

# Daniel Thorngren

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Physics Department  
Center for Adaptive Optics #102  
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## Education

**University of California, Santa Cruz** (2013-Present)  
Ph.D. Student, Candidate (2016) 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 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++, Python, Cython, and R.  
Data analysis tools - SQL, Matplotlib, Pandas, Stan.  
Working in a Unix environment, high-performance computing  
Implementing advanced MCMC techniques (e.g. Hamiltonian Monte Carlo, BPS).

## Experience

**LUX Dark Matter Detector** - Undergraduate Researcher, UC Davis (2011-2013)  
Analyzed LUX data and calculated expected detection rates  
Wrote, modified, and operated particle physics simulation software  
Created optimized approximate simulation module for many-photon events which improved run-time by a factor of  $> 100$  (senior thesis work)

**Other Worlds Laboratory (OWL)** - Graduate Student, UCSC (2013-Present)  
Created computer models of the interior structure of giant planets  
Analyzed observed exoplanet data to infer the bulk composition of giant exoplanets and understand their relationship with mass through Bayesian statistics  
Analyzing stellar abundance data for the connection with planetary composition  
Assisting with MCMC-based inference of planetary interior structures using gravity moment measurements from the Cassini and Juno spacecraft.  
Advised two undergraduates for their senior theses.

**Amazon A9** - Applied Science Intern (June 2018 - September 2018)  
Constructed machine-learned models for ranking customer search results, which were subsequently deployed to the Amazon website.  
Analyzed Amazon internal books data to construct new features for use in improving the quality of customer search results.

## Teaching Assistantship

Taught lab sections for introductory physics classes and graded coursework.

## Publications

- Thorngren, D., Fortney J., (2017)  
*Bayesian Analysis of Hot Jupiter Radius Anomalies: Evidence for Ohmic Dissipation?* The Astronomical Journal, 155, 214
- Thorngren, D., Fortney J., Murray-Clay, R., Lopez E., (2016)  
*The Mass-Metallicity Relation for Giant Planets*, The Astrophysical Journal, 831, 64
- Yadav, R., Thorngren, D. (2017)  
*Estimating the Magnetic Field Strength in Hot Jupiters.*,  
The Astrophysical Journal Letters, 849, L12
- Espinoza, N., Fortney, J., Miguel, Y., Thorngren, D., Murray-Clay, R. (2017)  
*Metal enrichment leads to low atmospheric C/O ratios in transiting giant exoplanets.*,  
The Astrophysical Journal Letters, 838 L9
- Kreidberg, L.; Line, M.; Thorngren, D.; Morley, C.; Stevenson, K. (2017)  
*Water, Methane Depletion, and High-Altitude Condensates in the Atmosphere of the Warm Super-Neptune WASP-107b*, The Astrophysical Journal Letters, 858, L6
- Morley, C., Knutson, H., Line, M., Fortney, J., Thorngren, D., Marley, M., Teal, D., Lupu, R. (2017).  
*Forward and Inverse Modeling of the Emission and Transmission Spectrum of GJ 436b: Investigating Metal Enrichment, Tidal Heating, and Clouds*,  
The Astronomical Journal, 153, 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, 8, 10.

## 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

## Talks and Presentations

- 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