

Juliette Becker

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Research Interests / Goals

My major goal is to build a coherent model of planet formation that reproduces the planet populations and covariances seen in the observational data. I am also interested in habitability and how the specific dynamics of each exoplanet system affects its feasibility for supporting life.

Appointments

51 Pegasi b Postdoctoral Fellow, Caltech	Sept. 2019 - present
Postdoctoral Scholar (funded by Leinweber Fellowship), University of Michigan	Summer 2019

Education

University of Michigan	Ann Arbor, MI
<i>M.S. in Astronomy and Astrophysics</i>	<i>August 2016</i>
<i>PhD in Astronomy and Astrophysics (advisor: Fred Adams)</i>	<i>May 2019</i>

California Institute of Technology	Pasadena, CA
<i>B.S. Astrophysics with honor and a minor in English</i>	<i>September 2010 - June 2014</i>

Awards

Ralph B. Baldwin Prize in Astronomy	2021
2019 ProQuest Distinguished Dissertation Award	2020
51 Pegasi b Fellowship	2019
Leinweber Center for Theoretical Physics Graduate Fellowship	2018
University of Michigan Aspire, Advance, Achieve Mentoring Award (Nominee)	2018
DPS Bill Hartmann Student Travel Grant	2017
K2SciCon Student Travel Award	2015, 2019
DDA/AAS Raynor L. Duncombe Prize for Student Research	2015
National Science Foundation Graduate Research Fellowship	2014-2019
Chambliss Astronomy Achievement Student Awards, honorable mention	2014
Golden Ankle Dedication and Leadership Award (Caltech)	2011, 2013, 2014
Richter Scholar, Summer Undergraduate Research Fellow (Caltech)	2013
Celia Peterson Leadership Award (Caltech)	2012, 2013
Alain Porter Memorial Summer Undergraduate Research Fellow (Caltech)	2012
ARCS (Achievement Rewards for College Scientists) Fellowship	2012, 2013, 2014
SCIAC Scholar-Athlete Award	2011, 2012, 2013, 2014
Lingle Merit Award (Caltech)	2011

Peer Reviewed Publications

48 total: 13 first author, 13 second author, h-index = 22, total citations ~ 1430

First Author Publications:

48. **Becker, J. C.**, Seligman, D. Z., Adams, F. C., Styczinski, M. J. 2023. "The Influence of Tidal Heating on the Habitability of Planets Orbiting White Dwarfs." arXiv e-prints. doi:10.48550/arXiv.2303.02217, Accepted to ApJL

47. **Becker, J. C.**, Batygin, Konstantin, et al. “Migrating Planets into Ultra-short-period Orbits during Episodic Accretion Events.” *The Astrophysical Journal*, 919, 76 (2021).
46. **Becker, J.**, Batygin, K., et al. “The Origin of Systems of Tightly Packed Inner Planets with Misaligned, Ultra-short-period Companions.” *The Astronomical Journal*, 160, 254 (2020).
45. **Becker, J.**, Gallo, Elena, et al. “A Coupled Analysis of Atmospheric Mass Loss and Tidal Evolution in XUV Irradiated Exoplanets: The TRAPPIST-1 Case Study.” *The Astronomical Journal*, 159, 275 (2020).
44. **Becker, J. C.**, Vanderburg, Andrew, et al. “A Discrete Set of Possible Transit Ephemerides for Two Long-period Gas Giants Orbiting HIP 41378.” *The Astronomical Journal*, 157, 19 (2019).
43. **Becker, J. C.**, Khain, T., et al. “Discovery and Dynamical Analysis of an Extreme Trans-Neptunian Object with a High Orbital Inclination.” *The Astronomical Journal*, 156, 81 (2018).
42. **Becker, J. C.**, Vanderburg, Andrew, et al. “Exterior Companions to Hot Jupiters Orbiting Cool Stars Are Coplanar.” *The Astronomical Journal*, 154, 230 (2017).
41. **Becker, J. C.**, Adams, Fred C., et al. “Evaluating the Dynamical Stability of Outer Solar System Objects in the Presence of Planet Nine.” *The Astronomical Journal*, 154, 61 (2017).
40. **Becker, J. C.** & Adams, Fred C.. “Effects of unseen additional planetary perturbers on compact extrasolar planetary systems.” *Monthly Notices of the Royal Astronomical Society*, 468, 549 (2017).
39. **Becker, J. C.** & Adams, Fred C.. “Oscillations of relative inclination angles in compact extrasolar planetary systems.” *Monthly Notices of the Royal Astronomical Society*, 455, 2980 (2016).
38. **Becker, J. C.**, Vanderburg, Andrew, et al. “WASP-47: A Hot Jupiter System with Two Additional Planets Discovered by K2.” *The Astrophysical Journal Letters*, 812, L18 (2015).
37. **Becker, J. C.**, Johnson, John Asher, et al. “Extracting Radial Velocities of A- and B-type Stars from Echelle Spectrograph Calibration Spectra.” *The Astrophysical Journal Supplement Series*, 217, 29 (2015).
36. **Becker, J. C.** & Batygin, Konstantin. “Dynamical Measurements of the Interior Structure of Exoplanets.” *The Astrophysical Journal*, 778, 100 (2013).

Second Author Publications:

35. Weisserman, D.¹, **Becker, J. C.**, et al. “Kepler-80 Revisited: Assessing the Participation of a Newly Discovered Planet in the Resonant Chain.” *The Astronomical Journal*, 165, 89 (2023).
34. Seligman, Darryl Z., **Becker, J.**, et al. “Inferring Late-stage Enrichment of Exoplanet Atmospheres from Observed Interstellar Comets.” *The Astrophysical Journal Letters*, 933, L7 (2022).
33. Belkovski, Michelle¹, **Becker, J.**, et al. “A Multiplanet System’s Sole Super-puff: Exploring Allowable Physical Parameters for the Cold Super-puff HIP 41378 f.” *The Astronomical Journal*, 163, 277 (2022).
32. Epstein-Martin, Marguerite¹, **Becker, J.**, et al. “Generating Stellar Obliquity in Systems with Broken Protoplanetary Disks.” *The Astrophysical Journal*, 931, 42 (2022).
31. Brefka, L.¹ & **Becker, J. C.**. “A General Origin for Multiplanetary Systems With Significantly Misaligned USP Planets.” *The Astronomical Journal*, 162, 242 (2021).
30. Khain, T.¹, **Becker, J. C.**, et al. “The Resonance Hopping Effect in the Neptune-planet Nine System.” *Publications of the Astronomical Society of the Pacific*, 132, 124401 (2020).
29. Khain, T.¹, **Becker, J. C.**, et al. “Dynamical Classification of Trans-Neptunian Objects Detected by the Dark Energy Survey.” *The Astronomical Journal*, 159, 133 (2020).

¹Student-led paper

28. Quinn, Samuel N., **Becker, J. C.**, et al. “Near-resonance in a System of Sub-Neptunes from TESS.” *The Astronomical Journal*, 158, 177 (2019).
27. Khain, T.¹, **Becker, J. C.**, et al. “Dynamical Analysis of Three Distant Trans-Neptunian Objects with Similar Orbits.” *The Astronomical Journal*, 156, 273 (2018).
26. Rodriguez, Joseph E., **Becker, J. C.**, et al. “A Compact Multi-planet System with a Significantly Misaligned Ultra Short Period Planet.” *The Astronomical Journal*, 156, 245 (2018).
25. Vanderburg, Andrew, **Becker, J. C.**, et al. “Precise Masses in the WASP-47 System.” *The Astronomical Journal*, 154, 237 (2017).
24. Vanderburg, Andrew, **Becker, J. C.**, et al. “Five Planets Transiting a Ninth Magnitude Star.” *The Astrophysical Journal Letters*, 827, L10 (2016).
23. Muirhead, Philip S., **Becker, J.**, et al. “Characterizing the Cool KOIs. VI. H- and K-band Spectra of Kepler M Dwarf Planet-candidate Hosts.” *The Astrophysical Journal Supplement Series*, 213, 5 (2014).

Other Publications:

22. Christian, Sam; Vanderburg, Andrew, **Becker, J.**; et al. “A Possible Alignment Between the Orbits of Planetary Systems and their Visual Binary Companions.” *The Astronomical Journal*, 163, 207 (2022).
21. Hedges, Christina et al., **including Becker, J.** “Erratum: ”TOI-2076 and TOI-1807: Two Young, Comoving Planetary Systems within 50 pc Identified by TESS that are Ideal Candidates for Further Follow Up” (2021, AJ, 162, 54).” *The Astronomical Journal*, 163, 143 (2022).
20. Hedges, Christina et al., **including Becker, J.** “TOI-2076 and TOI-1807: Two Young, Comoving Planetary Systems within 50 pc Identified by TESS that are Ideal Candidates for Further Follow Up.” *The Astronomical Journal*, 162, 54 (2021).
19. Seager, Sara et al., **including Becker, J.** “HD 219134 Revisited: Planet d Transit Upper Limit and Planet f Transit Nondetection with ASTERIA and TESS.” *The Astronomical Journal*, 161, 117 (2021).
18. Vanderburg, Andrew et al., **including Becker, J.** “A giant planet candidate transiting a white dwarf.” *Nature*, 585, 363 (2020).
17. Huang, Chelsea X. et al., **including Becker, J.** “TESS Spots a Hot Jupiter with an Inner Transiting Neptune.” *The Astrophysical Journal Letters*, 892, L7 (2020).
16. Bernardinelli, Pedro H. et al., **including Becker, J.** “Trans-Neptunian Objects Found in the First Four Years of the Dark Energy Survey.” *The Astrophysical Journal Supplement Series*, 247, 32 (2020).
15. Markwardt, Larissa et al., **including Becker, J.** “Search for L5 Earth Trojans with DECam.” *Monthly Notices of the Royal Astronomical Society*, 492, 6105 (2020).
14. Li, Gongjie; Dai, Fei, & **Becker, J.** “Mutual Inclination Excitation by Stellar Oblateness.” *The Astrophysical Journal Letters*, 890, L31 (2020).
13. Lin, Hsing Wen et al., **including Becker, J.** “Detection of Diatomic Carbon in 2I/Borisov.” *The Astrophysical Journal Letters*, 889, L30 (2020).
12. Wong, Ian; Shporer, Avi, **Becker, J. C.**; et al. “The Full Kepler Phase Curve of the Eclipsing Hot White Dwarf Binary System KOI-964.” *The Astronomical Journal*, 159, 29 (2020).
11. Lund, Mikkel N. et al., **including Becker, J.** “Asteroseismology of the Multiplanet System K2-93.” *The Astronomical Journal*, 158, 248 (2019).

10. Vanderburg, Andrew et al., **including Becker, J.** “TESS Spots a Compact System of Super-Earths around the Naked-eye Star HR 858.” *The Astrophysical Journal Letters*, 881, L19 (2019).
9. Batygin, Konstantin et al., **including Becker, J.** “The planet nine hypothesis.” *Physics Reports*, 805, 1 (2019).
8. Lin, Hsing Wen et al., **including Becker, J.** “Evidence for color dichotomy in the primordial Neptunian Trojan population.” *Icarus*, 321, 426 (2019).
7. Weiss, Lauren M. et al., **including Becker, J.** “New Insights on Planet Formation in WASP-47 from a Simultaneous Analysis of Radial Velocities and Transit Timing Variations.” *The Astronomical Journal*, 153, 265 (2017).
6. Gerdes, D. W. et al., **including Becker, J.** “Discovery and Physical Characterization of a Large Scattered Disk Object at 92 au.” *The Astrophysical Journal Letters*, 839, L15 (2017).
5. Fox, Ori D. et al., **including Becker, J.** “On the nature of Type II_n/Ia-CSM supernovae: optical and near-infrared spectra of SN 2012ca and SN 2013dn.” *Monthly Notices of the Royal Astronomical Society*, 447, 772 (2015).
4. Schaefer, G. H. et al., **including Becker, J.** “The expanding fireball of Nova Delphini 2013.” *Nature*, 515, 234 (2014).
3. Howard, Andrew W. et al., **including Becker, J.** “The NASA-UC-UH ETA-Earth Program. IV. A Low-mass Planet Orbiting an M Dwarf 3.6 PC from Earth.” *The Astrophysical Journal*, 794, 51 (2014).
2. Muirhead, Philip S. et al., **including Becker, J.** “Characterizing the Cool KOIs. V. KOI-256: A Mutually Eclipsing Post-common Envelope Binary.” *The Astrophysical Journal*, 767, 111 (2013).
1. Ben-Ami, Sagi et al., **including Becker, J.** “Discovery and Early Multi-wavelength Measurements of the Energetic Type Ic Supernova PTF12gzk: A Massive-star Explosion in a Dwarf Host Galaxy.” *The Astrophysical Journal Letters*, 760, L33 (2012).

Teaching

University of Michigan Astronomy Dept. (Guest Lecturer, ASTRO 220)	2020
Guest Lecturer (7 total lectures at Middle/High Schools)	2017 - current
MREACH (Michigan Ross Enriching Academics in Collab. with High Schools) Instructor	2017 - 2018
UMich Honors College, Astronomy Dept. & Physics Dept. (Guest Lecturer, four classes)	2018 - 2019
University of Michigan, Astrobiology & The Solar System Teaching Assistant	2015
Caltech (The Evolving Universe & Cosmology) Teaching Assistant	2013, 2014

Selected Leadership, Service, & Outreach

Division of Dynamical (DDA) Astronomy Committee Member	2020 - current
DDA Mentoring Program Founder & Chair (voted the DDA’s 2021 DEI initiative)	2020 - current
Division of Dynamical Astronomy Annual Meeting SOC	2021
Exoplanet Demographic Conference LOC (Caltech, 500+ participants)	2020
Panelist & External Reviewer (NASA / various TACs)	3 years
Referee for ApJ, AJ, ApJ Letters, PASP, A&A, PSJ, Nature, MNRAS	2016 - current
Caltech FSRI Research Mentor (2 students)	Summer 2020
Michigan UROP & Research Scholars Mentor (3 students)	2019 - 2021
VESPA Hands-on session co-leader, Sagan Summer Workshop (Caltech)	2018
Michigan Astronomy Graduate Admissions Committee	2018 - 2019
UMich Astronomy Graduate Mentoring Program (Chair)	2017 - 2019
UMich Astronomy Dept. Star/Planet Formation Journal Club Organizer	2016 - 2017

University of Michigan Graduate Outreach Coordinator	2015 - 2016
Astronomy On Tap (Presenter, Ann Arbor)	2016
UMich Conference for Undergraduate Women in Physics Organizing Board	2014 - 2016
Caltech NCAA Intercollegiate Track and Field Team Captain	2013, 2014
Caltech NCAA Intercollegiate Cross Country Team Captain	2012, 2013

Conference Invited Talks

5. “More Complete Orbital States with TTVs.” TESS Science Meeting, Virtual Format (August 2021).
4. “The Origins of Multi-Planet Systems with Misaligned, Nearby Companions”. Exoplanets in Southern California (ExSoCal), Virtual Format (September 2020).
3. “System Solutions with Data and Dynamics”. Kavli Foundation Symposium: Planetary Architectures Panel, Boston, MA (August 2019).
2. “Drawing Insights on Past Planetary Migration from Current System States”. Planet-Star Connections in the Era of TESS and Gaia, Santa Barbara, CA (May 2019).
1. “Differentiating Between Planet Nine and Alternative Theories”. 156th Annual Meeting of the National Academy of the Sciences Breakout Session (The Search for Planet Nine), Washington DC (April 2019)

Seminars / Colloquia

24. “Small Planets, Short Orbits”. Caltech Center for Comparative Planetary Evolution Invited Talk, Pasadena, CA (December 2022)
23. “Planet Formation from a Dynamical Perspective: Using Theoretical Methods to Constrain and Understand the Outcomes of Planet Formation”. University of Wisconsin Madison Astronomy Colloquium, Madison, WI (April 2022)
22. “Planet Formation from a Dynamical Perspective: Using Theoretical Methods to Constrain and Understand the Outcomes of Planet Formation”. University of Michigan Physics Colloquium, Ann Arbor, MI (February 2022)
21. “Explaining the Orbits of Ultra-Short-Period Planets Through Disk-Planet and Star-Planet Interactions”. Michigan State Astronomy Seminar, Lansing, MI (November 2021)
20. “Explaining the Orbits of Ultra-Short-Period Planets Through Disk-Planet and Star-Planet Interactions”. University of Kansas Physics Astronomy Colloquium, Lawrence, KS (October 2021)
19. “Planet Formation from Lifetimes of Multi-Planet Systems Around Evolving Stars”. UC Berkeley Planetary Science Seminar, Virtual (May 2021)
18. “Planet Formation from a Dynamical Perspective: Using Theoretical Methods to Constrain and Understand the Outcomes of Planet Formation”. Cal State LA Physics Department Colloquium, Virtual (February 2021)
17. “Planet Formation from a Dynamical Perspective: Using Theoretical Methods to Constrain and Understand the Outcomes of Planet Formation”. Yale Astronomy Department Seminar, Virtual (February 2021)
16. “Planet Formation from a Dynamical Perspective: Using Theoretical Methods to Constrain and Understand the Outcomes of Planet Formation”. Massachusetts Institute of Technology Physics Department Colloquium, Virtual (February 2021)
15. “The Origins of Multi-Planet Systems with Misaligned, Nearby Companions”. University of Oklahoma Physics and Astronomy Department Colloquium, Virtual (November 2020)
14. (Cancelled due to COVID-19). Harvard ITC Seminar (April 2020)
13. “Classifying New Kuiper Belt Objects from DES Data: from Planet Nine to the most extreme TNOs”. Kansas University Seminar, Lawrence, KS (March 2020)
12. “Classifying New Kuiper Belt Objects from DES Data: from Planet Nine to the most extreme TNOs”. Flatiron Center for Computational Astrophysics Lunch Talk, New York, NY (January 2020)
11. “Dynamical Insights Towards Gas Giant Formation and Migration Processes”. UC Riverside Hewitt Club Department of Earth & Planetary Science Colloquium, Riverside, CA (November 2019)

10. “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration”. Georgia Tech Colloquium, Atlanta, GA (October 2019)
9. “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration”. IPAC Seminar, Caltech, Pasadena, CA (October 2019)
8. “Using Dynamics to Determine Observationally Ill-Constrained Planet Parameters”. TESS Science Meeting, Boston, MA (July 2019)
7. “Extreme Trans-Neptunian Objects from DES Data and Insights Towards Planet Nine”. University of Washington Lunch Seminar (February 2019)
6. “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” Penn State CEHW Seminar (November 2018)
5. “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” University of Texas ISM Seminar (September 2018)
4. “An Extreme, High-Inclination Trans-Neptunian Object and Insights Towards Planet Nine.” University of Texas Special Seminar (September 2018)
3. “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” Caltech Yuk Lunch Seminar (April 2018)
2. “Effects of Unseen Planetary Companions on Compact Exoplanetary Systems.” Harvard Center for Astrophysics Stars and Planets Seminar (April 2017)
1. “The Dynamics of WASP-47.” University of Toronto, Centre for Planetary Science Lunch Seminar (April 2016)

Contributed Talks

10. “Forming Ultra-Short-Period Planets Via Disk Migration in a Sub-Keplerian Disk.” 2021, Division of Dynamical Astronomy (AAS/DDA) meeting 52 (Virtual)
9. “The Origins of Multi-Planet Systems with Misaligned, Nearby Companions.” 2021, Exoplanets Orbits & Dynamics (hosted by University of Liege, Belgium, held virtually)
8. “The Origins of Multi-Planet Systems with Misaligned, Nearby Companions.” 2020, Exoplanet Demographics: Piecing Together the Complete Puzzle of Planet Populations (hosted by NASA Exoplanet Science Institute, IPAC/Caltech, held virtually)
7. “The Origins of Multi-Planet Systems with Misaligned, Nearby Companions.” 2020, Division of Dynamical Astronomy (AAS/DDA) meeting 51 (Virtual)
6. “The Origin of Systems of Tightly Packed Inner Planets with Misaligned, Ultra-Short-Period Companions.” 2020, American Astronomical Society 236th Meeting, 222.03 (Virtual)
5. “Dynamically Determining Observationally Ill-Constrained Planet Parameters: Towards Precise Transit Ephemerides for the Benchmark System HIP 41378.” 2019, Kepler Science Meeting, (Glendale, CA)
4. “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” 2018, American Astronomical Society, Division of Dynamical Astronomy (AAS/DDA) meeting 49 (San Jose, CA), 203.01
3. “Evaluating the Dynamical Stability of Outer Solar System Objects in the Presence of Planet Nine.” 2017, Division of Planetary Sciences Meeting (405.07)
2. “The Dynamics of WASP-47.” 2016, AAS/DDA Meeting
1. “Inclination Excitation in Compact Extrasolar Planetary Systems.” 2015, AAS/DDA, 46, #101.05

Press Coverage

2015 BP519 (discovery and analysis of the most highly inclined trans-Neptunian Object, Becker et al. 2018). Articles on this science result were published in The Atlantic, Quanta Magazine, Newsweek, Popular Mechanics, Business Insider, Space.com, among others.

WASP-47 (discovery and analysis of a hot Jupiter with nearby planetary companions, Becker et al. 2015). Articles on this science result were published in Astronomy Online, Science Daily, India Times, and system was included on JPL-produced list of “20 Most Interesting Exoplanet Systems.”

Other. Other work that I contributed to as a coauthor has been featured on Smithsonian Magazine, CNN, Fox News, Sky and Telescope Magazine, Spectrum News, and The Weather Channel. I have also been interviewed by The Atlantic, the NPR show All Things Considered, Newsweek, National Geographic and local public radio as an uninvolved scientist on other groups’ work.

Observing and Computing Experience

CPU time through XSEDE

PI, 1.9 million CPU hours (total) on Open Science Grid (2014 - 2021)

PI, 600 node hours (total) on Stampede2 (2018)

SWIFT X-Ray Telescope, Space

PI, 40 ks (2019)

Magellan 6.5m Telescope, Chile

PI, 4 half-nights using IMACS on Baade 6.5m telescope (May 2018)

Co-I, 2 nights using M2FS on Clay 6.5m telescope (June 2016)

PI, 2 nights using PFS on Clay 6.5m telescope (March - August 2015, queue observing)

Palomar Observatory, Palomar Mountain, CA

Assisted with 30 nights total of observing on TripleSpec between 2012 - 2014

Keck, Mauna Kea, HI

Assisted with 4 nights of remote observing on HIRES in 2012 - 2013