Daniel Thorngren

Johns Hopkins University
Physics and Astronomy Department
https://dpthorngren.github.io/
ORCID: 0000-0002-5113-8558

Bloomberg Center for Physics and Astronomy
3400 N. Charles Street, Baltimore, MD 21218
dpthorngren@gmail.com

Education

University of California, Santa Cruz (2013-2019)
Ph.D. in Physics (Advisor: Jonathan Fortney)
Master of Science in Physics (2015)

University of California, Davis (2008-2013)
Bachelor of Science in Physics, Highest Honors (Advisor: Mani Tripathi)

Research Interests

Giant planets - composition, structure evolution, thermal transport, anomalous heating, and core physics.
Astrostatistics - Bayesian modelling applications to astrophysical data and populations.
Planet formation and its effect on observable outcomes

Skills

Constructing mathematical models of physical systems
Statistical modeling and inference - generalized linear models, parametric inference, Gaussian processes, and hierarchical Bayesian models.
Machine learning techniques - PCA, SVM, and neural networks.
Programming in C, C++, C#, Python, Cython, Numba, and R.
Data analysis tools - SQL, Scipy, Matplotlib, Pandas, Stan.
High-performance computing, working in a Unix environment
Implementing advanced MCMC techniques (e.g. Hamiltonian Monte Carlo, BPS).

Experience

LUX Dark Matter Detector - Undergraduate Researcher, UC Davis (2011-2013)
Other Worlds Laboratory (OWL) - Graduate Student, UCSC (2013-2019)
Amazon A9 - Applied Science Intern (June 2018 - September 2018)
Trottier Fellowship - Postdoctoral Researcher, University of Montrèal (2019-2022)
Davis Fellowship - Postdoctoral Researcher, Johns Hopkins University (2022-present)

Honors

Member of Sigma Pi Sigma (Society of Physics Students honors society)
Dean's list five times
Highest Honors from UC Davis for senior thesis work
Trottier Postdoctoral Fellowship 2019
Davis Postdoctoral Fellowship 2022

Software

Planet Slicer – Package for fitting brightness maps to phase curves of reflective or self-luminous objects. *https://github.com/dpthorngren/PlanetSlicer*
Sam – Flexible MCMC sampling package written in Cython for difficult astrophysical use cases. *https://github.com/dpthorngren/Sam*
Eggman – Python package for computing the transit curves of piecewise-ellipsoidal objects. *https://github.com/dpthorngren/Eggman*

Talks and Presentations

Exoclimes VII - Atmospheres to Cores: Giant Planets with JWST (7/9/25)

Carnegie Earth and Planetary Laboratory NCAD Seminar
Observational Constraints on Runaway Gas Accretion (3/21/25)

Max Planck Institute for Astronomy Exoplanet Seminar
Exoplanet Interiors in the JWST Era (6/24/24)

Exoplanets V Plenary Talk
Exoplanet Interiors in the JWST Era (6/18/24)

Imperial College London Exoplanets Seminar
Exoplanet Interiors in the JWST Era & Hot Saturn Runaway Mass Loss (6/13/24)

Oxford SPIMAX Seminar
Exoplanet Interiors in the JWST Era (6/11/24)

NASA Goddard SEEC Non-Transiting Planets Symposium
The Deep Interiors of Directly Imaged Planets (4/16/24)

Carnegie Earth & Planetary Laboratory Astronomy Seminar
Exoplanet Deep Interiors With JWST (3/15/24)

UC Santa Cruz Flash Seminar
Exoplanet Deep Interiors With JWST (3/1/24)

UC Berkeley TAC Seminar
Exoplanet Deep Interiors With JWST (2/26/24)

Pennsylvania State University CEHW Seminar
Exoplanet Deep Interiors With JWST (2/5/24)

Open Problems in the Astrophysics of Gas Giants (OPAGA) Conference (12/5/23)
Synergy Between Atmospheric and Bulk Studies of Giant Planets

STScI 2023 Spring Symposium (5/16/23)
Using JWST Spectra to Explore Exoplanet Deep Interiors

Princeton Astrophysics Department Seminar (10/10/22)
Formation and Mass Loss of Exo-Saturns

University of Maryland Exoplanet Seminar (9/28/22)
Hot Saturns: Formation and Mass Loss

Math+X Symposium (7/11/22)
Giant Planet Population Physics

TESS Science Conference 2 (8/3/21)
Exoplanet Interior Physics in the TESS Era (Invited Talk & Panel)

JWST Early Release Science Program Workshop (7/1/21)
What Masses and Radii Tell us About Planets (Review Talk)

Canada Planet Discussion Day (6/10/21)
Giant Exoplanet Interiors (Review Talk)

American Astronomical Society Meeting (6/9/21)
The Diverse Hot Saturn Population: Composition, Thermal Evolution, and Mass Loss

NASA Goddard SFC Exoplanet Seminar (1/6/21)
Slow Cooling and Fast Reinflation for Hot Jupiters

Chesapeake Bay Area Exoplanet Meeting (12/11/20)
Slow Cooling and Fast Reinflation for Hot Jupiters

PLATO Extra-Solar Planet Workshop (11/30/20)
Slow Cooling and Fast Reinflation for Hot Jupiters

NExScI Exoplanet Demographics Conference (11/10/20)
Giant Planet Population Physics (Invited Review Talk)

Caltech Division of Geological and Planetary Sciences Seminar (6/4/19)
Giant Exoplanet Physics From Population Statistics

American Astronomical Society Meeting (1/10/19)
Bayesian Inference of Giant Exoplanet Physics (Thesis Talk)

AAS Division of Planetary Science (10/24/18)
Bayesian Inference of Giant Planet Physics (Thesis Talk)

Bay Area Exoplanets Meeting (6/1/18)
Giant Exoplanet Main Sequence Reinflation & Atmosphere Metallicity

MIT Kavli Institute Exoplanet Tea Talk (4/4/18)
Bayesian Inference of Giant Planet Physics

Harvard-Smithsonian Center for Astrophysics Stars and Planets Seminar (4/2/18)
Bayesian Inference of Giant Planet Physics

American Astronomical Society Meeting (1/10/18)
Bayesian Inference of Hot Jupiter Radii: Evidence for Ohmic Dissipation?

AAS Division of Planetary Sciences Meeting (10/19/17)
Bayesian Inference of Hot Jupiter Radii: Evidence for Ohmic Dissipation?

Exoclipse Conference, Boise (8/21/17)
Bayesian Inference of Hot Jupiter Radii Points to Ohmic Dissipation

American Astronomical Society Meeting (1/5/17)
Bayesian Inference of Giant Planet Physics

Bay Area Exoplanets Meeting (12/9/16)
Bayesian Inference of Giant Planet Physics

AAS Division of Planetary Sciences Meeting (10/17/16)
Bayesian Inference of the Composition and Inflation Power of Hot Jupiters

Giant Magellan Telescope Meeting (9/26/16)
Bayesian Inference of Giant Planet Physics (Poster)

Linking Exoplanet and Disk Compositions, Space Telescope Science Institute (9/12/16)
Examining the Bulk Metallicity of Giant Planets

Exoplanets I Meeting (7/3/16)
Giant Planet Composition and Inflation: Breaking the Degeneracy (Poster)

Extreme Solar Systems Meeting (11/29/15) - The Metallicity of Giant Planets (Poster)

Bay Area Exoplanets Meeting (9/30/15) - The Metallicity of Giant Planets

Publications

Thorngren, D. P. (2024)
The Hot Jupiter Radius Anomaly and Stellar Connections
Handbook of Exoplanets, 2nd Edition (in Editing); arXiv:2405.05307

Thorngren, D. P., Lee, E. J., & Lopez, E. D. (2023)
Removal of Hot Saturns in Mass-Radius Plane by Runaway Mass Loss
The Astrophysical Journal; 2, L36

Thorngren, D. P., Fortney, J. J., Lopez, E. D., Berger, T. A., et al. (2021)
Slow Cooling and Fast Reinflation for Hot Jupiters
The Astrophysical Journal; 1, L16

Thorngren, D., Gao, P., & Fortney, J. J. (2019)
The Intrinsic Temperature and Radiative-Convective Boundary Depth in the Atmospheres of Hot Jupiters
The Astrophysical Journal; 1, L6

Thorngren, D., & Fortney, J. J. (2019)
Connecting Giant Planet Atmosphere and Interior Modeling: Constraints on Atmospheric Metal Enrichment
The Astrophysical Journal; 2, L31

Thorngren, D. P., & Fortney, J. J. (2018)
Bayesian Analysis of Hot-Jupiter Radius Anomalies: Evidence for Ohmic Dissipation?
The Astronomical Journal; 5, 214

Thorngren, D. P., Fortney, J. J., Murray-Clay, R. A., & Lopez, E. D. (2016)
The Mass-Metallicity Relation for Giant Planets
The Astrophysical Journal; 1, 64

Wang, G., Balmer, W. O., Pueyo, L., Thorngren, D., et al. (2025)
A Revised Density Estimate for the Largest Known Exoplanet, HAT-P-67 b
The Astronomical Journal; 6, 336

Chachan, Y., Dalba, P. A., Thorngren, D. P., Kane, S. R., et al. (2025)
Giant Outer Transiting Exoplanet Mass (GOT 'EM) Survey. V. Two Giant Planets in Kepler-511 but Only One Ran Away
The Astronomical Journal; 5, 248

Yee, S. W., Stefánsson, G., Thorngren, D., Monson, A., et al. (2025)
The Super-puff WASP-193 b is on a Well-aligned Orbit
The Astronomical Journal; 4, 225

Kirk, J., Ahrer, E.-M., Claringbold, A. B., Zamyatina, M., et al. (2025)
BOWIE-ALIGN: JWST reveals hints of planetesimal accretion and complex sulphur chemistry in the atmosphere of the misaligned hot Jupiter WASP-15b
Monthly Notices of the Royal Astronomical Society; 4, 3027

Karalis, A., Lee, E. J., & Thorngren, D. P. (2025)
Separating Super-puffs versus Hot Jupiters among Young Puffy Planets
The Astrophysical Journal; 1, 46

Balmer, W. O., Franson, K., Chomez, A., Pueyo, L., et al. (2025)
VLTI/GRAVITY Observations of AF Lep b: Preference for Circular Orbits, Cloudy Atmospheres, and a Moderately Enhanced Metallicity
The Astronomical Journal; 1, 30

Thao, P. C., Mann, A. W., Feinstein, A. D., Gao, P., et al. (2024)
The Featherweight Giant: Unraveling the Atmosphere of a 17 Myr Planet with JWST
The Astronomical Journal; 6, 297

Morley, C. V., Mukherjee, S., Marley, M. S., Fortney, J. J., et al. (2024)
The Sonora Substellar Atmosphere Models. III. Diamondback: Atmospheric Properties, Spectra, and Evolution for Warm Cloudy Substellar Objects
The Astrophysical Journal; 1, 59

Swain, M. R., Hasegawa, Y., Thorngren, D. P., & Roudier, G. M. (2024)
Planet Mass and Metallicity: The Exoplanets and Solar System Connection
Space Science Reviews; 6, 61

Nabbie, E., Huang, C. X., Burt, J. A., Armstrong, D. J., et al. (2024)
Surviving in the Hot-Neptune Desert: The Discovery of the Ultrahot Neptune TOI-3261b
The Astronomical Journal; 3, 132

Grunblatt, S. K., Saunders, N., Huber, D., Thorngren, D., et al. (2024)
TESS Giants Transiting Giants. IV. A Low-density Hot Neptune Orbiting a Red Giant Star
The Astronomical Journal; 1, 1

Sing, D. K., Rustamkulov, Z., Thorngren, D. P., Barstow, J. K., et al. (2024)
A warm Neptune's methane reveals core mass and vigorous atmospheric mixing
Nature; 8018, 831

Vissapragada, S., Greklek-McKeon, M., Linssen, D., MacLeod, M., et al. (2024)
Helium in the Extended Atmosphere of the Warm Superpuff TOI-1420b
The Astronomical Journal; 5, 199

Dalba, P. A., Kane, S. R., Isaacson, H., Fulton, B., et al. (2024)
Giant Outer Transiting Exoplanet Mass (GOT 'EM) Survey. IV. Long-term Doppler Spectroscopy for 11 Stars Thought to Host Cool Giant Exoplanets
The Astrophysical Journal Supplement Series; 1, 16

Radica, M., Coulombe, L.-P., Taylor, J., Albert, L., et al. (2024)
Muted Features in the JWST NIRISS Transmission Spectrum of Hot Neptune LTT 9779b
The Astrophysical Journal; 1, L20

Pereira, F., Grunblatt, S. K., Psaridi, A., Campante, T. L., et al. (2024)
TESS giants transiting giants V - two hot Jupiters orbiting red giant hosts
Monthly Notices of the Royal Astronomical Society; 3, 6332

Eberhardt, J., Hobson, M. J., Henning, T., Trifonov, T., et al. (2023)
Three Warm Jupiters around Solar-analog Stars Detected with TESS
The Astronomical Journal; 6, 271

Mann, C. R., Dalba, P. A., Lafrenière, D., Fulton, B. J., et al. (2023)
Giant Outer Transiting Exoplanet Mass (GOT 'EM) Survey. III. Recovery and Confirmation of a Temperate, Mildly Eccentric, Single-transit Jupiter Orbiting TOI-2010
The Astronomical Journal; 6, 239

Yoshida, S., Vissapragada, S., Latham, D. W., Bieryla, A., et al. (2023)
TESS Spots a Super-puff: The Remarkably Low Density of TOI-1420b
The Astronomical Journal; 5, 181

Bean, J. L., Xue, Q., August, P. C., Lunine, J., et al. (2023)
High atmospheric metal enrichment for a Saturn-mass planet
Nature; 7963, 43

Narang, M., Oza, A. V., Hakim, K., Manoj, P., et al. (2023)
uGMRT observations of the hot-Saturn WASP-69b: Radio-Loud Exoplanet-Exomoon Survey II (RLEES II)
Monthly Notices of the Royal Astronomical Society; 2, 1662

Calissendorff, P., De Furio, M., Meyer, M., Albert, L., et al. (2023)
JWST/NIRCam Discovery of the First Y+Y Brown Dwarf Binary: WISE J033605.05-014350.4
The Astrophysical Journal; 2, L30

Piaulet, C., Benneke, B., Almenara, J. M., Dragomir, D., et al. (2023)
Evidence for the volatile-rich composition of a 1.5-Earth-radius planet
Nature Astronomy; 206

Greklek-McKeon, M., Knutson, H. A., Vissapragada, S., Jontof-Hutter, D., et al. (2023)
Constraining the Densities of the Three Kepler-289 Planets with Transit Timing Variations
The Astronomical Journal; 2, 48

Narang, M., Oza, A. V., Hakim, K., Manoj, P., et al. (2023)
Radio-loud Exoplanet-exomoon Survey: GMRT Search for Electron Cyclotron Maser Emission
The Astronomical Journal; 1, 1

Komacek, T. D., Gao, P., Thorngren, D. P., May, E. M., et al. (2022)
The Effect of Interior Heat Flux on the Atmospheric Circulation of Hot and Ultra-hot Jupiters
The Astrophysical Journal; 2, L40

Lee, E. J., Karalis, A., & Thorngren, D. P. (2022)
Creating the Radius Gap without Mass Loss
The Astrophysical Journal; 2, 186

Jacobs, B., Désert, J.-M., Pino, L., Line, M. R., et al. (2022)
A strong H^- opacity signal in the near-infrared emission spectrum of the ultra-hot Jupiter KELT-9b
Astronomy and Astrophysics; L1

Dymont, A. H., Yu, X., Ohno, K., Zhang, X., et al. (2022)
Cleaning Our Hazy Lens: Exploring Trends in Transmission Spectra of Warm Exoplanets
The Astrophysical Journal; 2, 90

Kreidberg, L., Mollière, P., Crossfield, I. J. M., Thorngren, D. P., et al. (2022)
Tentative Evidence for Water Vapor in the Atmosphere of the Neptune-sized Exoplanet HD 106315c
The Astronomical Journal; 4, 124

Chachan, Y., Dalba, P. A., Knutson, H. A., Fulton, B. J., et al. (2022)
Kepler-167e as a Probe of the Formation Histories of Cold Giants with Inner Super-Earths
The Astrophysical Journal; 1, 62

Dalba, P. A., Kane, S. R., Dragomir, D., Villanueva, S., et al. (2022)
The TESS-Keck Survey. VIII. Confirmation of a Transiting Giant Planet on an Eccentric 261 Day Orbit with the Automated Planet Finder Telescope
The Astronomical Journal; 2, 61

Dang, L., Bell, T. J., Cowan, N. B., Thorngren, D., et al. (2022)
Thermal Phase Curves of XO-3b: An Eccentric Hot Jupiter at the Deuterium Burning Limit
The Astronomical Journal; 1, 32

Wahl, S. M., Thorngren, D., Lu, T., & Militzer, B. (2021)
Tidal Response and Shape of Hot Jupiters
The Astrophysical Journal; 2, 105

Dalba, P. A., Kane, S. R., Li, Z., MacDougall, M. G., et al. (2021)
Giant Outer Transiting Exoplanet Mass (GOT 'EM) Survey. II. Discovery of a Failed Hot Jupiter on a 2.7 Yr, Highly Eccentric Orbit
The Astronomical Journal; 4, 154

Hobson, M. J., Brahm, R., Jordán, A., Espinoza, N., et al. (2021)
A Transiting Warm Giant Planet around the Young Active Star TOI-201
The Astronomical Journal; 5, 235

Baxter, C., Désert, J.-M., Tsai, S.-M., Todorov, K. O., et al. (2021)
Evidence for disequilibrium chemistry from vertical mixing in hot Jupiter atmospheres. A comprehensive survey of transiting close-in gas giant exoplanets with warm-Spitzer/IRAC
Astronomy and Astrophysics; A127

Piaulet, C., Benneke, B., Rubenzahl, R. A., Howard, A. W., et al. (2021)
WASP-107b's Density Is Even Lower: A Case Study for the Physics of Planetary Gas Envelope Accretion and Orbital Migration
The Astronomical Journal; 2, 70

Mikal-Evans, T., Crossfield, I. J. M., Benneke, B., Kreidberg, L., et al. (2021)
Transmission Spectroscopy for the Warm Sub-Neptune HD 3167c: Evidence for Molecular Absorption and a Possible High-metallicity Atmosphere
The Astronomical Journal; 1, 18

Fortney, J. J., Visscher, C., Marley, M. S., Hood, C. E., et al. (2020)
Beyond Equilibrium Temperature: How the Atmosphere/Interior Connection Affects the Onset of Methane, Ammonia, and Clouds in Warm Transiting Giant Planets
The Astronomical Journal; 6, 288

Mayorga, L. C., Charbonneau, D., & Thorngren, D. P. (2020)
Reflected Light Observations of the Galilean Satellites from Cassini: A Test Bed for Cold Terrestrial Exoplanets
The Astronomical Journal; 5, 238

Díaz, M. R., Jenkins, J. S., Feng, F., Butler, R. P., et al. (2020)
The Magellan/PFS Exoplanet Search: a 55-d period dense Neptune transiting the bright (V = 8.6) star HD 95338
Monthly Notices of the Royal Astronomical Society; 4, 4330

Gao, P., Thorngren, D. P., Lee, E. K. H., Fortney, J. J., et al. (2020)
Aerosol composition of hot giant exoplanets dominated by silicates and hydrocarbon hazes
Nature Astronomy; 951

Komacek, T. D., Thorngren, D. P., Lopez, E. D., & Ginzburg, S. (2020)
Reinflation of Warm and Hot Jupiters
The Astrophysical Journal; 1, 36

Movshovitz, N., Fortney, J. J., Mankovich, C., Thorngren, D., et al. (2020)
Saturn's Probable Interior: An Exploration of Saturn's Potential Interior Density Structures
The Astrophysical Journal; 2, 109

Vissapragada, S., Jontof-Hutter, D., Shporer, A., Knutson, H. A., et al. (2020)
Diffuser-assisted Infrared Transit Photometry for Four Dynamically Interacting Kepler Systems
The Astronomical Journal; 3, 108

Teske, J. K., Thorngren, D., Fortney, J. J., Hinkel, N., et al. (2019)
Do Metal-rich Stars Make Metal-rich Planets? New Insights on Giant Planet Formation from Host Star Abundances
The Astronomical Journal; 6, 239

Wallack, N. L., Knutson, H. A., Morley, C. V., Moses, J. I., et al. (2019)
Investigating Trends in Atmospheric Compositions of Cool Gas Giant Planets Using Spitzer Secondary Eclipses
The Astronomical Journal; 6, 217

Kreidberg, L., Line, M. R., Thorngren, D., Morley, C. V., et al. (2018)
Water, High-altitude Condensates, and Possible Methane Depletion in the Atmosphere of the Warm Super-Neptune WASP-107b
The Astrophysical Journal; 1, L6

Yadav, R. K., & Thorngren, D. P. (2017)
Estimating the Magnetic Field Strength in Hot Jupiters
The Astrophysical Journal; 1, L12

Espinoza, N., Fortney, J. J., Miguel, Y., Thorngren, D., et al. (2017)
Metal Enrichment Leads to Low Atmospheric C/O Ratios in Transiting Giant Exoplanets
The Astrophysical Journal; 1, L9

Morley, C. V., Knutson, H., Line, M., Fortney, J. J., et al. (2017)
Forward and Inverse Modeling of the Emission and Transmission Spectrum of GJ 436b: Investigating Metal Enrichment, Tidal Heating, and Clouds
The Astronomical Journal; 2, 86

Szydagis, M., Fyhrie, A., Thorngren, D., & Tripathi, M. (2013)
Enhancement of NEST capabilities for simulating low-energy recoils in liquid xenon
Journal of Instrumentation; 10, C10003