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RESEARCH INTERESTS

I develop methods and analyze large datasets to understand how **galaxies** like our own **Milky Way** form, behave, and evolve. This work lies in the interdisciplinary fields of **astrostatistics** and **data science** at the intersections of statistics, astronomy, and computer science.

POSITIONS

Dunlap Postdoctoral Fellow: Dunlap Institute, University of Toronto 2020-2025
Banting Postdoctoral Fellow: Statistical Sciences, University of Toronto 2020-2022
Supervisor: Gwen Eadie (joint with Astronomy & Astrophysics)
Project Academic Support Staff: Kavli IPMU, University of Tokyo 2015-2016
Supervisors: Naoki Yoshida, Alexie Leauthaud, & Kevin Bundy

EDUCATION

Harvard University: PhD in Astronomy 2016-2020
Advisers: Doug Finkbeiner, Charlie Conroy, Daniel Eisenstein, & Alyssa Goodman
Harvard University: MA in Astronomy 2016-2020
Advisers: Daniel Eisenstein & Alexie Leauthaud
Harvard University: BA in Astrophysics and Physics 2011-2015

SELECTED AWARDS & HONORS

Best Astrostatistics Student Paper Award (ASA/AIG) 2020
Eric R. Keto Prize for Best Thesis in Theoretical Astrophysics (Harvard) 2020
Banting Postdoctoral Fellowship (Canada) 2020
Department of Astronomy Teaching Award (Harvard) Spring 2018
Bok Center Certificate of Distinction in Teaching (Harvard) Spring 2017, 18; Fall 2018
NSF Graduate Research Fellowship (USA) 2016

TEACHING

I have a strong interest in education and pedagogy, with a focus on skills such as **programming, statistics, and data science**. See my **teaching statement** for additional details.

EQUITY, DIVERSITY, & INCLUSION

I am committed to improving equity, diversity, and inclusion (EDI) in the classroom, in my work, and in the wider academic community. See my **EDI statement** for additional details.

MENTORSHIP

I am currently (co-)mentoring a total of **11 individuals**. See my **List of Mentees** for a full record of the individuals I have (co-)mentored.

Graduate

2. Steffani Grondin (Astronomy, Toronto) — Spring 2021-Present
   Tidal Stripping in Clusters with Machine Learning and Corespray (with Prof. Jeremy Webb)
1. Aarya Patil (Astronomy, Toronto) — Winter 2021-Present
   Asteroseismology with Multitaper Methods (with Prof. Gwen Eadie)

Undergraduate

8. Charlie Hughes (Astronomy, Toronto) — Fall 2021-Present
   Photometric Metallicity with DECam and S5 (with Prof. Ting Li)
7. Eric Conenna (Astronomy, Toronto) — Fall 2021-Present
   High-Dimensional Analysis of APOGEE Data (with Prof. Jeremy Webb and Steffani Grondin)
6. Daniel Ding (Engineering, Toronto) — Fall 2021-Present
   Exploring Latent Space Decompositions of APOGEE Spectra (with Prof. Jo Bovy)
5. Ava Oveisi (CS/Physics, Toronto-Scarborough) — Summer 2020-Present
   Imaging Cosmic Dust with Machine Learning (with Prof. Kristen Menou)
4. Alicia Savelli (Math/Education/Physics, Brock) — Summer 2020-Present
   Characterizing Milky Way Analogues in Cosmological Simulations (with Dr. Ted Mackereth)
3. Jeff Shen (Statistics/Astronomy/Math, Toronto) — Winter 2020-Present
   Disentangling Stellar Age Estimates from Galactic Chemodynamical Evolution (with Drs. Neige Frankel and Ted Mackereth)
   Estimating the Mass of the Milky Way with the H3 Survey (with Profs. Gwen Eadie, Norm Murray, and Dennis Zaritsky)
2. Mingxuan Teng (Math/CS, Toronto) — Fall 2020-Present
   Detecting and Characterizing Outliers in Supervised Machine Learning Applications
1. Zhiya Lou (Math/Statistics, Toronto → Statistics, ICL) — Fall 2020-Present
   Bayesian Model Selection with Globular Clusters (with Profs. Gwen Eadie and Jeremy Webb)

High School

1. Liam Pilarski (Millburn High School, NJ) — Fall 2021-Present
   Estimating Galaxy Properties from Images with Probabilistic Deep Learning

SELECTED PROFESSIONAL ACTIVITIES & SERVICE

American Astronomical Society (AAS)
Steering Committee: Working Group on Astroinformatics & Astrostatistics — 2020-Present

American Statistical Association (ASA)
Web Director: Astrostatistics Interest Group — 2020-Present

University of Toronto (UofT) Astronomy
Postdoc Representative: Training & Mentoring Committee — 2021-Present

(Co-)Founder: Statistics & Machine Learning Journal Club 2020-Present
Organizing Committee: Summer Undergraduate Research Program Summer 2021
Postdoc Representative: Graduate Admissions Committee Winter 2021

Center for Astrophysics | Harvard & Smithsonian (CfA)

Founder: CfA Machine Learning Journal Club 2017-2020

Workshops & Conferences

Joint Statistical Meetings (JSM) 2021 August 2021
Topic-Contributed Panel: Understanding a Data-Rich Universe with Data-Driven Approaches
Co-organizer: Stellar Stats Workshop (UofT) May 2021

Manuscript Referee

Bayesian Analysis 2021-Present
Journal of Open Source Software (JOSS) 2020-Present
Astronomy & Astrophysics (A&A) 2017-Present
Monthly Notices of the Royal Astronomical Society (MNRAS) 2016-Present
American Astronomical Society (AAS) Journals (AJ, ApJ, ApJL, ApJS) 2014-Present

SELECTED PRESENTATIONS

Invited Talks

IPAM: Inference and Estimation in Gravitational Wave Astronomy Workshop November 2021
Dynamic Nested Sampling with *dynesty*
University of Surrey: Cross-Research Platform for Bayesian Data-fitting Workshop July 2021
Keynote Address: An Introduction to Nested Sampling
Harvard University: CMSA Big Data Conference August 2018
Revealing the Milky Way's Dust-iny

Colloquia & Seminars

University of Toronto: Toronto Data Workshop October 2021
What is Data Science and How Does it Relate to Astronomy?
Penn State University: Colloquium September 2021
Mapping the Milky Way with Stars and Dust
University of Chicago: Kavli Institute for Cosmological Physics Seminar April 2021
Cosmological Cartography with Photometric Redshifts
CANSSI Ontario: Data Science Applied Research and Education Seminar February 2021
Mapping the Milky Way in the Age of Gaia
University of Florida: Colloquium September 2020
Enabling Data-Driven Discovery in the Milky Way and Beyond Using Large Astronomical Datasets
Villanova University: Colloquium October 2019
Exploring the Galaxy Near and Far in the Age of Gaia
Harvard University: Summer Colloquium (joint with Catherine Zucker) June 2019
Charting Nearby Molecular Clouds with Gaia: A New Map of Our Local Interstellar Medium
University of Cambridge: Data Intensive Science Seminar April 2019
Mapping the 3-D Distribution of Dust in the Milky Way with Stellar Photometry
UMass Amherst: Data Science Tea October 2017

Big Data Inference: Using Hierarchical Bayes and Machine Learning to Improve Photometric Redshifts

Kavli IPMU: Astronomy Lunch Seminar — March 2016
Mapping, Visualizing, and Exploiting the Color-Redshift Relation

University of Tsukuba: Theoretical Astrophysics Seminar — August 2013
The Evolution of Star-Forming Galaxies over Cosmic Time

Contributed

AAS 238: Special Session (Statistics Discussant) — June 2021
Unaccounted Uncertainties: The Role of Systematics in Astrophysics

Astro Hack Week 2020 (Tutorial Leader) — August 2020
Introduction to Bayesian Inference with Linear Regression

Lorentz Center: Colours of the Universe Workshop (Session Leader) — September 2018
Challenges Working with Posterior Distributions (with Alex Malz)

Public Talks & Events

RASC Ottawa Centre: Monthly Meeting — June 2021
Mapping the Milky Way in the Age of Gaia

GitHub Satellite 2019 — May 2019
Open-source code contributions (*dynesty*) in the analysis of M87* by the EHT collaboration

PUBLICATIONS

I am an author on **61 papers** that have **over 3900** citations (h-index=19). This includes:
13 papers as (co-)lead author with **over 1300** citations (h-index=9)
18 papers with significant contributions with **over 900** citations (h-index=11)
2 papers led by students with **over 5** citations (h-index=1)

Most of my papers can be found online on arxiv and ADS. My ORCID is 0000-0003-2573-9832.
See my full **Publications List** for additional details.

Top 5 Most Cited Publications as (Co-)Lead Author

772: **Speagle, J. S.**; Steinhardt, C. L.; Capak, P. L.; & Silverman, J. D., 2014, ApJS
A Highly Consistent Framework for the Evolution of the Star-Forming 'Main Sequence' from z~0-6
arxiv: 1405.2041

340: **Speagle, J. S.**, 2020, MNRAS
dynesty: A Dynamic Nested Sampling Package for Estimating Bayesian Posteriors and Evidences
arxiv: 1904.02180

98: **Zucker, C. & Speagle, J. S.**; Schlafly, E. F.; Green, G. M., Finkbeiner, D. P.; Goodman, A. A.; & Alves, J., 2019, ApJ
A Large Catalog of Accurate Distances to Local Molecular Clouds: The Gaia DR2 Edition
arxiv: 1902.01425

21: **Speagle, J. S.** & Eisenstein, D. J., 2017, MNRAS
Deriving Photometric Redshifts with Fuzzy Archetypes and Self-Organizing Maps I. Methodology

arxiv: 1510.08073

15: **Speagle, J. S.**; Capak, P. L.; Eisenstein, D. J.; Masters, D. C.; & Steinhardt, C. L., 2016, MNRAS
Exploring Photometric Redshifts as an Optimization Problem: An Ensemble MCMC and Simulated Annealing-Driven Template-fitting Approach
arxiv: 1508.02484

Top 5 Most Cited Publications with Significant Contributions

249: Green, G. M.; Schlafly, E. F.; Zucker, C.; **Speagle, J. S.**; & Finkbeiner, D. P., 2019, ApJ
A 3D Dust Map Based on Gaia, Pan-STARRS 1 and 2MASS
arxiv: 1905.02734

158: Tanaka, M.; Coupon, J.; Hsieh, B.-C.; Mineo, S., Nishizawa, A. J.; **Speagle, J.**; Furusawa, H.; Miyazaki, S.; & Murayama, H., 2018, PASJ
Photometric Redshifts for the Hyper Suprime-Cam Subaru Strategic Program Data Release 1
arxiv: 1704.05988

128: Steinhardt, C. L.; **Speagle, J. S.** et al. [22 additional co-authors], 2014, ApJL
Star Formation at $4 < z < 6$ from the Spitzer Large Area Survey with Hyper-Suprime-Cam (SPLASH)
arxiv: 1407.7030 **Media**: JPL

100: Leja, J.; Carnall, A. C.; Johnson, B. D.; Conroy, C.; & **Speagle, J. S.**, 2019, ApJ
How to Measure Galaxy Star Formation Histories II: Nonparametric Models
arxiv: 1811.03637

60: Zucker, C.; **Speagle, J. S.**; Schlafly, E. F.; Green, G. M.; Finkbeiner, D. P., Goodman, A.; & Alves, J., 2020, A&A
A Compendium of Distances to Molecular Clouds in the Star Formation Handbook
arxiv: 2001.00591

Top 5 Most Cited Publications as a Contributing Author

469: Aihara, H. et al. [142 additional co-authors including **Speagle, J. S.**], 2018, PASJ
The Hyper Suprime-Cam SSP Survey: Overview and Survey Design
arxiv: 1704.05858

355: Aihara, H. et al. [108 additional co-authors including **Speagle, J. S.**], 2018, PASJ
First Data Release of the Hyper Suprime-Cam Subaru Strategic Program
arxiv: 1702.08449

269: Hikage, C. et al. [35 additional co-authors including **Speagle, J. S.**], 2019, PASJ
Cosmology from cosmic shear power spectra with Subaru Hyper Suprime-Cam first-year data
arxiv: 1809.09148 **Media**: PASJ Excellent Paper Award (English)

144: Mandelbaum, R. et al. [30 additional co-authors including **Speagle, J. S.**], 2018, PASJ
The first-year shear catalog of the Subaru Hyper Suprime-Cam SSP Survey
arxiv: 1706.06745

101: Masters, D. C. et al. [19 additional co-authors including **Speagle, J. S.**], 2015, ApJ
Mapping the Galaxy Color-Redshift Relation: Optimal Photometric Redshift Calibration Strategies for Cosmology Surveys
arxiv: 1509.03318