

# Juliette Becker

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## Research Interests / Goals

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My two current major research goals are as follows: (1) to construct a model of the mechanisms by which hot Jupiters form (and to determine the extent that these processes overlap with the formation mechanisms of longer-period, Jupiter-sized planets), and (2) to understand the populations of unseen objects in our solar system and beyond.

## Appointments

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

## Education

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<b>University of Michigan</b>	<b>Ann Arbor, MI</b>
<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>

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

## Peer Reviewed Publications

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**37 total: 11 first author, 8 second author, h-index = 17, total citations ~ 790**

### First Author Publications:

37. **Becker, J. C.**, Batygin, K., Fabrycky, D. et al. “The Origin of Systems of Tightly Packed Inner Planets with Misaligned, Ultra-Short-Period Companions” 2020, Accepted to Astronomical Journal
36. **Becker, J. C.**, Gallo, E., Hodges-Kluck, E., Adams, F. C., Barnes, R. “A Coupled Analysis of Atmospheric Mass Loss and Tidal Evolution in XUV Irradiated Exoplanets: the TRAPPIST-1 Case Study” 2020, Astronomical Journal, 159, 275
35. **Becker, J. C.**, Vanderburg, A., Rodriguez, J. E., et al. “A Discrete Set of Possible Transit Ephemerides for Two Long Period Gas Giants Orbiting HIP 41378.” 2019, Astronomical Journal, 157, 19.
34. **Becker, J. C.**, Khain, T., Hamilton, S. J., Adams, F., et al. “Discovery and Dynamical Analysis of an Extreme Trans-Neptunian Object with a High Orbital Inclination.” 2018, Astronomical Journal, 156, 81
33. **Becker, J. C.**, Vanderburg, A., Adams, F., Khain, T., & Bryan, M. “Exterior Companions to Hot Jupiters orbiting Cool Stars are Coplanar.” 2017, Astronomical Journal, 154, 230
32. **Becker, J. C.**, Adams, F., Khain, T., Hamilton, S., & Gerdes, D. “Evaluating the Dynamical Stability of Outer Solar System Objects in the Presence of Planet Nine.” 2017, Astronomical Journal, 154, 61
31. **Becker, J. C.**, & Adams, F. C. “Effects of Unseen Additional Planetary Perturbors on Compact Extrasolar Planetary Systems.” 2017, Monthly Notices of the Royal Astronomical Society, 468, 549

30. **Becker, J. C.**, & Adams, F. C. “Oscillations of Relative Inclination Angles in Compact Extrasolar Planetary Systems.” 2016, MNRAS, 455, 2980
29. **Becker, J. C.**, Vanderburg, A., Adams, F.C., Rappaport, S.A., & Schwengeler, H. M. “WASP-47: A Hot Jupiter System with Two Additional Planets Discovered by K2” 2015, Astrophysical Journal Letters, 812, L18
28. **Becker, J. C.**, Johnson, J. A., Vanderburg, A., & Morton, T. D. “Extracting Radial Velocities of A-and B-type Stars from Echelle Spectrograph Calibration Spectra” 2015, Astrophysical Journal Supplement Series, 217 29
27. **Becker, J.**, & Batygin, K. “Dynamical Measurements of the Interior Structure of Exoplanets.” 2013, Astrophysical Journal, 778, 100

### Second Author Publications:

26. Khain, T.<sup>1</sup>, **Becker, J. C.**, Adams, F. “The Resonance Hopping Effect in the Neptune-Planet Nine System.” 2020, submitted to PASP.
25. Khain, T.<sup>1</sup>, **Becker, J. C.**, Lin, H.W., et al. “Dynamical Classification of Trans-Neptunian Objects Detected by the Dark Energy Survey.” 2020, The Astronomical Journal 159, 133.
24. Quinn, S. N., **Becker, J. C.**, et al. “Near-resonance in a system of sub-Neptunes from TESS.” 2019, Astronomical Journal, 158, 177
23. Khain, T.<sup>1</sup>, **Becker, J. C.**, Adams, F. et al. “Dynamical Analysis of Three Distant Trans-Neptunian Objects with Similar Orbits.” 2018, Astronomical Journal, 156, 273.
22. Rodriguez, J. E., **Becker, J. C.**, Eastman, J. D., et al. “A Compact Multi-Planet System With A Significantly Misaligned Ultra Short Period Planet.” 2018, Astronomical Journal, 156, 245.
21. Vanderburg, A., **Becker, J. C.**, Buchhave, L. A., et al. “Precise Masses in the WASP-47 System.” 2017, Astronomical Journal, 154, 237.
20. Vanderburg, A., **Becker, J. C.**, Kristiansen, M. H., et al. “Five Planets Transiting a Ninth Magnitude Star.” 2016, Astrophysical Journal Letters, 827, L10
19. Muirhead, P. S., **Becker, J.**, Feiden, G. A., et al. ”Characterizing the Cool KOIs. VI. H- and K-band Spectra of Kepler M Dwarf Planet-Candidate Hosts.” 2014, Astrophysical Journal Supplement Series, 213, 5

### Other Publications:

18. Vanderburg, A., Rappaport, S., Xu, S., Crossfield, I, **Becker, J. C.**, et al. “A Giant Planet Candidate Transiting a White Dwarf.” 2020. arXiv e-prints (arXiv:2009.07282) Accepted to Nature
17. Huang, C. X., Quinn, S. N., Vanderburg, A., **Becker, J. C.**, et al. “TESS Spots a Hot Jupiter with an Inner Transiting Neptune.” 2020, Astrophysical Journal Letters, 892, L7
16. Markwardt, L., Gerdes, D. W., Malhotra, R., **Becker, J. C.**, Hamilton, S. J., Adams, F. C. “Search for L5 Earth Trojans with DECam.” 2020, Monthly Notices of the Royal Astronomical Society 492, 6105.

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<sup>1</sup>student advised

15. Li, G., Dai, F., **Becker, J. C.** “Mutual Inclination Excitation by Stellar Oblateness.” 2020, The Astrophysical Journal 890, L31.
14. Lin, H. W., et al. including **Becker, J. C.** “Detection of Diatomic Carbon in 2I/Borisov.” 2020, The Astrophysical Journal 889, L30.
13. Wong, I., Shporer, A., **Becker, J. C.**, et al. “The full Kepler phase curve of the eclipsing hot white dwarf binary system KOI-964.” 2020, Astronomical Journal, 159, 29
12. Lund, M. N., et al including **Becker, J.C.** “Asteroseismology of the Multiplanet System K2-93.” 2019. The Astronomical Journal 158, 248.
11. Bernardinelli, P. H., Bernstein, G. M., Sako, M., et al including **Becker, J.C.** “Trans-Neptunian objects found in the first four years of the Dark Energy Survey.” 2020, Astrophysical Journal Supplement Series, 247, 32
10. Vanderburg, A., Huang, C. X., Rodriguez, J. E., **Becker, J. C.**, et al. “TESS Spots a Compact System of Super-Earths around the Naked-eye Star HR 858.” 2019. The Astrophysical Journal 881, L19.
9. Batygin, K., Adams, F. C., Brown, M. E., **Becker, J. C.** “The Planet Nine Hypothesis.” 2019. Physics Reports, 805, 1
8. Lin, H.W., Gerdes, D. W., et al including **Becker, J.C.** “Evidence for Color Dichotomy in the Primordial Neptunian Trojan Population.” 2019, Icarus, 321, 426.
7. Weiss, L. M., Deck, K., Sinukoff, E., et al including **Becker, J.C.** “Mass and Eccentricity Constraints in the WASP-47 Planetary System from a Simultaneous Analysis of Radial Velocities & Transit Timing Variations.” 2017, AJ, 153, 265
6. Gerdes, D., Sako, M., Hamilton, S., et al including **Becker, J.C.** “Discovery and Physical Characterization of a Large Scattered Disk Object at 92 au.” 2017, Astrophysical Journal Letters, 839, L15
5. Fox, O., Silverman, J., Filippenko, A., Mauerhan, J., **Becker, J.**, et al. “Suppressed [Fe III] in Type Ia-CSM Supernovae: Optical and Near-Infrared Spectra of SNe 2012ca and 2013dn”. 2015, MNRAS, 447, 772
4. Schaefer, G., Brummelaar, T., Gies, D., et al including **Becker, J.** “Imaging the Expanding Fireball of Nova Delphini 2013.” 2014, Nature, 515 (7526). pp. 234-236.
3. Howard, A., Marcy, G., Fischer, D., 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.” 2014, Astrophysical Journal, 794, 51
2. Muirhead, P. S., Vanderburg, A., Shporer, A., **Becker, J.**, et al. “Characterizing the Cool KOIs. V. KOI-256: A Mutually Eclipsing Post-common Envelope Binary.” 2013, Astrophysical Journal, 767, 111
1. Ben-Ami, S., Gal-Yam, A., Filippenko, A. V., 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.” 2012, Astrophysical Journal, 760, L33

## Awards

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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

## Selected Leadership, Service, Outreach, Teaching

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Panelist, External Reviewer (NASA)	1 year
Division of Dynamical Astronomy Committee Member	2020 - 2023
Caltech FSRI Research Mentor (2 students)	Summer 2020
University of Michigan Astronomy Dept. (Guest Lecturer, ASTRO 220)	2020
VESPA Hands-on session co-leader, Sagan Summer Workshop (Caltech)	2018
UMich Honors College, Astronomy Dept. & Physics Dept. (Guest Lecturer, four classes)	2018 - 2019
MREACH (Michigan Ross Enriching Academics in Collab. with High Schools) Instructor	2017 - 2018
UMich Astronomy Graduate Mentoring Program (Chair)	2017 - 2019
Referee for ApJ, AJ, ApJ Letters, PASP, A&A	2016 - current
University of Michigan Graduate Outreach Coordinator	2015 - 2016
University of Michigan, Astrobiology & The Solar System Teaching Assistant	2015
UMich Conference for Undergraduate Women in Physics Organizing Board	2014 - 2016
Caltech (The Evolving Universe & Cosmology) Teaching Assistant	2013, 2014
Caltech NCAA Intercollegiate Track and Field Team Captain	2013, 2014
Caltech NCAA Intercollegiate Cross Country Team Captain	2012, 2013

## Conference Invited Talks

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“The Origins of Multi-Planet Systems with Misaligned, Nearby Companions”. Exoplanets in Southern California (ExSoCal), Virtual Format (September 2020).

“System Solutions with Data and Dynamics”. Kavli Foundation Symposium: Planetary Architectures Panel, Boston, MA (August 2019).

“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).

“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

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(Cancelled due to COVID-19). Harvard ITC Seminar (April 2020)  
 “Classifying New Kuiper Belt Objects from DES Data: from Planet Nine to the most extreme TNOs”. Kansas University Seminar, Lawrence, KS (March 2020)  
 “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)  
 “Dynamical Insights Towards Gas Giant Formation and Migration Processes”. UC Riverside Hewitt Club Department of Earth & Planetary Science Colloquium, Riverside, CA (November 2019)  
 “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration”. Georgia Tech Colloquium, Atlanta, GA (October 2019)  
 “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration”. IPAC Seminar, Caltech, Pasadena, CA (October 2019)  
 “Using Dynamics to Determine Observationally Ill-Constrained Planet Parameters”. TESS Science Meeting, Boston, MA (July 2019).  
 “Extreme Trans-Neptunian Objects from DES Data and Insights Towards Planet Nine”. University of Washington Lunch Seminar (February 2019)  
 “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” Penn State CEHW Seminar (November 2018)  
 “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” University of Texas ISM Seminar (September 2018)  
 “An Extreme, High-Inclination Trans-Neptunian Object and Insights Towards Planet Nine.” University of Texas Special Seminar (September 2018)  
 “Forming Hot Jupiters: Observational Constraints on Gas Giant Formation and Migration.” Caltech Yuk Lunch Seminar (April 2018)  
 “Effects of Unseen Planetary Companions on Compact Exoplanetary Systems.” Harvard Center for Astrophysics Stars and Planets Seminar (April 2017)  
 “The Dynamics of WASP-47.” University of Toronto, Centre for Planetary Science Lunch Seminar (April 2016)

## Contributed Talks

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“The Origin of Systems of Tightly Packed Inner Planets with Misaligned, Ultra-Short-Period Companions.” 2020, American Astronomical Society 236th Meeting, 222.03 (Virtual)  
 “Dynamically Determining Observationally Ill-Constrained Planet Parameters: Towards Precise Transit Ephemerides for the Benchmark System HIP 41378.” 2019, Kepler Science Meeting, (Glendale, CA)  
 “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  
 “Evaluating the Dynamical Stability of Outer Solar System Objects in the Presence of Planet Nine.” 2017, Division of Planetary Sciences Meeting (405.07)  
 “The Dynamics of WASP-47.” 2016, AAS/DDA Meeting  
 “Inclination Excitation in Compact Extrasolar Planetary Systems.” 2015, AAS/DDA, 46, #101.05

## Press Coverage

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**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 CNN, Fow News, Sky and

Telescope Magazine, Spectrum News, The Weather Channel, and Smithsonian Magazine. I have also been interviewed by The Atlantic, the NPR show All Things Considered, Newsweek, and local Detroit radio as an uninvolved scientist on other groups' work.

## **Observing and Computing Experience**

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### **CPU time through XSEDE**

PI, 1.6 million CPU hours (total) on Open Science Grid (2014 - 2020)

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

### **SWIFT X-Ray Telescope, Space**

PI, 40 ks (2019)

### **Magellan 6.5m Telescope, Chile**

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

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

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

### **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