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Center for Computational
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about

I am a postdoctoral fellow at the Center for Computational Astrophysics in New York City, working on finding novel ways to discover and characterize exoplanets. I am broadly interested in exocartography, astro-statistics, noise modeling, & general analytic techniques for astronomy. Outside of the office I love to hike, cycle, swim, craft lattes, faulty parallelism, and Oxford commas.

stats

Total Pubs	51
Refereed	45
First Author	15
Citations	2579
h-index	25

references

eric agol

agol@uw.edu

david w. hogg

dhogg@flatironinstitute.org

rory barnes

rory@astro.washington.edu

education

2012–2017	PhD Astronomy and Astrobiology	University of Washington, Seattle WA
	– On the evolution, detection, and characterization of small planets in the habitable zones of M dwarfs	
	– Advised by Eric Agol, Rory Barnes, and Victoria Meadows	
2012–2013	MSc Astronomy and Astrobiology	University of Washington, Seattle WA
2006–2010	BA Astrophysics	Swarthmore College, Swarthmore PA
	– Minor in English Literature	

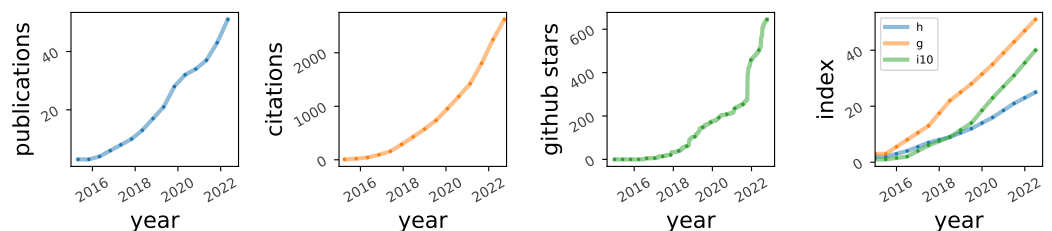
positions

2018–	Flatiron Fellow	Center for Computational Astrophysics, New York, NY
	– Work on statistical and computational data analysis problems applied to stellar and exoplanetary astronomy	
	– Develop algorithms and open-source software for timeseries analysis	
2017–2018	Postdoctoral Researcher	University of Washington
	– Developed photometric de-trending methods to aid in the search for small planets transiting small stars; developed and maintained the everest pipeline	
2012–2017	Research Associate	University of Washington
	– Developed techniques to detect and characterize habitable zone planets	
	– Investigated the atmospheric evolution of planets orbiting M dwarfs	
2008–2009	Student Researcher	Swarthmore College
	– Research under Professor Eric Jensen on planet formation and T Tauri disks	





honors

2018–2022	Flatiron Fellowship	Center for Computational Astrophysics, New York, NY
2018	Hubble Postdoctoral Fellowship	(Declined)
2018	51 Pegasi b Fellowship	(Declined)
2012–2015	ARCS Fellowship	University of Washington
2010	Bobby Berman Memorial Prize	Swarthmore College
2010	The Phi Beta Kappa Society	Swarthmore College

metrics



links

-  [LSST Lecture I](#)
-  [LSST Worksheet I](#)
-  [LSST Lecture II](#)
-  [LSST Worksheet II](#)

teaching & outreach

- 2020- **Mentor, Simons-NSBP Program** Flatiron Institute
– Mentor black undergraduate students through the Simons-National Society of Black Physicists summer program
- 2019- **Mentor, AstroCom** AMNH / CUNY
– Mentor undergraduate students from underrepresented groups in the sciences at the City University of New York
- 2019- **Lecturer, LSST Data Science Fellowship** Carnegie Mellon / Flatiron Institute
– Lectured on various topics related to statistical inference at week-long schools for early-career astronomers
- 2012–2017 **Mobile Planetarium** University of Washington
– Presented planetarium shows at schools and public venues throughout Washington state using UW's inflatable mobile planetarium
- 2012–2013 **Teaching Assistant** University of Washington
– Taught two bi-weekly tutorial sessions for two college astronomy courses
- 2010–2012 **High School Teacher** St. Luke's School, New Canaan CT
– Created and taught a rigorous, college-level elective course in astrophysics aimed at seniors interested in pursuing college classes in the field
– Taught three sections of 11th grade physics with a focus on astronomy, helping students develop critical thinking and creative problem solving skills
- 2009–2010 **Science Associate & Tutor** Swarthmore College
– Directed weekly large-group study sessions for an introductory course in astronomy; tutored students in courses in mechanics and E&M

students

- 2020- **Shashank Dholakia** University of California, Berkeley
– Developing analytic transit light curve models for oblate stars
- 2020- **Shishir Dholakia** University of California, Berkeley
– Developing analytic transit light curve models for oblate stars
- 2020–2021 **Rebecca Young** Simons-NSBP Scholars Program, CCA
– Inferring differential rotation rates from Kepler light curves
- 2020- **Fran Bartolić** Pre-doctoral Program, CCA
– Mapping the surface of Io from Jupiter occultation data
- 2019- **Asmaa Elsayed** AstroCom Program, CUNY/CCA
– Understand the time evolution of spotted stellar surfaces
- 2019 **Brynnner Hidalgo** AstroCom Program, CUNY/CCA
– Understand the time evolution of spotted stellar surfaces
- 2016–2018 **Nicholas Saunders** University of Washington
– Develop tools to mitigate systematics in K2 data

other

- 2018– **Organizer, Stars and Exoplanets Meeting** CCA
– Organize weekly meeting for NYC area graduate students, postdocs, & faculty
- 2013–2017 **IT Manager** Virtual Planet Laboratory, University of Washington
– Managed VPL’s virtual conferencing system and network
- 2010–2012 **Head Coach** St. Luke’s School, New Canaan CT
– Head coach of the JV Boys Soccer and Fencing Teams

popular software

- starry** `pip install starry`
– Tools for light curve modeling & mapping stars and planets
- starry-process** `pip install starry-process`
– Gaussian processes for modeling stellar variability
- showyourwork** `github.com/rodluger/showyourwork`
– A workflow for open source, reproducible scientific articles
- planetplanet** `pip install planetplanet`
– Tools for modeling planet-planet occultations
- everest** `pip install everest-pipeline`
– Tools for de-trending K2 light curves
- exoplanet** `pip install exoplanet`
– Tools for probabilistic modeling of exoplanet time series data
- VPLANET** `pip install vplanet`
– Suite for simulating planetary system evolution and habitability

primary developer

secondary developer

publications

citations →
(refereed in **bold**)

- 4 **Luger, R.**, Agol, E., Bartolić, F., & Foreman-Mackey, D., 2022, [Analytic Light Curves in Reflected Light: Phase Curves, Occultations, and Non-Lambertian Scattering for Spherical Planets and Moons](#), AJ, **AJ accepted**, 164, 4
- 5 Johnson, M., David, T., Petigura, E., Isaacson, H., et al. (including **Luger, R.**), 2022, [An Aligned Orbit for the Young Planet V1298 Tau B](#), AJ, 163, 247
- 4 Wong, K., Breivik, K., Farr, W., & **Luger, R.**, 2022, [Backward Population Synthesis: Mapping the Evolutionary History of Gravitational-Wave Progenitors](#), arXiv:2206.04062
- 1 Lustig-Yaeger, J., Sotzen, K., Stevenson, K., **Luger, R.**, et al., 2022, [Hierarchical Bayesian Atmospheric Retrieval Modeling for Population Studies of Exoplanet Atmospheres: A Case Study on the Habitable Zone](#), AJ, 163, 140
- 2 do Amaral, L., Barnes, R., Segura, A., & **Luger, R.**, 2022, [The Contribution of M-Dwarf Flares to the Thermal Escape of Potentially Habitable Planet Atmospheres](#), ApJ, 928, 12
- 3 Bartolić, F., **Luger, R.**, Foreman-Mackey, D., Howell, R., & Rathbun, J., 2022, [Occultation Mapping of Io's Surface in the Near-Infrared. I. Inferring Static Maps](#), The Planetary Science Journal, 3, 67
- 14 Zinn, J., Stello, D., Elsworth, Y., García, R., et al. (including **Luger, R.**), 2022, [The K2 Galactic Archaeology Program Data Release 3: Age-Abundance Patterns in C1-C8 and C10-C18](#), ApJ, 926, 191
- 3 Dholakia, S., **Luger, R.**, & Dholakia, S., 2022, [Efficient and Precise Transit Light Curves for Rapidly Rotating, Oblate Stars](#), ApJ, 925, 185
- 10 Feinstein, A., Montet, B., Johnson, M., Bean, J., et al. (including **Luger, R.**), 2021, [H-Alpha and Ca II Infrared Triplet Variations During a Transit of the 23 Myr Planet V1298 Tau C](#), AJ, 162, 213
- 10 **Luger, R.**, Bedell, M., Foreman-Mackey, D., Crossfield, I., et al., 2021, [Mapping Stellar Surfaces III: An Efficient, Scalable, and Open-Source Doppler Imaging Model](#), arXiv:2110.06271
- 15 **Luger, R.**, Foreman-Mackey, D., & Hedges, C., 2021, [Mapping Stellar Surfaces. II. An Interpretable Gaussian Process Model for Light Curves](#), AJ, 162, 124
- 19 **Luger, R.**, Foreman-Mackey, D., Hedges, C., & Hogg, D., 2021, [Mapping Stellar Surfaces. I. Degeneracies in the Rotational Light-Curve Problem](#), AJ, 162, 123
- 3 Hedges, C., **Luger, R.**, Martinez-Palomera, J., Dotson, J., & Barentsen, G., 2021, [Linearized Field Deblending: Point-Spread Function Photometry for Impatient Astronomers](#), AJ, 162, 107
- 2 **Luger, R.**, Foreman-Mackey, D., & Hedges, C., 2021, [starry_process: Interpretable Gaussian Processes for Stellar Light Curves](#), The Journal of Open Source Software, 6, 3071
- 128 Foreman-Mackey, D., **Luger, R.**, Agol, E., Barclay, T., et al., 2021, [Exoplanet: Gradient-Based Probabilistic Inference for Exoplanet Data & Other Astronomical Time Series](#), The Journal of Open Source Software, 6, 3285
- 97 Agol, E., Dorn, C., Grimm, S., Turbet, M., et al. (including **Luger, R.**), 2021, [Refining the Transit-Timing and Photometric Analysis of TRAPPIST-1: Masses, Radii, Densities, Dynamics, and Ephemerides](#), The Planetary Science Journal, 2, 1
- 3 Hedges, C., **Luger, R.**, Dotson, J., Foreman-Mackey, D., & Barentsen, G., 2021, [Multiwavelength Photometry Derived From Monochromatic Kepler Data](#), AJ, 161, 95
- 16 Zinn, J., Stello, D., Elsworth, Y., García, R., et al. (including **Luger, R.**), 2020, [The K2 Galactic Archaeology Program Data Release 2: Asteroseismic Results From Campaigns 4, 6, and 7](#), The Astrophysical Journal Supplement Series, 251, 23

- 25 Cunningham, E., Garavito-Camargo, N., Deason, A., Johnston, K., et al. (including **Luger, R.**), 2020, [Quantifying the Stellar Halo's Response to the LMC's Infall With Spherical Harmonics](#), *ApJ*, 898, 4
- 77 Agol, E., **Luger, R.**, & Foreman-Mackey, D., 2020, [Analytic Planetary Transit Light Curves and Derivatives for Stars With Polynomial Limb Darkening](#), *AJ*, 159, 123
- 18 Montet, B., Feinstein, A., **Luger, R.**, Bedell, M., et al., 2020, [The Young Planet DS Tuc Ab Has a Low Obliquity](#), *AJ*, 159, 112
- 18 Fleming, D., Barnes, R., **Luger, R.**, & VanderPlas, J., 2020, [On the XUV Luminosity Evolution of TRAPPIST-1](#), *ApJ*, 891, 155
- 27 Barnes, R., **Luger, R.**, Deitrick, R., Driscoll, P., et al., 2020, [VPlanet: The Virtual Planet Simulator](#), *PASP*, 132, 24502
- 71 David, T., Petigura, E., **Luger, R.**, Foreman-Mackey, D., et al., 2019, [Four Newborn Planets Transiting the Young Solar Analog V1298 Tau](#), *ApJ*, 885
- 32 Bedell, M., Hogg, D., Foreman-Mackey, D., Montet, B., & **Luger, R.**, 2019, [WOBBLE: A Data-Driven Analysis Technique for Time-Series Stellar Spectra](#), *AJ*, 158, 164
- 131 Feinstein, A., Montet, B., Foreman-Mackey, D., Bedell, M., et al. (including **Luger, R.**), 2019, [Eleanor: An Open-Source Tool for Extracting Light Curves From the TESS Full-Frame Images](#), *PASP*, 131, 94502
- 38 Kruse, E., Agol, E., **Luger, R.**, & Foreman-Mackey, D., 2019, [Detection of Hundreds of New Planet Candidates and Eclipsing Binaries in K2 Campaigns 0-8](#), *The Astrophysical Journal Supplement Series*, 244, 11
- 26 Fleming, D., Barnes, R., Davenport, J., & **Luger, R.**, 2019, [Rotation Period Evolution in Low-Mass Binary Stars: The Impact of Tidal Torques and Magnetic Braking](#), *ApJ*, 881, 88
- 132 Eastman, J., Rodriguez, J., Agol, E., Stassun, K., et al. (including **Luger, R.**), 2019, [EXOFASTv2: A Public, Generalized, Publication-Quality Exoplanet Modeling Code](#), *arXiv:1907.09480*
- 2 Kislyakova, K., Fossati, L., Shulyak, D., Günther, E., et al. (including **Luger, R.**), 2019, [Detecting Volcanically Produced Tori Along Orbits of Exoplanets Using UV Spectroscopy](#), *arXiv:1907.05088*
- 38 Kreidberg, L., **Luger, R.**, & Bedell, M., 2019, [No Evidence for Lunar Transit in New Analysis of Hubble Space Telescope Observations of the Kepler-1625 System](#), *ApJ*, 877
- 3 Saunders, N., **Luger, R.**, & Barnes, R., 2019, [The Pointing Limits of Transiting Exoplanet Light Curve Characterization With Pixel Level Decorrelation](#), *AJ*, 157, 197
- 17 **Luger, R.**, Bedell, M., Vanderspek, R., & Burke, C., 2019, [TESS Photometric Mapping of a Terrestrial Planet in the Habitable Zone: Detection of Clouds, Oceans, and Continents](#), *arXiv:1903.12182*
- 140 **Luger, R.**, Agol, E., Foreman-Mackey, D., Fleming, D., et al., 2019, [Starry: Analytic Occultation Light Curves](#), *AJ*, 157, 64
- Barnes, R., **Luger, R.**, Smotherman, H., Deitrick, R., & Fleming, D., 2019, [After the Habitable Zone](#), *Memorie della Societa Astronomica Italiana*, 90, 641
- 33 Lustig-Yaeger, J., Meadows, V., Tovar Mendoza, G., Schwieterman, E., et al. (including **Luger, R.**), 2018, [Detecting Ocean Glint on Exoplanets Using Multiphase Mapping](#), *AJ*, 156, 301
- 93 Lincowski, A., Meadows, V., Crisp, D., Robinson, T., et al. (including **Luger, R.**), 2018, [Evolved Climates and Observational Discriminants for the TRAPPIST-1 Planetary System](#), *ApJ*, 867, 76
- 115 **Luger, R.**, Kruse, E., Foreman-Mackey, D., Agol, E., & Saunders, N., 2018, [An Update to the EVEREST K2 Pipeline: Short Cadence, Saturated Stars, and Kepler-Like Photometry Down to \$K_p = 15\$](#) , *AJ*, 156, 99
- 24 Fleming, D., Barnes, R., Graham, D., **Luger, R.**, & Quinn, T., 2018, [On the Lack of Circumbinary](#)

Planets Orbiting Isolated Binary Stars, *ApJ*, 858, 86

- 12 Tian, F., Güdel, M., Johnstone, C., Lammer, H., et al. (including **Luger, R.**), 2018, [Water Loss From Young Planets](#), *Space Science Reviews*, 214, 65
- 111 Meadows, V., Arney, G., Schwieterman, E., Lustig-Yaeger, J., et al. (including **Luger, R.**), 2018, [The Habitability of Proxima Centauri B: Environmental States and Observational Discriminants](#), *Astrobiology*, 18, 133
- 17 **Luger, R.**, Foreman-Mackey, D., & Hogg, D., 2017, [Linear Models for Systematics and Nuisances](#), *Research Notes of the American Astronomical Society*, 1, 7
- 29 **Luger, R.**, Lustig-Yaeger, J., & Agol, E., 2017, [Planet-Planet Occultations in TRAPPIST-1 and Other Exoplanet Systems](#), *ApJ*, 851, 94
- 229 **Luger, R.**, Sestovic, M., Kruse, E., Grimm, S., et al., 2017, [A Seven-Planet Resonant Chain in TRAPPIST-1](#), *Nature Astronomy*, 1, 129
- 27 **Luger, R.**, Lustig-Yaeger, J., Fleming, D., Tilley, M., et al., 2017, [The Pale Green Dot: A Method to Characterize Proxima Centauri B Using Exo-Aurorae](#), *ApJ*, 837, 63
- 202 **Luger, R.**, Agol, E., Kruse, E., Barnes, R., et al., 2016, [EVEREST: Pixel Level Decorrelation of K2 Light Curves](#), *AJ*, 152, 100
- 58 Barnes, R., Deitrick, R., **Luger, R.**, Driscoll, P., et al., 2016, [The Habitability of Proxima Centauri B I: Evolutionary Scenarios](#), [arXiv:1608.06919](#)
- 73 Schwieterman, E., Meadows, V., Domagal-Goldman, S., Deming, D., et al. (including **Luger, R.**), 2016, [Identifying Planetary Biosignature Impostors: Spectral Features of CO and O₄ Resulting From Abiotic O₂/O₃ Production](#), *ApJ*, 819
- 307 **Luger, R.**, & Barnes, R., 2015, [Extreme Water Loss and Abiotic O₂ Buildup on Planets Throughout the Habitable Zones of M Dwarfs](#), *Astrobiology*, 15, 119
- 96 **Luger, R.**, Barnes, R., Lopez, E., Fortney, J., et al., 2015, [Habitable Evaporated Cores: Transforming Mini-Neptunes Into Super-Earths in the Habitable Zones of M Dwarfs](#), *Astrobiology*, 15, 57
- 19 Deitrick, R., Barnes, R., McArthur, B., Quinn, T., et al. (including **Luger, R.**), 2015, [The Three-Dimensional Architecture of the \$\nu\$ Andromedae Planetary System](#), *ApJ*, 798, 46

selected talks

📄: Downloadable

📺: Watchable

- 📄 [Statistical Approaches to the Characterization of Stars, Exoplanets, and Solar System Bodies](#), Department Colloquium, University of California, Berkeley, April 14, 2022
- [Algorithms, Statistics, and Software for Exoplanet Detection and Characterization](#), Department Colloquium, University of Toronto Mississauga, March 15, 2022
- [Algorithms, Statistics, and Software for Exoplanet Detection and Characterization](#), Department Colloquium, Carnegie Mellon University, February 03, 2022
- [Statistical Approaches to Stellar and Exoplanetary Characterization](#), Department Colloquium, University of Toronto, February 18, 2022
- [Algorithms, Statistics, and Software for Exoplanet Detection and Characterization](#), Department Colloquium, Stony Brook University, January 31, 2022
- [Algorithms, Statistics, and Software for Exoplanet Detection and Characterization](#), Department Colloquium, Pennsylvania State University, January 28, 2022
- [Stellar Variability as a Statistical Process](#), Department Colloquium, Institut für Astrophysik Göttingen, November 18, 2021
- 📄 [An Introduction to Gaussian Process Regression](#), LSSTC Data Science Fellowship Program, Online, October 05, 2021
- 📄 [Signal or Noise: My love-hate relationship with stellar variability](#), University of Michigan Astronomy Department Colloquium, Ann Arbor, MI, September 23, 2021
- 📺 [Linear Models for TESS Systematics](#), TESS Science Conference II, Online, August 05, 2021
- 📺 [A Bunch of Random Things I'm Working On \(don't worry, they're all related to spherical harmonics\)](#), Center for Computational Astrophysics Lunch Talk, New York, NY, April 29, 2021
- [Gaussian Processes for Stellar Variability](#), University of New South Wales AstroSeminar, Sydney, Australia, February 03, 2021
- 📺 [Gaussian Processes for Stellar Variability](#), Center for Computational Astrophysics Lunch Talk, New York, NY, November 05, 2020
- [Toward Maps of Exoplanet Surfaces](#), University of British Columbia Astronomy Seminar, Vancouver, Canada, April 12, 2020
- [Toward Maps of Exoplanet Surfaces](#), American Museum of Natural History Astronomy Colloquium, New York, NY, March 10, 2020
- [Lots of Fun With TRAPPIST-1](#), Stanford KIPAC Tea, Stanford, CA, February 07, 2020
- [Toward Maps of Exoplanet Surfaces](#), Stanford Astrophysics Colloquium, Stanford, CA, February 06, 2020
- 📄 [Toward Maps of Exoplanet Surfaces](#), Oxford Physics Department Seminar, Oxford, UK, January 15, 2020
- [Surface Maps of Stars and Exoplanets](#), AAS Meeting 235, 132.01, Honolulu, HI, January 2020
- 📄 [Toward Maps of Exoplanet Surfaces](#), Yale University Exoplanet Journal Club, New Haven, CT, October 08, 2019
- 📄 [Toward Maps of Exoplanet Surfaces](#), Villanova University Astronomy Department Colloquium, Villanova, PA, September 20, 2019
- 📄 [Regularization and Ridge Regression](#), LSSTC Data Science Fellowship Program, New York, NY, September 12, 2019

- 📎 [An Introduction to Gaussian Process Regression](#), LSSTC Data Science Fellowship Program, Pittsburgh, PA, June 08, 2019
- 📎 [Gradient-based Inference Techniques for Exoplanet Light Curves](#), Kepler Science Conference V, Glendale, CA, March 05, 2019
- 📎 [STARRY: Analytic Occultation and Rotation Light Curves](#), TESS Data Workshop, Baltimore, MD, February 11, 2019
- [Probing the TRAPPIST-1 System with K2, JWST, and Beyond](#), AAS Meeting 231, 410.02, National Harbor, MD, January 2018
- [Probing the TRAPPIST-1 System with Planet-Planet Occultations](#), Stars & Planets Seminar, Center for Astrophysics, Cambridge, MA, October 30, 2017
- [Probing the TRAPPIST-1 System with Planet-Planet Occultations](#), Dept. Colloquium, Penn State University, State College, PA, September 11, 2017
- 📎 [On the Evolution, Detection, and Characterization of Small Planets in the Habitable Zones of Low Mass Stars](#), Dissertation Talk, Seattle, WA, August 11, 2017
- 📎 [EVEREST Tutorial and Workshop](#), Kepler Science Conference IV, Mountain View, CA, June 21, 2017
- 📎 [TRAPPIST-1: A Seven-Planet Resonant Chain Unveiled by K2](#), Kepler Science Conference IV, Mountain View, CA, June 21, 2017
- [Evolution of the Water Content of Proxima Centauri b](#), Astrobiology Science Conference, 3534, Mesa, AZ, April 28, 2017
- [Habitable Zone Planets with K2](#), Astrobiology Science Conference, 3338, Mesa, AZ, April 26, 2017
- [Extreme Water Loss and Abiotic O₂ Buildup on Planets Throughout the Habitable Zones of M Dwarfs](#), AAS Meeting 225, 407.04, Seattle, WA, January 2015
- [Habitable Evaporated Cores: Converting Mini-Neptunes into Super-Earths in the Habitable Zone of M Dwarfs](#), AAS Meeting 223, 325.05, National Harbor, MD, January 2014