Daniel Foreman-Mackey

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Member of Technical Staff, Anthropic, New York, NY

Education

PhD 2015, Department of Physics, New York University. Advisor: Hogg
MSc 2010, Department of Physics, Queen's University, Canada. Advisor: Widrow
BSc 2008, Department of Physics, McGill University, Canada.

Positions

Member of Technical Staff, Anthropic, 2025–present.
Research Engineer, Google DeepMind, 2024–2025.
Research Scientist, Flatiron Institute, 2022–2024.
Associate Research Scientist, Flatiron Institute, 2017–2022.
Sagan Postdoctoral Fellow, University of Washington, 2015–2017.

Popular open-source software

jax — 34919 stars / 3432 forks
Composable transformations of Python+NumPy programs: differentiate, vectorize, JIT to GPU/TPU, and more [docs]

tinygp — 333 stars / 32 forks
The tiniest of Gaussian Process libraries [docs]

emcee — 1567 stars / 440 forks
The Python ensemble sampling toolkit for affine-invariant MCMC [docs]

corner.py — 559 stars / 235 forks
Make some beautiful corner plots [docs]

exoplanet — 233 stars / 56 forks
Fast & scalable MCMC for all your exoplanet needs! [docs]

daft — 684 stars / 120 forks
Render probabilistic graphical models using matplotlib [docs]

Mentorship

I collaborate with and mentor many students and postdocs, often on a single project. Below is a list of the group members who I have formally mentored as part of the Flatiron Research Fellowship and Pre-doctoral Fellowship at the Center for Computational Astrophysics.

Current postdocs: Thavisha Dharmawardena, Jiayin Dong, Nora Eisner, Lionel Garcia, Joseph Long.

Current students: Quadry Chance, Soichiro Hattori.

Former postdocs: Megan Bedell, Trevor David, Rodrigo Luger.

Former students: Fran Bartolić, Eoin Farrell, Alex Gagliano, Karl Jaehnig, Gautam Nagaraj, Pa Chia Thao, Nhat Quang Hoang Tran.

Selected invited talks & tutorials

Open software for Astrophysics, 2023, Invited Plenary, 241st AAS Meeting, Seattle.

Gaussian Processes for EPRV, 2022, Invited Tutorial, University of Oxford, UK.

Methods for scalable probabilistic inference, 2022, Colloquium, University of Illinois Urbana-Champaign.
2022, Colloquium, UC Berkeley.
2022, Colloquium, University of Oxford, UK.
2021, Invited Talk, Institute for Pure & Applied Mathematics, UCLA.

Advanced probabilistic modeling, 2021, Tutorial, Harley Wood Winter School of Astronomy, Australia.

Open-source software for probabilistic data analysis in astronomy, 2021, Seminar, Instituto de Astrofísica, Portugal.

Gaussian processes & stellar variability, 2021, Seminar, CARMENES Team Meeting.

Extending JAX with custom C++ & CUDA, 2021, Invited Talk, IRIS-HEP Topical Meeting, CERN.

Open source software for probabilistic data analysis, 2020, Invited Talk, OzGrav Early Career Researcher Symposium, Australia.

The why & how of exoplanet, a domain-specific PyMC3 extension, 2020, Contributed Talk, PyMC Con.

A modular ecosystem for probabilistic data analysis, 2019, Invited Talk, Open Digital Infrastructure in Astronomy conference, Kavli Institute for Theoretical Physics.

Exoplanet population inference, a tutorial, 2019, Invited Talk, Exostar19 conference, Kavli Institute for Theoretical Physics.

Astronomy as a testbed for statistical method development, 2019, Colloquium, Center for Statistics and Machine Learning, Princeton.

Data-driven discovery in the astronomical time domain, 2018, Colloquium, Institute for Theory and Computation, Harvard-Smithsonian Center for Astrophysics.
2018, Colloquium, University of California, Santa Cruz.
2017, Interdisciplinary Colloquium, CIERA, Northwestern University.

A practical introduction to Gaussian Processes for astronomy, 2017, Invited Talk, Statistical Challenges in Astrophysics, University of New South Wales, Australia.

Long-period transiting planets & their population, 2016, Invited talk, Exoplanets I, Davos.
2016, Invited talk, Statistical Challenges of Modern Astrophysics, Carnegie Mellon.
2016, Colloquium, Villanova.

Scalable Gaussian processes & the search for transiting exoplanets, 2015, Data Science at the LHC, CERN, Geneva.

Discovery & characterization of transiting exoplanets & their population, 2015, Colloquium, University of Washington.

Hierarchical inference for exoplanet population inference, 2015, IAU Symposium, Honolulu.

Data-driven models, 2015, Extreme precision radial velocities, Yale.

Population inference from noisy & incomplete catalogs, 2015, Local Group Astrostatistics, University of Michigan.

Time series analysis, Gaussian Processes, and the search for exo-Earths, 2014, PyData NYC

conference, New York.

Introduction to Gaussian Processes, probabilistic graphical models, and deep learning, 2014, Astro Hack Week, University of Washington.

An astronomer's introduction to Gaussian processes, 2014, Bayesian Computing for Astronomical Data Analysis (Summer school at Penn State University).

Grants

NSF-CDS&E (PI: Agol) *Development of fast, multi-dimensional Gaussian Processes for Exoplanet discovery and beyond*, $471,048.00, 2019–2022

NSF-AAG (PI: Agol), *Collaborative Research: Masses and architectures of (potentially habitable) exoplanet systems*, $491,950, 2016–2018

K2 Guest Observer – Cycle 3 (PI: Penny), *Free-Floating and Bound Planet Mass Measurements with K2: Ground- and Space-Based Photometry, Event Detection and Modeling*, $84,000, 2016–2017

K2 Guest Observer – Cycle 3 (PI: Hogg), *Ultra-precise photometry in crowded fields: A self-calibration approach*, $100,000, 2016–2017

XSEDE (PI: Foreman-Mackey), *A systematic search for transiting exoplanets using K2*, 100,000 CPU hours, 2015–2016

Honors

Kavli Fellow, 2015.

Sagan Postdoctoral Fellowship, 2015–2017.

James Arthur Graduate Fellowship, 2014.

Horizon Fellowship in the Natural & Physical Sciences, 2012.

Henry M. MacCracken Fellowship, 2010.

NSERC Undergraduate Summer Research Award, 2007.

Professional service & activities

Associate Editor-in-Chief — Journal of Open Source Software, 2019–2025

Active Referee — AAS Journals, MNRAS, PASP, A&A, Journal of Statistical Software, Journal on Uncertainty Quantification, Journal of Open Source Software

Panelist — NSF, NASA, LSSTC