JOSHUA S. SPEAGLE (沈佳士)

Statistical Sciences | Astronomy & Astrophysics
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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

Assistant Professor of Astrostatistics: University of Toronto	2022-Present
Dunlap Postdoctoral Fellow: University of Toronto	2020-2022
Banting Postdoctoral Fellow: University of Toronto	2020-2022
Supervisor: Gwen Eadie	
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

John Charles Polanyi Prize in Physics (Council of Ontario Universities)	2022
Best Astrostatistics Student Paper Award (ASA/AIG)	2020
Eric R. Keto Prize for Best Thesis in Theoretical Astrophysics (Harvard)	2020
Department of Astronomy Teaching Award (Harvard)	Spring 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, applied 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.

SUPERVISION & MENTORSHIP

I am currently (co-)supervising/mentoring a total of **19 individuals**. This includes:
   3 postdoctoral researchers
   6 doctoral students
   10 undergraduate students

See my **List of Mentees** for a full record of the **48 individuals** I have (co-)supervised/mentored.

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
Canadian Astronomical Society (CASCA)	
Postdoc Committee	2020-2023
University of Toronto (UofT) Astronomy	
Training & Mentoring Committee	2021-Present
Summer Undergraduate Research Program (SURP) Committee	2021-Present
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: Annual UofT Stellar Stats Workshop	2021-Present
Manuscript Referee	
Annals of Applied Statistics	2022-Present
Statistical Science	2022-Present
RAS Techniques and Instruments (RASTI)	2022-Present
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 & APPEARANCES

I have given numerous presentations on the work being done by me and my collaborators to the scientific community and the public along with providing lectures and tutorials and participating in panel discussions. See my **List of Talks** for a fuller record. A selected list is provided below.

Invited Talks

NSF IAIFI Summer Workshop	August 2023

    Uncertainty and Interpretability in Machine Learning Models

MaxEnt 2023 Workshop   July 2023
Frontiers of Nested Sampling Meeting-within-a-Meeting
    Musings on Nested Sampling from Interactions with Everyday Users

Statistical Challenges in Modern Astronomy VIII   June 2023
    Extending Bayesian Modeling Approaches to ML Applications

IAU General Assembly 2022   August 2022
Machine Learning in Astronomy: Possibilities and Pitfall
    Incorporating Errors into Machine Learning Methods

Colloquia & Seminars

Carnegie Mellon University   September 2023
STAMPS Seminar
    Nested Sampling: Past, Present, and Future

University of Pittsburgh   September 2023
Astronomy Seminar
    From Panchromatic Images to Stellar Ages and Beyond

Center for Astrophysics | Harvard & Smithsonian   August 2023
AstroAI Seminar
    Extending Statistical Thinking to ML Applications

McMaster University   April 2023
Astronomy Lunch Seminar
    From Panchromatic Images to Stellar Ages and Beyond

University of Waterloo   February 2023
Astroseminar
    From Panchromatic Images to Stellar Ages and Beyond

NRC Herzberg Astronomy and Astrophysics Research Centre   November 2022
Colloquium
    Galaxy Evolution through the Eyes of the Milky Way

Queen's University   November 2022
Astronomy Seminar
    Galaxy Evolution through the Eyes of the Milky Way

Institute for Advanced Study   August 2022
Astrophysics Seminar
    From Panchromatic Images to Stellar Ages and Beyond

Saint Mary's University   August 2022
Department of Astronomy and Physics Colloquium
    More Data + More Parameters = More Fun with Galaxy Evolution

Contributed Talks

University of Michigan   August 2023
2023 Clusters & Streams Workshop

Rapid Stellar Parameter Inference with Probabilistic Machine Learning

JSM 2023   August 2023
True North Strong and... Amazing at Astrostatistics! (Invited Paper Session)
    Connecting Galaxy Evolution between Observation, Simulation, and Theory

Surveys to Discovery (S2D) Conference   May 2023
    Photometric Biases in Modern Surveys

2023 Spring Research Conference (SRC)   May 2023
    From Light to Mass and Back Again: Exploring Galaxy Evolution with "New" Methods
    and "Old" Outcomes

McMaster University   August 2022
2022 Clusters Workshop
    Panchromatic Modelling of Co-Eval Stellar Populations

JSM 2022   August 2022
Advances in Astrostatistics in the Great White North (Invited Paper Session)
    Mapping the Milky Way in 5-D with Big Data

Lectures & Tutorials

2023 ESO Conference   September 2023
Two in a million – The interplay between binaries and star clusters
    Machine Learning for Star Cluster Science

University of Michigan   August 2023
2023 Clusters & Streams Workshop
    Dimensionality Reduction: Applications to Star Cluster Science

NSF IAIFI Summer School   August 2023
    Uncertainty and Interpretability in Machine Learning Models (with Alex Gagliano)

Statistical Challenges in Modern Astronomy VIII   June 2023
    A Tutorial of (Dynamic) Nested Sampling

Posters

2023 ESO Conference   September 2023
Two in a million – The interplay between binaries and star clusters
    A machine-learning led search for extra-tidal stars of globular clusters

PUBLICATIONS

I am an author on **90+ papers** that have **7900+** citations (h-index=34). This includes:
    10+ papers as (co-)lead author with 2300+ citations (h-index=10)
    25+ papers with significant contributions with 2200+ citations (h-index=16)
    5+ papers led by students with 45+ citations (h-index=3)

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

1121 cites: **Speagle, J. S.**; Steinhardt, C. L.; Capak, P. L.; & Silverman, J. D., 2014, The Astrophysical Journal Supplement Series, Vol. 214, Iss. 2, id. 15
> A Highly Consistent Framework for the Evolution of the Star-Forming 'Main Sequence' from z~0-6
> arxiv: 1405.2041

955 cites: **Speagle, J. S.**, 2020, Monthly Notices of the Royal Astronomical Society, Vol. 493, Iss. 3, p. 3132-3158
> *dynesty*: A Dynamic Nested Sampling Package for Estimating Bayesian Posteriors and Evidences
> arxiv: 1904.02180

181 cites: **Zucker, C. & Speagle, J. S.**; Schlafly, E. F.; Green, G. M., Finkbeiner, D. P.; Goodman, A. A.; & Alves, J., 2019, The Astrophysical Journal, Vol. 879, Iss. 2, id. 125
> A Large Catalog of Accurate Distances to Local Molecular Clouds: The Gaia DR2 Edition
> arxiv: 1902.01425

25 cites: **Speagle, J. S.**, arxiv e-print
> A Conceptual Introduction to Markov Chain Monte Carlo Methods
> arxiv: 1909.12313

23 cites: **Speagle, J. S.** et al. [11 additional co-authors], 2019, Monthly Notices of the Royal Astronomical Society, Vol. 490, Iss. 4, p. 5658-5677
> Galaxy-Galaxy Lensing in HSC: Validation Tests and the Impact of Heterogeneous Spectroscopic Training Sets
> arxiv: 1906.05876

Top 5 Most Cited Publications with Significant Contributions

681 cites: Green, G. M.; Schlafly, E. F.; Zucker, C.; **Speagle, J. S.**; & Finkbeiner, D. P., 2019, The Astrophysical Journal, Vol. 887, Iss. 1, id. 93
> A 3D Dust Map Based on Gaia, Pan-STARRS 1 and 2MASS
> arxiv: 1905.02734

264 cites: Johnson, B. D.; Leja, J.; Conroy, C.; & **Speagle, J. S.**, 2021, The Astrophysical Journal Supplement Series, Vol. 254, Iss. 2, id. 22
> Stellar Population Inference with Prospector
> arxiv: 2012.01426

256 cites: Leja, J.; Carnall, A. C.; Johnson, B. D.; Conroy, C.; & **Speagle, J. S.**, 2019, The Astrophysical Journal, Vol. 876, Iss. 1, id. 3
> How to Measure Galaxy Star Formation Histories II: Nonparametric Models
> arxiv: 1811.03637

225 cites: Tanaka, M.; Coupon, J.; Hsieh, B.-C.; Mineo, S., Nishizawa, A. J.; **Speagle, J.**; Furusawa, H.; Miyazaki, S.; & Murayama, H., 2018, Publications of the Astronomical Society of Japan, Vol. 70, Iss. SP1, id. S9
> Photometric Redshifts for the Hyper Suprime-Cam Subaru Strategic Program Data Release 1
> arxiv: 1704.05988

157 cites: Steinhardt, C. L.; **Speagle, J. S.** et al. [22 additional co-authors], 2014, The Astrophysical Journal Letters, Vol. 791, Iss. 2, id. L25
> Star Formation at 4 < z < 6 from the Spitzer Large Area Survey with Hyper-Suprime-Cam (SPLASH)
> arxiv: 1407.7030   **Media**: JPL

Top 5 Most Cited Publications as a Contributing Author

754 cites: Aihara, H. et al. [142 additional co-authors including **Speagle, J. S.**], 2018, Publications of the Astronomical Society of Japan, Vol. 70, Iss. SP1, id. S4
> The Hyper Suprime-Cam SSP Survey: Overview and Survey Design
> arxiv: 1704.05858

484 cites: Aihara, H. et al. [108 additional co-authors including **Speagle, J. S.**], 2018, Publications of the Astronomical Society of Japan, Vol. 70, Iss. SP1, id. S8
> First Data Release of the Hyper Suprime-Cam Subaru Strategic Program
> arxiv: 1702.08449

466 cites: Hikage, C. et al. [35 additional co-authors including **Speagle, J. S.**], 2019, Publications of the Astronomical Society of Japan, Vol. 71, Iss. 2, id. 43
> Cosmology from cosmic shear power spectra with Subaru Hyper Suprime-Cam first-year data
> arxiv: 1809.09148   **Media**: PASJ Excellent Paper Award (English)

200 cites: Mandelbaum, R. et al. [30 additional co-authors including **Speagle, J. S.**], 2018, Publications of the Astronomical Society of Japan, Vol. 70, Iss. Sp1, id. S25
> The first-year shear catalog of the Subaru Hyper Suprime-Cam SSP Survey
> arxiv: 1706.06745

151 cites: Leja, J.; Johnson, B. D.; Conroy, C.; van Dokkum, P.; **Speagle, J. S.**; Brammer, G.; Momcheva, I.; Skelton, R.; Whitaker, K. E.; Franx, M; & Nelson, E. J., 2019, The Astrophysical Journal, Vol. 877, Iss. 2, id. 140
> An Older, More Quiescent Universe from Panchromatic SED Fitting of the 3D-HST Survey
> arxiv: 1812.05608