## PUBLICATIONS

### Peer-Reviewed Articles

1. **Komacek T.D.**, Thorngren D.P., Lopez E.D., and Ginzburg S., Re-inflation of Warm and Hot Jupiters, in revision at AAS Journals.
2. **Komacek T.D.**, Fauchez T., Wolf E.T., and Abbot D.S., Clouds Will Likely Prevent the Detection of Water Vapor in JWST Transmission Spectra of Terrestrial Exoplanets, 2020, ApJL, 888, L20.
3. Mansfield M., Bean J.L., Stevenson K.B., **Komacek T.D.** et al., Evidence for H<sub>2</sub> Dissociation and Recombination Heat Transport in the Atmosphere of KELT-9b, 2020, ApJL, 888, L15.
4. **Komacek T.D.** and Showman A.P., Temporal Variability in Hot Jupiter Atmospheres, 2020, ApJ, 888, 2.
5. Tan X. and **Komacek T.D.**, The Atmospheric Circulation of Ultra-Hot Jupiters, 2019, ApJ, 886, 26.
6. **Komacek T.D.**, Jansen M.F., Wolf E.T., and Abbot D.S., Scaling Relations for Terrestrial Exoplanet Atmospheres from Baroclinic Criticality, 2019, ApJ, 883, 46.
7. **Komacek T.D.**, Showman A.P., and Parmentier V., Vertical Tracer Mixing in Hot Jupiter Atmospheres, 2019, ApJ, 881, 152.
8. Zellem R.T., Swain M.R., Cowan N.B., Bryden G., **Komacek T.D.** et al., Constraining Exoplanet Metallicities and Aerosols with ARIEL: An Independent Study by the Contribution to ARIEL Spectroscopy of Exoplanets (CASE) Team, 2019, PASP, 131, 094401.
9. Yang H., **Komacek T.D.**, and Abbot D.S., 2019, Effects of Radius and Gravity on the Inner Edge of the Habitable Zone, ApJL, 876, L27.
10. **Komacek T.D.** and Abbot D.S., The Atmospheric Circulation and Climate of Terrestrial Planets Orbiting Sun-like and M-dwarf Stars over a Broad Range of Planetary Parameters, 2019, ApJ, 871, 245.
11. Koll D.D.B. and **Komacek T.D.**, Atmospheric Circulations of Hot Jupiters as Planetary Heat Engines, 2018, ApJ, 853, 133.

12. **Komacek T.D.** and Youdin A.N., Structure and Evolution of Internally Heated Hot Jupiters, 2017, ApJ, 844, 94.
13. **Komacek T.D.**, Showman A.P., and Tan X., Atmospheric Circulation of Hot Jupiters: Dayside-Nightside Temperature Differences. II. Comparison with Observations, 2017, ApJ, 835, 198.
14. **Komacek T.D.** and Abbot D.S., Effect of Surface-Mantle Water Exchange Parameterizations on Exoplanet Ocean Depths, 2016, ApJ, 832, 54.
15. **Komacek T.D.** and Showman A.P., Atmospheric Circulation of Hot Jupiters: Dayside-Nightside Temperature Differences, 2016, ApJ, 821, 16.
16. Rogers T.M. and **Komacek T.D.**, Magnetic Effects in Hot Jupiter Atmospheres, 2014, ApJ, 794, 132.

### Unrefereed Articles

1. **Komacek T.D.** and Tan X., Effects of Dissociation/Recombination on the Day–Night Temperature Contrasts of Ultra-hot Jupiters, 2018, Research Notes of the AAS, 2, 36.
2. Apai D. and 32 other authors including **Komacek T.D.**, Exploring Other Worlds: Science Questions for Future Direct Imaging Missions (EXOPAG SAG15 Report), 2017, arXiv:1708.02821.

### MENTORSHIP

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**Andrea Salazar** (Undergraduate researcher, October 2019-)

- Andrea is an undergraduate at the University of Chicago doing her senior thesis work with Dorian Abbot, Stephanie Olson, and myself at the University of Chicago. Andrea is studying how substellar continents of different sizes affect the climate, habitability, and ocean dynamics of tidally locked planets orbiting M dwarf stars.

**Caroline Chael** (High School visiting researcher, June-August 2019)

- Caroline is a high school student from Indiana who spent the summer of 2019 working with Stephanie Olson and myself at the University of Chicago. Caroline studied the cloud microphysics of exoplanet atmospheres in order to determine how cloud formation might vary over the wide range of possible exoplanets.

**Hang Luo** (Undergraduate visiting researcher, July-September 2019)

- Hang is an undergraduate student from Peking university who spent the summer of 2019 at the University of Chicago working with Dorian Abbot and myself. Hang studied the atmospheric circulation of warm Jupiter exoplanets using the MITgcm.

**Haynes Stephens** (Graduate student, September 2018-September 2019)

- Haynes is a graduate student at the University of Chicago. Dorian Abbot, Stephanie Olson, and I co-mentored Haynes on a project using the ROCKE-3D GCM to study the effect of substellar continents on the climate of tidally locked terrestrial exoplanets.

**Huanzhou Yang** (Undergraduate visiting researcher and graduate student, June 2018-)

- Huanzhou is a graduate student at the University of Chicago in Dorian Abbot's group who is working with Prof. Abbot and I on the cloud microphysics of terrestrial exoplanets. When he was an undergraduate, Huanzhou spent the summer of 2018 at the University of Chicago working with Dorian Abbot and myself. In this summer, Huanzhou studied how the inner edge of the habitable zone depends on planetary radius and surface gravity using the general circulation model ExoCAM, which led to a publication (Yang et al. 2019, ApJL, 876, L27).

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#### TEACHING, SERVICE & OUTREACH

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**Referee, Review Panel Member, Session Organizer** (The Astrophysical Journal, Geophysical Research Letters, Nature Astronomy, Monthly Notices of the Royal Astronomical Society, Astronomy & Astrophysics, NASA Exoplanets Research Program, American Geophysical Union)

**Science Olympiad** (National Science Olympiad Astronomy Co-Supervisor: 2009-Present)

- As a national event co-supervisor for Science Olympiad, I present at coaches clinics, develop educational materials and exams, and supervise the Astronomy event at invitational, regional, and national competitions.

**International Olympiad on Astronomy and Astrophysics** (United States Team: 2014-Present)

- I am a member of the U.S.A. team board, which involves organizing the National Astronomy Olympiad yearly.
- I was the 2014 U.S.A. team leader, which involved mentoring the (high-school) students competing in the competition and supervising the 2014 competition in Romania.

**UChicago Astronomy & Astrophysics Diversity, Equity, and Inclusion Journal Club** (2018-Present)

- I participate in the bi-weekly DEI Journal Club for students and postdocs in the UChicago Astronomy & Astrophysics department.

**Noble Academy Python Club** (Instructor: 2018-2019)

- I taught Chicago high school students the Python programming language as a weekly after-school activity.

**University of Arizona** (Teaching Assistant: 2017-2018)

- Teaching assistant for "The Universe and Humanity: Origin and Destiny," Fall 2017, with Prof. Travis Barman.
- Teaching assistant for "Our Golden Age of Planetary Exploration," Spring 2018, with Prof. Jeff Andrews-Hanna.

**Lunar and Planetary Laboratory Allyship Auxiliary** (Co-founder: 2017-2018)

- Helped start the LPL Allyship Auxiliary (<https://www.lpl.arizona.edu/about/department-life/allyship>), a biweekly discussion on equity, diversity, and inclusion based on the DPS Men's Auxiliary.

**Lunar and Planetary Laboratory Journal Club** (Graduate Student Coordinator: 2015-2018)

- I organized, found speakers for, and ran the weekly departmental journal club as a graduate student at LPL.

**Ryerson Astronomical Society (UChicago)** (President: 2011-2013; Webmaster: 2010-2011)

- As an undergraduate, I ran weekly meetings and public observing nights.
- Additionally, I organized and led trips for local elementary school students to tour Ryerson observatory.

**Splash! Chicago** (Instructor: 2009-2012)

- As an undergraduate, I developed and taught introductory astronomy courses for local high school students.

HONORS AND AWARDS

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1. Recipient of 2018-2021 Heising-Simons Foundation 51 Pegasi b Postdoctoral Fellowship
2. Recipient of 2017 LPL Gerard P. Kuiper Memorial Award for graduate student scholarship
3. Recipient of 2015 and 2016 University of Arizona Galileo Circle Scholarship
4. Recipient of 2014-2017 NASA Earth and Space Science Fellowship Program Award
5. Recipient of 2013-2014 Lieutenant Colonel Kenneth Rondo Carson and Virginia Bryan Carson LPL Graduate Fellowship

PRESENTATIONS

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**Seminars, Colloquia, & Invited Talks**

1. "The Atmospheric Circulation and Evolution of Warm, Hot, and Ultra-Hot Jupiters," Purdue EAPS Colloquium. January 30, 2020.
2. "The Atmospheric Circulation of Terrestrial Planets Orbiting M Dwarfs and Sun-like Stars." *Exoplanet Lunch*, Harvard CfA. April 9, 2019.
3. "The Atmospheric Circulation of Ultra-Hot Jupiters." *Stars & Planets Seminar*, Harvard CfA. April 8, 2019.
4. "The Atmospheric Circulation of Ultra-Hot Jupiters." *Exoplanet Tea*, MIT. April 4, 2019.
5. "The Atmospheric Circulation of Ultra-Hot Jupiters." *Astronomy Lunch*, MIT. February 7, 2019.
6. "The Atmospheric Circulation of Ultra-Hot Jupiters." *Noon Balloon*, University of Chicago. November 16, 2018.
7. "A Predictive Theory for the Atmospheric Circulation of Hot Jupiters." *Planetary Lunch*, University of California, Santa Cruz. February 14, 2017.
8. "A Predictive Theory for Vertical Mixing in Hot Jupiter Atmospheres." *Exoplanet Lunch*, Harvard CfA. January 24, 2017.
9. "A Predictive Theory for the Atmospheric Circulation of Hot Jupiters." *MIT Atmospheric Sciences Seminar*, MIT. January 23, 2017.
10. "Effect of Surface-Mantle Water Exchange Parameterizations on the Prevalence of Waterworlds." *Kavli Institute Brown Bag*, MIT. January 23, 2017.

11. "Partitioning of Water Between Surface and Mantle: What Makes a Waterworld?" *Origins Seminar*, University of Arizona. October 31, 2016.
12. "Understanding Water Cycling Between Mantle and Surface on Terrestrial Exoplanets Using Simplified Models." *Lunar and Planetary Laboratory Conference*, University of Arizona. August 19, 2016.

### Contributed Oral Presentations

1. Komacek T.D., Jansen M., Wolf T., Abbot D. (2019) Scaling Relations for the Equator-to-Pole Temperature Contrast and Bulk Lapse Rate of Terrestrial Exoplanets. *AGU*.
2. Komacek T.D., Lopez E., Thorngren D., Youdin A. (2019) Re-inflation of Hot Jupiters. *Lake Michigan Exoplanet Meeting*.
3. Komacek T.D. (2019) The Atmospheric Circulation and Climate of Terrestrial Planets over a Broad Range of Planetary Parameters. *Exoclimes V*.
4. Komacek T.D. and Abbot D.S. (2019) The Climate and Habitability of Terrestrial Exoplanets Orbiting M Dwarf Stars. *51 Pegasi b Summit*.
5. Komacek T.D., Fauchez T., Kopparapu R., Wolf E.T., and Abbot D.S. (2019) The Effects of Clouds on Observable Properties of Terrestrial Exoplanets: Results from a Large Suite of GCMs. *AbSciCon*.
6. Komacek T.D. Tan X., Mansfield M., and Bean J. (2019) The Atmospheric Circulation of Ultra-Hot Jupiters. *OWL Summer Program*.
7. Komacek T.D., Showman A.P., and Parmentier V. (2018) Vertical Mixing in Hot Jupiter Atmospheres. *Lake Michigan Exoplanet Meeting*.
8. Komacek T.D. and Abbot D.S. (2018) The Atmospheric Circulation of Terrestrial Planets over a Broad Range of Planetary Parameters. *Sagan Fellows Symposium*.
9. Komacek T.D. and Koll D.D.B. (2018) Constraining Atmospheric Drag in Hot Jupiter Atmospheres Using Doppler Spectroscopy. *High Resolution Spectroscopy for Exoplanet Atmospheres*.
10. Komacek T.D., Showman A.P., and Parmentier V. (2018) Vertical Mixing in Hot Jupiter Atmospheres. *Cloud Academy, École de Physique des Houches*.
11. Komacek T.D. and Abbot D.S. (2018) The Atmospheric Circulation and Cloud Behavior in a Large Suite of Terrestrial Planet GCMs. *CCTP III*.
12. Komacek T.D. and Abbot D.S. (2018) The Atmospheric Circulation and Cloud Behavior in a Large Suite of Terrestrial Planet GCMs. *51 Pegasi b Summit*.
13. Komacek T.D. and Showman A.P. (2017) The Atmospheric Circulation of Hot Jupiters: A Hierarchical Modeling Approach. *DPS 49*.
14. Komacek T.D. and Abbot D.S. (2017) Effect of Surface-Mantle Water Exchange Parameterizations on the Prevalence of Waterworlds. *AbSciCon*.

15. Komacek T.D. and Abbot D.S. (2016) Partitioning of Water between Surface and Mantle on Terrestrial Exoplanets: Effect of Surface-Mantle Water Exchange Parameterizations on Ocean Depth. *AGU*.
16. Komacek T.D. and Showman A.P. (2016) A Predictive Theory for the Atmospheric Circulation of Hot Jupiters. *DPS* **48**.
17. Komacek T.D. and Showman A.P. (2016) A Predictive Theory for the Atmospheric Circulation of Hot Jupiters. *Exoclimes* **IV**.
18. Komacek T.D. and Youdin A.N. (2015) Structure and Evolution of Internally Heated Hot Jupiters. *DPS* **47**.
19. Komacek T.D. and Showman A.P. (2015) Transitions in Efficiency of Heat Redistribution in Hot Jupiter Atmospheres. *International Colloquium of the Paris Institute of Astrophysics* **31**.
20. Komacek T.D., Rogers T.M., Barman, T.S., Showman A.P., Youdin A.N. (2014) Effects of Magnetism on the Atmospheres and Evolution of Hot Jupiters. *DPS* **46**.

### Contributed Poster Presentations

1. Komacek T.D., Fauchez T., Wolf E.T., Abbot D.S. (2019) Clouds Inhibit the Detection of Water in Transmission Spectra of Terrestrial Exoplanets Orbiting M Dwarf Stars. *NASA SEEC Symposium*.
2. Komacek T.D. and Showman A.P. (2019) Time-Variability in Hot Jupiter Atmospheres. *ESS* **4**.
3. Komacek T.D., Abbot D.S. (2018) The Atmospheric Circulation and Observable Properties of a Large Suite of Terrestrial Planet GCMs. *AGU*.
4. Komacek T.D., Showman A.P., Tan X., Parmentier V. (2017) A Predictive Theory for Vertical Mixing in Hot Jupiter Atmospheres. *École de Physique des Houches*.
5. Komacek T.D. and Showman A.P. (2016) A Predictive Theory for the Atmospheric Circulation of Hot Jupiters. *Kavli Summer Program in Astrophysics*.
6. Komacek T.D. and Showman A.P. (2015) Dayside-Nightside Temperature Differences in Hot Jupiter Atmospheres. *AGU*.
7. Komacek T.D. and Showman A.P. (2015) Dayside-Nightside Temperature Differences in Hot Jupiter Atmospheres. *ESS* **3**.
8. Komacek T.D., Young D. (2015) Exoplanet Science in the National Science Olympiad. *DPS* **47**.
9. Komacek T.D. and Youdin A.N. (2015) Effects of Turbulent Mixing on the Evolution and Structure of Hot Jupiters. *SPF* **1**.
10. Youdin A.N. and Komacek T.D. (2014) Hot Jupiter Radii: A Turbulent History. *DPS* **46**.
11. Komacek T.D., Young D., Schroeder D.M., Van Hecke M.A. (2014) Star Formation and Exoplanetary Systems in the National Science Olympiad Astronomy Event for High School Students. *DPS* **46**.

12. Komacek T.D., Rogers T.M., Showman A.P. (2014) Magnetohydrodynamic Simulations of Hot Jupiters: Temperature Dependent Magnetic Conductivity. *Exoclimes III*.
13. Komacek T.D., Ciesla F.J, Davison T.M. (2013) A Model For the Three-Dimensional Heating of a Planetesimal. *LPSC 44*.