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RESEARCH INTERESTS

My research interests lie in the interdisciplinary fields of **astrostatistics** and **data science** at the intersections of astronomy, statistics, and computer science. I focus on developing new statistics and machine learning techniques to study **stars, galaxies, and other astronomical phenomena** using large datasets in order to better understand how galaxies like our own Milky Way evolve.

POSITIONS

Banting Postdoctoral Fellow: University of Toronto 2020-2022
Project Academic Support Staff: Kavli IPMU, University of Tokyo 2015-2016

EDUCATION

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

AWARDS & HONORS

Banting Postdoctoral Fellowship 2020
Department of Astronomy Teaching Award (Harvard) Spring 2018
Certificate of Distinction in Teaching (Harvard) Spring 2017, 2018; Fall 2018
National Science Foundation Graduate Research Fellowship 2016

TEACHING

I have a strong interest in undergraduate and graduate education and pedagogy, with a focus on skills such as **programming, statistics, and data science** that are invaluable across a wide range of disciplines but too often not taught as part of a typical science curriculum.

Harvard: Teaching Fellow
ASTRON 22: The Unity of Science: From the Big Bang to the Brontosaurus and Beyond *Spring 2020*
ASTRON 191: Astrophysics Laboratory *Spring 2019*
ASTRON 17: Galactic and Extragalactic Astronomy *Fall 2018*
ASTRON 130: Cosmology *Spring 2018*
ASTRON 16: Stellar and Planetary Astronomy *Spring 2017*

Banneker Institute (Harvard): Course Instructor
Introduction to Programming in Python *Summer 2017, 18, 19*

PROFESSIONAL ACTIVITIES

CfA Machine Learning Journal Club: Founder and Organizer 2017-2020
Manuscript Referee: ApJ, ApJL, AJ, A&A, MNRAS 2014-present

RECENT PRESENTATIONS

Villanova: Colloquium October 2019
Exploring the Galaxy Near and Far in the Age of Gaia

Harvard: Summer Colloquium (joint with Catherine Zucker) June 2019
Charting Nearby Molecular Clouds with Gaia: A New Map of Our Local Interstellar Medium

GitHub Satellite 2019: Keynote Address Participant May 2019
Invited for open source code contributions (dynesty) in the analysis of the supermassive black hole in M87 by the Even Horizon Telescope collaboration

Cambridge: Data Intensive Science Seminar April 2019
Mapping the 3-D Distribution of Dust in the Milky Way with Stellar Photometry

Harvard: CMSA Big Data Conference August 2018
Revealing the Milky Way's Dust-iny

Bayes Comp 2018: Poster March 2018
Dynamic Nested Sampling with dynesty

UMass Amherst: Data Science Tea October 2017
Big Data Inference: Combining Hierarchical Bayes and Machine Learning to Improve Photometric Redshifts

PUBLICATIONS

I am an author of **35 papers**, including **10 as (co-)first author** (in **red**) and **13 where I have made substantial contributions** (in **blue**). These papers have over **1800 citations** (h-index=17), including over **650 citations** (h-index=7) for papers where I am (co-)first author.

My papers can be found online on arxiv and ADS.

In Preparation

37. **Speagle, J. S.**; Zucker, C.; Cargile, P. A.; Bonaca, A.; Johnson, B. D.; Beane, A.; Kamdar, H.; Dotter, A.; Conroy, C.; Green, G. M.; Schlafly, E. F.; Finkbeiner, D. P.; Rix, H.-W.; & Goodman, A.
Mapping the Milky Way in 5-D with 120 Million Stars at High Galactic Latitudes

36. **Speagle, J. S.**; Zucker, C.; Cargile, P. A.; Johnson, B. D.; Beane, G.; Green, G. M.; Schlafly, E. F.; Finkbeiner, D. P.; Dotter, A.; Bonaca, A.; Conroy, C.; Rix, H.-W.; Goodman, A. A.; & Eisenstein, D. J.
Deriving Stellar Properties, Distances, and Reddenings from Photometry and Astrometry with brutus

Submitted

35. Cabrera-Ziri, I.; **Speagle, J. S.**; Dalessandro, E.; Usher, C.; Bastian, N. J.; Salaris, M.; Martocchia, S.; Kozhurina-Platais, V.; Niederhofer, F.; Lardo, C.; & Larsen, S. S., **MNRAS**

Searching for Globular Cluster Chemical Anomalies on the Main Sequence of a Young Massive Cluster

2020

34. Bonaca, A.; Conroy, C.; Hogg, D. W.; Cargile, P. A.; Caldwell, N.; Naidu, R. P.; Price-Whelan, A. M.; **Speagle, J. S.**; & Johnson, B. D., **ApJL**
High-Resolution Spectroscopy of the GD-1 Stellar Stream Localizes the Perturber Near the Orbital Plane of Sagittarius

33. Leja, J.; **Speagle, J. S.**; Johnson, B. D.; Conroy, C.; van Dokkum, P.; & Franx, M., **ApJ**
A New Census of the 0.2 < z < 3.0 Universe, Part I: The Stellar Mass Function

32. **Portillo, S. K. N. & Speagle, J. S.**; & Finkbeiner, D. P., **AJ**
Photometric Biases in Modern Surveys

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

30. Alves, J.; Zucker, C.; Goodman, A. A.; **Speagle, J. S.**; Meingast, S.; Robitaille, T.; Finkbeiner, D. P.; Schlafly, E. F.; & Green, G. M., **Nature**
Discovery of a Galactic-scale gas wave in the Solar Neighborhood
Press: Official Website

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

2019

28. **Speagle, J. S.**, **arxiv**
A Conceptual Introduction to Markov Chain Monte Carlo Methods

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

26. Huang, S.; Leauthaud, A.; Hearin, A.; Behroozi, P.; Bradshaw, C.; Ardila, F.; **Speagle, J.**; Tenenti, A.; Bundy, K.; Greene, J.; Sifón, C.; & Bahcall, N., **MNRAS**
Weak Lensing Reveals a Tight Connection Between Dark Matter Halo Mass and the Distribution of Stellar Mass in Massive Galaxies

25. **Speagle, J. S.**; Leauthaud, A.; Huang, S.; Bradshaw, C. P.; Ardila, F.; Capak, P. L.; Eisenstein, D. J.; Masters, D. C.; Mandelbaum, R.; More, S.; Simet, M.; & Sifón, C., **MNRAS**
Galaxy-Galaxy Lensing in HSC: Validation Tests and the Impact of Heterogeneous Spectroscopic Training Sets

24. Namikawa, T. **et al.** [73 additional co-authors], **ApJ**
Evidence for the Cross-correlation between Cosmic Microwave Background Polarization Lensing from POLARBEAR and the Cosmic Shear from Subaru Hyper Suprime-Cam

23. Forbes, J. C.; Krumholz, M. R.; & **Speagle, J. S.**, **MNRAS**
Towards a Radially-Resolved Semi-Analytic Model for the Evolution of Disc Galaxies Tuned with Machine Learning

22. Cook, B. A.; Conroy, C.; van Dokkum, P.; & **Speagle, J. S.**, **ApJ**

Measuring Star-Formation Histories, Distances, and Metallicities with Pixel Color-Magnitude Diagrams I: Model Definition and Mock Tests

21. Safarzadeh, M.; Berger, E.; Leja, J.; & **Speagle, J. S.**, **ApJL**
Measuring the Delay Time Distribution of Binary Neutron Stars III. Using the Individual Star Formation Histories of Gravitational Wave Event Host Galaxies in the Local Universe
Press: AAS NOVA

20. Hikage, C. **et al.** [35 additional co-authors], **PASJ**
Cosmology from cosmic shear power spectra with Subaru Hyper Suprime-Cam first-year data

19. 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., **ApJ**
An Older, More Quiescent Universe from Panchromatic SED Fitting of the 3D-HST Survey

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

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

2018

16. Zucker, C.; Schlafly E. F.; **Speagle, J. S.**; Green, G. M.; Portillo, S. K. N.; Finkbeiner, D. P.; & Goodman, A. A., **ApJ**
A New Technique for Mapping Distances Across the Perseus Molecular Cloud Using CO Observations and Stellar Photometry

15. Medezinski, E.; Oguri, M.; Nishizawa, A.; **Speagle, J. S.**; Miyatake, H.; Umetsu, K.; Leauthaud, A.; Murata, R.; Mandelbaum, R.; Sifón, C.; Strauss, M. A.; Huang, S.; Simet, M.; Okabe, N.; Tanaka, M.; & Yutaka, K., **PASJ**
Source Selection for Cluster Weak Lensing Measurements in the Hyper Sprime-Cam Survey

14. Oguri, M. **et al.** [24 additional co-authors], **PASJ**
An optically-selected cluster catalog at redshift $0.1<z<1.1$ from Hyper Suprime-Cam Subaru Strategic Program S16A data

13. Mandelbaum, R. **et al.** [30 additional co-authors], **PASJ**
The first-year shear catalog of the Subaru Hyper Suprime-Cam SSP Survey

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

11. Aihara, H. **et al.** [108 additional co-authors], **PASJ**
First Data Release of the Hyper Suprime-Cam Subaru Strategic Program

10. Aihara, H. **et al.** [142 additional co-authors], **PASJ**
The Hyper Suprime-Cam SSP Survey: Overview and Survey Design

2017

9. **Speagle, J. S.** & Eisenstein, D. J., **MNRAS**
Deriving Photometric Redshifts with Fuzzy Archetypes and Self-Organizing Maps II. Implementation

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

2016

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

6. Steinhardt, C. L.; Capak, P. L.; Masters, D. C.; & **Speagle, J. S.**, **ApJ**
The Impossibly Early Galaxy Problem

2015

5. Masters, D. C. **et al.** [19 additional co-authors], **ApJ**
Mapping the Galaxy Color-Redshift Relation: Optimal Photometric Redshift Calibration Strategies for Cosmology Surveys

2014

4. Steinhardt, C. L. & **Speagle, J. S.**, **ApJ**
A Uniform History for Galaxy Evolution

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

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

2011

1. **Speagle, J. S.**; Kaplan, D. L.; & van Kerkwijk, M. H., **ApJ**
The X-ray Counterpart of the High-B Pulsar J0726-2612