Luke G. Bouma

Astrophysicist · he/him

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Research Interests

- Exoplanets: formation, evolution, and long-term fates.
- Stellar and galactic astrophysics, including the evolution of young stars & dissolution of their host clusters.
- Computational methods in large-scale astrophysical data analysis ("big data").

Professional Appointments

California Institute of Technology — Pasadena, CA
Heising Simons 51 Pegasi b Fellow. Supervisor: L. Hillenbrand — *09/2021–present*

Education

Princeton University — Princeton, NJ
Ph.D, Astrophysics. Thesis: "Origins and Fates of Close-In Giant Planets" — *09/2018–08/2021*
M.A, Astrophysics. Advisor: J. Winn — *09/2016–08/2018*

Massachusetts Institute of Technology — Cambridge, MA
Physics Ph.D. program (transferred after completing first year). Advisor: J. Winn — *09/2015-08/2016*

University of Southern California — Los Angeles, CA
B.Sc, Physics; B.A, Mathematics; Minor, Astronomy — *09/2011-05/2015*

Publication Summary

Refereed publications: 63 (11 first author; 2 second author; 28 many author; 22 TESS collaboration).

Non-refereed publications: 1 (1 white paper).

Citations: 404 first & second author; 1415 many author; 5453 code. *h-index*: 25.

My first & second author publications are listed here; a full publication list is available here.

Distinctions

2021–24 Heising-Simons 51 Pegasi b Fellowship *Postdoctoral fellowship in planetary astronomy.*

2020–21 Charlotte Elizabeth Procter Fellowship *Honorific fellowship for final-year Ph.D. students.*

05/2015 USC Discovery Scholar *University fellowship based on research portfolio.*

04/2014 Goldwater Scholarship *National fellowship for undergraduates pursuing careers in STEM.*

2011–15 USC Trustee and University Scholarships *Full tuition award and merit stipend.*

Grants (The † symbol denotes active or pending awards)

† 12/2023 PI: NASA TESS Cycle 6 GI Program G06030.
A Census Of Complex Periodic Variables.

† 02/2023 Collaborator: NASA Astrophysics Data Analysis Program (PI: K. Pardo).
Detecting Gravitational Waves from Supermassive Black Holes with Kepler.

12/2021 PI: NASA TESS Cycle 4 GI Program G04032.
Difference Imaging of Stars in Clusters.

06/2020 Co-I: NASA TESS Cycle 3 GI Program G03064 (PI: J. Hartman).
Cluster Difference Imaging Photometric Survey.

07/2019 Co-I: NASA TESS Cycle 2 GI Program G022117 (PI: J. Hartman).
Cluster Difference Imaging Photometric Survey.

07/2018 Co-I: NASA TESS Cycle 1 GI Program G011103 (PI: J. Hartman).
Difference Imaging of Star Clusters at Low Galactic Latitude.

Advising

Post-baccalaureate Student

Andrew Boyle (Caltech): May 2022-May 2023. Grad school, astrophysics, UNC Chapel Hill.

Undergraduate Students

Elin Stenmark (Caltech 1st-2nd year): July 2023-present. Currently at Caltech.

Elsa Palumbo (Caltech 3rd-4th year): Jan 2022-May 2023. Grad school, statistics, Carnegie Mellon.

High School Students

Thaddaeus Kiker (Sunny Hills High School, 11th grade): Jan 2022-Sep 2022. Undergrad, physics, Columbia.

Veronica Diaz (Sunny Hills High School, 11th grade): Jan 2022-Sep 2022. Undergrad, CS, Carnegie Mellon.

Service & Public Engagement

- *Prison Education Project*: Jan 2022 – present. Designed and facilitated remote academic workshops in prisons. Topics have included STEM careers, astronomy, and a mix of astronomy and planetary science. 10-20 students attended each workshop per two-month term. Host institutions have been in California (Spring 2022), Scotland (Summer 2022), and Hawaii (Fall 2022, Spring 2023, Fall 2023, Spring 2024); my current focus is on an astronomy workshop at Kulani Correctional Facility on Hawaii island.
- *Skype a Scientist*: Oct 2020 – Spring 2022. Gave 15 remote public talks in K-12 classrooms.
- *Resident Graduate Student*: Sept 2018 – May 2021. Resident advisor to 30 undergraduate students per year. Encouraged a civilized and supportive residential environment; hosted star-gazing nights, office hours, and social events; during COVID, focused on academic support and one-on-one advising.
- *Observing Outreach Organizer*: Sept 2016 – Sept 2019. Organized over 30 public observing events at Princeton's department telescope. Led outreach team to host groups ranging from 10 to 100 people; also hosted private groups (*e.g.*, middle and high-school classes; student clubs; university staff).
- *Princeton LGBT Center Discussion Group Co-Organizer*: Sept 2018 – May 2019. Hosted a discussion group for students to speak about identity, orientation, relationships, and community.

Professional Activities

Member, TESS Users Committee (2023-present).

Reviewer for Caltech Optical Observatories Time Allocation Committee (2022).

Chair, Emerging Researchers in Exoplanet Science (ERES) 2021.

Active referee for AJ, ApJ, ApJL, Nature Astronomy, A&A, MNRAS, PASP (12 articles; 2019-present).

Reviewer for NASA panels (2021, 2022, 2023).

Member, American Astronomical Society (AAS). (2018-present)

Member, Division for Planetary Sciences of the AAS. (2020-present)

Member, TESS Follow-up Observing Program (TFOP; 2018-present).

Organizer, TESS Extended Mission Working Group (2015-2018).

PUBLICATION LIST [LINK TO ADS LIBRARY]

First & second author

The † symbol highlights students for whom I served as the primary research mentor.

14. Bouma, L., Jayaraman, R., et al. *Transient Corotating Clumps Around Adolescent Low-Mass Stars From Four Years of TESS*. AJ, 167, 38 (2024).
13. †Boyle, A. and Bouma, L. *When Does Gyrochronology Start to Work? – Stellar Rotation and Structure of the α Persei Complex*. AJ, 166, 14 (2023).
12. Bouma, L., †Palumbo, E. and Hillenbrand, L. *The Empirical Limits of Gyrochronology*. ApJL, 947, 3 (2023).
11. Bouma, L., Kerr, R., et al. *Kepler and the Behemoth: Three Mini-Neptunes in a 40 Million Year Old Association*. AJ, 164, 215 (2022).
10. Bouma, L., Curtis, J., et al. *A 38 Million Year Old Neptune-Sized Planet in the Kepler Field*. AJ, 163, 121 (2022).
9. Bouma, L., Curtis, J., et al. *Rotation and Lithium Confirmation of a 500 Parsec Halo for the Open Cluster NGC 2516*. AJ, 162, 197 (2021).
8. Bouma, L., Hartman, J., et al. *Cluster Difference Imaging Photometric Survey. II. TOI 837: A Young Validated Planet in IC 2602*. AJ, 160, 239 (2020).
7. Bouma, L., Winn, J., et al. *PTFO 8-8695: Two Stars, Two Signals, No Planet*. AJ, 160, 86 (2020).
6. Bouma, L., Winn, J., et al. *WASP-4 is Accelerating Toward the Earth*. ApJL, 893, 2 (2020).
5. Bouma, L., Hartman, J., et al. *Cluster Difference Imaging Photometric Survey. I. Light Curves of Stars in Open Clusters from TESS Sectors 6 & 7*. ApJS, 245, 13 (2019).
4. Bouma, L., Winn, J., et al. *WASP-4b Arrived Early for the TESS Mission*. AJ, 157, 217 (2019).
3. Bouma, L., Masuda, K., and Winn, J. *Biases in Planet Occurrence Caused by Unresolved Binaries in Transit Surveys*. AJ, 155, 244 (2018).
2. Penev, K., Bouma, L., et al. *Empirical Tidal Dissipation in Exoplanet Hosts From Tidal Spin-Up*. AJ, 155, 165 (2018).
1. Bouma, L., Winn, J., et al. *Planet-Detection Simulations for Several Possible TESS Extended Missions*. arXiv:1705.08891 (2017). Non-refereed white paper.

Many author

For each of these papers, I contributed key methods, data, code, and/or co-authored significant portions of the text.

29. Hartman, J. et al., incl. Bouma, L. *TOI 4201 b and TOI 5344 b: Discovery of Two Transiting Giant Planets Around M Dwarf Stars and Revised Parameters for Three Others*. AJ, 166, 163 (2023).
28. Dai, F. et al., incl. Bouma, L. *A Mini-Neptune Orbiting the Metal-poor K Dwarf BD+29 2654*. AJ, 166, 49 (2023).
27. Blunt, S. et al., incl. Bouma, L. *Overfitting Affects the Reliability of Radial Velocity Mass Estimates of the V1298 Tau Planets*. AJ, 166, 62 (2023).
26. Wood, M. et al., incl. Bouma, L. *TESS Hunt for Young and Maturing Exoplanets (THYME) VII: a 27 Myr extended population of Lower-Centarus Crux with a transiting two-planet system*. AJ, 165, 85 (2023).
25. Yee, S. et al., incl. Bouma, L. *The TESS Grand Unified Hot Jupiter Survey. II. Twenty Hot Jupiters*. ApJS, 265, 1 (2023).
24. Heitzmann, A. et al., incl. Bouma, L. *TOI-4562 b: A highly eccentric temperate Jupiter analog orbiting a young field star*. AJ, 165, 121 (2023).

23. Dai, F. et al., incl. Bouma, L. *TOI-1136 is a Young, Coplanar, Aligned Planetary System in a Pristine Resonant Chain*. AJ, 165, 33 (2023).
22. Hua, X. et al., incl. Bouma, L. *A Transiting Super-Earth in the Radius Valley and an Outer Planet Candidate Around HD 307842*. AJ 166, 32 (2023).
21. Stassun, K. et al., incl. Bouma, L. *A Low-Mass Pre-Main-Sequence Eclipsing Binary in Lower Centaurus Crux Discovered with TESS.* AJ, 941, 125 (2022).
20. Kounkel, M. et al., incl. Bouma, L. *Untangling the Galaxy. IV. Empirical Constraints on Angular Momentum Evolution and Gyrochronology for Young Stars in the Field*. AJ, 164, 137 (2022).
19. Palumbo, E. et al., incl. Bouma, L. *Evidence for Centrifugal Breakout around the Young M Dwarf TIC 234284556*. ApJ, 925, 75 (2022).
18. Zhou, G. et al., incl. Bouma, L. *A Mini-Neptune from TESS and CHEOPS Around the 120 Myr Old AB Dor member HIP 94235*. AJ, 163, 289 (2022).
17. Günther, M. et al., incl. Bouma, L. *Complex Modulation of Rapidly Rotating Young M Dwarfs: Adding Pieces to the Puzzle*. AJ, 163, 144 (2022).
16. Heitzmann, A. et al., incl. Bouma, L. *The obliquity of HIP 67522 b: a 17 Myr old transiting hot Jupiter-sized planet*. ApJL, 922, 1 (2021).
15. Fausnaugh, M. et al., incl. Bouma, L. *The TESS Mission Target Selection Procedure*. PASP. 133, 1027 (2021).
14. Grieves, N. et al., incl. Bouma, L. *Populating the brown dwarf and stellar boundary: Five stars with transiting companions near the hydrogen-burning mass limit*. A&A, 652, 127 (2021)
13. Wirth, C. et al., incl. Bouma, L. *TOI-942b: A Prograde Neptune in a ∼60 Myr old Multi-transiting System*. ApJL, 917, 34 (2021).
12. Stassun, K. et al., incl. Bouma, L. *Discovery and Characterization of a Rare Magnetic Hybrid β Cephei Slowly Pulsating B-type Star in an Eclipsing Binary in the Young Open Cluster NGC 6193* AJ, 910, 133 (2021).
11. Tofflemire, B. et al., incl. Bouma, L. *TESS Hunt for Young and Maturing Exoplanets (THYME) V: A Sub-Neptune Transiting a Young Field Star*. AJ, 161, 171 (2021).
10. Zhou, G. et al., incl. Bouma, L. *Two young planetary systems around field stars with ages between 10–170 Myr from TESS*. AJ, 161, 2 (2021).
9. Patra, K. et al., incl. Bouma, L. *The Continuing Search For Evidence of Tidal Orbital Decay For Hot Jupiters*. AJ, 159, 150 (2020).
8. Soares-Furtado, M. et al., incl. Bouma, L. *A Catalog of Periodic Variables in Open Clusters M 35 and NGC 2158*. ApJS, 246, 15 (2020).
7. Rodríguez Martínez, R. et al., incl. Bouma, L. *KELT-25b and KELT-26b: A Hot Jupiter and a Substellar Companion Transiting Young A-Stars Observed by TESS*. ApJS, 246, 15 (2020).
6. Newton, E. et al., incl. Bouma, L. *TESS Hunt for Young and Maturing Exoplanets (THYME): A Planet in the 45 Myr Tucana-Horologium Association*. ApJL, 880, 1, L17 (2019).
5. Zhan, Z. et al., incl. Bouma, L. *Complex Rotational Modulation of Rapidly Rotating M Stars Observed with TESS*. ApJ, 876, 127 (2019).
4. Rappaport, S. et al., incl. Bouma, L. *Deep long asymmetric occultation in EPIC 204376071*. MNRAS, 485, 2681 (2019).
3. Burt, J. et al., incl. Bouma, L. *Simulating the M-R Relation From APF Followup of TESS Targets: Survey Design and Strategies for Overcoming Mass Biases*. AJ, 156, 255 (2018).

2. Louie, D. et al., incl. Bouma, L. *Simulated JWST/NIRISS Transit Spectroscopy of Anticipated TESS Planets Compared to Select Discoveries from Space-Based and Ground-Based Surveys*. PASP 130d 4401 (2018).

1. Campante, T. et al., incl. Bouma, L. *The asteroseismic potential of TESS: Exoplanet-Host Stars*. ApJ, 830, 2 (2016).

TESS Collaboration

These are papers for which my authorship results from my contributions to mission planning and internal data analysis in the TESS collaboration. In all such instances, I provided substantive feedback on the manuscripts.

22. Naponiello, L. et al., incl. Bouma, L. *A super-massive Neptune-sized planet.* Nature, 622, 255 (2023).

21. Osborn, A. et al., incl. Bouma, L. *TOI-332 b: a super dense Neptune found deep within the Neptunian desert.* MNRAS, 526, 548 (2023).

20. Sha, L. et al., incl. Bouma, L. *TESS Spots a Mini-Neptune Interior to a Hot Saturn in the TOI-2000 System.* MNRAS, 524, 1113 (2023).

19. Bozhilov, V. et al., incl. Bouma, L. *A 2:1 Mean-Motion Resonance Super-Jovian pair revealed by TESS, FEROS, and HARPS* . ApJL, 946, 36 (2023).

18. El Mufti, M. et al., incl. Bouma, L. *TOI-560: Two Transiting Planets Orbiting a K Dwarf Validated with iSHELL, PFS and HIRES RVs*. AJ, 165, 10 (2023).

17. Cadieux, C. et al., incl. Bouma, L. *TOI-1452 b: SPIRou and TESS reveal a temperate super-Earth around a nearby M4 dwarf*. AJ, 164, 96 (2022).

16. Hord, B. et al., incl. Bouma, L. *The Discovery of a Planetary Companion Interior to Hot Jupiter WASP-132b*. AJ, 164, 13 (2022).

15. Wittenmyer, R. et al., incl. Bouma, L. *TOI-1842b: A Transiting Warm Saturn Undergoing Reinflation around an Evolving Subgiant*, AJ, 163, 82 (2022).

14. Cabot, S. H. C. et al., incl. Bouma, L. *TOI-1518b: A Misaligned Ulta-hot Jupiter with Iron in Its Atmosphere*. AJ, 162, 218 (2021).

13. Addison, B. C. et al., incl. Bouma, L. *TOI-1431b/MASCARA-5b: A Highly Irradiated Ultra-Hot Jupiter Orbiting One of the Hottest & Brightest Known Exoplanet Host Stars*. AJ, 162, 292 (2021).

12. Hedges, C. et al., incl. Bouma, L. *TOI-2076 and TOI-1807: Two Young, Comoving Planetary Systems within 50 pc Identified by TESS that are Ideal Candidates for Further Follow Up* . AJ, 162, 54 (2021).

11. Guerrero, N. et al., incl. Bouma, L. *The TESS Objects of Interest Catalog from the TESS Prime Mission*. ApJS, 254, 39 (2021).

10. Dawson, B. et al., incl. Bouma, L. *Precise transit and radial-velocity characterization of a resonant pair: a warm Jupiter TOI-216c and eccentric warm Neptune TOI-216b*. AJ, 161, 161 (2021).

9. Daylan, T. et al., incl. Bouma, L. *TESS discovery of a super-Earth and three sub-Neptunes hosted by the bright, Sun-like star HD 108236*. AJ, 161, 85 (2021).

8. Fridlund, M.. et al., incl. Bouma, L. *The TOI-763 system: sub-Neptunes orbiting a Sun-like star*. MNRAS, 498, 3 (2020).

7. Rowden, P., et al., incl. Bouma, L. *TIC 278956474: Two Close Binaries in One Young Quadruple System Identified by TESS*. AJ, 160, 2 (2020).

6. Jordán, A. et al., incl. Bouma, L. *TOI-677 b: A Warm Jupiter (P=11.2d) on an eccentric orbit transiting a late F-type star*. AJ, 159, 145 (2020).

5. Quinn, S. et al., incl. Bouma, L. *Near-resonance in a system of sub-Neptunes from TESS*. AJ, 158, 177 (2019).

4. Günther, M. et al., incl. Bouma, L. *A Super-Earth and two sub-Neptunes transiting the bright, nearby, and quiet M-dwarf TOI-270*. Nature Astronomy, 3, 1099 (2019).
3. Dawson, B. et al., incl. Bouma, L. *TOI-216b and TOI-216c: Two warm, large exoplanets in or slightly wide of the 2:1 orbital resonance*. AJ, 158, 65 (2019).
2. Shporer, A. et al., incl. Bouma, L. *TESS Full Orbital Phase Curve of the WASP-18b System*. AJ, 157, 178 (2019).
1. Rodriguez, J. et al., incl. Bouma, L. *An Eccentric Massive Jupiter Orbiting a Sub-Giant on a 9.5 Day Period Discovered in the TESS Full Frame Images*. AJ, 157, 191 (2019).

Software

4. Foreman-Mackey, D., et al., incl. Bouma, L. *exoplanet: Gradient-based probabilistic inference for exoplanet data & other astronomical time series*. JOSS, 6, 62, 3285 (2021).
3. Bhatti, W. Bouma, L., and Yee S. `cdips-pipeline`*: difference-imaging photometry pipeline*. Link.
2. Bhatti, W. Bouma, L., and Wallace J. `astrobase`*: package for variable star astronomy*. Link.
1. Astropy Collaboration et al., incl. Bouma, L. *The Astropy Project*. AJ, 156, 123 (2018).

Selected Observing Programs

01/2024 PI: Keck/HIRES (2 nights), Hale/DBSP (4 nights).
What are the Complex Periodic Variables?

07/2023 PI: Keck/HIRES (2 nights), Hale/DBSP (7 nights), Hale/TSPEC (1 night).
What are the Complex Periodic Variables?

01/2023 PI: Keck/HIRES (2 nights).
Age-Dating the Cep-Her Complex and Reconstructing its Formation History.

07/2022 PI: Keck/HIRES (1.75 nights).
Confirming Transiting Planets Around Young Stars From TESS & Kepler.

01/2022 Co-I: NOAO LCOGT 1 m, 2 m, & MuSCAT3 (20, 1.2, & 1.1 nights) (PI: J. Hartman, 2022A-934009).
Confirming and Characterizing Transiting Planets From HAT & TESS with LCO.
(Long-term status awarded for 2022A, 2022B, 2023A.)

07/2022 Co-I: Keck/HIRES (1 night) (PI: L. Hillenbrand).
Confirming a 30 Million Year Old Mini-Neptune and Measuring its Stellar Obliquity.

07/2021 Co-I: NOAO LCOGT 1 m & 2 m (20 & 2.5 nights) (PI: J. Hartman, 2021B-0004).
Confirming and Characterizing Transiting Planets From HAT & TESS with LCO.

01/2021 PI: NOIRLab Minerva-Australis (2 nights).
Confirming and Characterizing Transiting Planets Around Young Stars.

01/2021 Co-I: NOAO LCOGT 1 m & 2 m (20 & 2 nights) (PI: J. Hartman, 2021A-0045).
Confirming and Characterizing Transiting Planets From HAT+TESS with LCO.

01/2021 PI: Magellan/PFS (2 nights).
Confirming and Characterizing Transiting Planets Around Young Stars

10/2020 PI: TESS Director's Discretionary Time
Complex Modulation of Rapidly Rotating Young M Dwarfs

Seminars & Colloquia

- OSU Astronomy Colloquium (Invited), February 2024
- Michigan State University Research Seminar (Invited), February 2024
- Caltech/IPAC Seminar (Invited), January 2024
- UH Manoa Institute for Astronomy Colloquium (Invited), January 2024
- MIT TESS Science Talks Seminar (Invited), January 2024
- Caltech Tea Talk Seminar, November 2023
- University of Geneva Exoplanets Seminar, March 2023
- Yale Exoplanets/Stars Seminar (Invited), February 2023
- Earth 2.0 Mission Science Seminar Series (Invited), October 2022
- University of Michigan Star and Planet Formation Seminar, September 2022
- MIT TESS Science Talks Seminar (Invited), March 2022
- Penn State Center for Exoplanets and Habitable Worlds (Invited), April 2021
- Harvard Exoplanet Pizza Lunch, April 2021
- JPL Astrophysics Colloquium (Invited), October 2020
- Caltech Dix Planetary Science Seminar, October 2020
- UCLA Physics and Astronomy Lunch Talk Series, September 2020
- University of Chicago Exoplanet Seminar, March 2020
- Princeton Thunch Seminar, January 2019

Talks & Posters

- Astronomy on Tap (Invited Public Talk), Pasadena, CA, November 2023.
- TASC7 (Talk), UH Manoa, Oahu, HI, July 2023.
- SPIDI23 (Invited Review), IESC, Cargèse, Corsica, France, May 2023.
- ESA ESTEC Planet-ESLAB-2023 Symposium (Talk), Noordwijk, Netherlands, March 2023.
- Flatiron Institute / CCA Thursday Lunch Talk, New York, NY, February 2023.
- 51 Pegasi Summit (Talk & Fun-Talk), San Francisco, CA, August 2022.
- ERES-VII (Poster), State College, PA, July 2022.
- AAS Meeting #240 (Talk), Pasadena, CA, June 2022.
- Exoplanets IV (Talk), Las Vegas, NV, May 2022.
- JHU-APL Exoplanet Early Career Highlight Seminar (Talk), Online, January 2022.
- TESS Science Conference II (Talk), Online, August 2021.
- AAS Meeting #238 (Talk & Press Conference), Online, July 2021

- THYME 2020 Conference (Invited Talk), Online, December 2020.
- ExSoCal 2020 (Poster), Online, September 2020.
- TESS Science Team Meeting #19 (Talk), Online, June 2020.
- Princeton Club of Chicago - Alumni Meeting (Invited Public Talk), Chicago, IL, March 2020.
- TESS Science Team Meeting #18 (Talk), Cambridge, MA, December 2019.
- Extreme Solar Systems IV (Poster), Reykjavik, Iceland, August 2019.
- STScI TESS Data Workshop (Invited Talk), Baltimore, MD, February 2019.
- TESS Science Conference I (Talk & Invited Panel), Cambridge, MA, July 2019.
- TESS Science Team Meeting #16 (Talk), Cambridge, MA, October 2018.
- Exoplanets II (Poster), Cambridge, England, June 2018.