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Joshua S. Speagle

Harvard University Department of Astronomy
A-202, 60 Garden Street, Cambridge, MA 02138
joshspeagle.github.io
jspeagle@cfa.harvard.edu

RESEARCH INTERESTS

My research interests lie in the interdisciplinary field of **astrostatistics** at the intersections of **astronomy**, **statistics**, and **computer science**. I focus on developing new statistical techniques to analyze large datasets in order to study stars, galaxies, and other astronomical phenomena with a focus on how galaxies like our own Milky Way evolve.

EDUCATION

Harvard University: MA/PhD — 2016-2020 (expected)
Advisers: Daniel Eisenstein, Charlie Conroy, Doug Finkbeiner

Harvard University: BA with Honors in Astrophysics and Physics — 2011-2015
Adviser: Daniel Eisenstein

POSITIONS

Project Academic Support Staff: Kavli IPMU (WPI), UTIAS, The University of Tokyo — 2015-2016
Worked with A. Leauthaud on weak lensing with Hyper Surpime-Cam data. **Led to papers [12], [25].**

Visiting Researcher: Infrared Processing and Analysis Center (IPAC), Caltech — Summer 2014
Worked with P. Capak on improving photometric redshift estimation. **Led to paper [7].**

Visiting Researcher: Kavli IPMU (WPI), UTIAS, The University of Tokyo — Summer 2013
Worked with C. Steinhardt on evolution of star-forming galaxies. **Led to papers [2], [3], [4].**

REU Student: Cornell University — Summer 2012
Worked with S. Parshley and G. Stacey on submillimeter instrumentation.

Research Aide: University of Wisconsin-Milwaukee (UWM) — Summer 2011
Worked with D. Kaplan on x-ray observations of a high-B pulsar. **Led to paper [1].**

TEACHING

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

Teaching Fellow: Harvard
I have taught five courses and every academic year since beginning my MA/PhD program in 2016, substantially above the two courses required.

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

Course Instructor: Banneker Institute (Harvard)
The Banneker Institute prepares students of color for graduate programs in astronomy through research, coursework, and social science education.
Introduction to Programming in Python — Summer 2017, 18, 19

AWARDS & HONORS

Department of Astronomy Teaching Award, Harvard	Spring 2018
Certificate of Distinction in Teaching, Harvard	Spring 2017, 18; Fall 2018
National Science Foundation Graduate Research Fellowship	2016
AAS Chambliss Astronomy Achievement Student Award	Winter 2011

PUBLICATIONS

Key: **(Co-)First Author** **Substantial Contribution** **Other**

I am an author of **33 papers**, including **10 as (co-)first author** (highlighted in **red**) and **13 where I have made substantial contributions** (highlighted in **blue**). These papers have **over 1600 citations** (h-index=14), including over **550 citations** (h-index=7) for papers where I am (co-)first author.

In Preparation:

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.; & Goodman, A. A.: "Mapping the Milky Way in 5-D with 120 Million Stars at High Galactic Latitudes"

Speagle, J. S.; Zucker, C.; Cargile, P. A.; Johnson, B. D.; Green, G. M.; Schlafly, E. F.; Finkbeiner, D. P.; Dotter, A.; Bonaca, A.; Conroy, C.; Eisenstein, D. J.; Goodman, A. A.; Meingast, S.; & Alves, 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., **submitted to MNRAS**: "Searching for Globular Cluster Chemical Anomalies on the Main Sequence of a Young Massive Cluster"

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., **submitted to ApJL** (2001.07215): "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., **submitted to ApJ** (1910.04168): "A New Census of the $0.2 < z < 3.0$ Universe, Part I: The Stellar Mass Function"

32. **Speagle, J. S.**, **submitted to The American Statistician (TAS)** (1909.12313): "A Conceptual Introduction to Markov Chain Monte Carlo Methods"

31. **Portillo, S. K. N. & Speagle, J. S.**; & Finkbeiner, D. P., **submitted to AJ** (1902.02374): "Photometric Biases in Modern Surveys"

2020:

30. **Speagle, J. S.**, **MNRAS** (1904.02180): "*dynesty*: A Dynamic Nested Sampling Package for Estimating Bayesian Posteriors and Evidences"

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

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

2019:

27. Green, G. M.; Schlafly, E. F.; Zucker, C.; **Speagle, J. S.**; & Finkbeiner, D. P., **ApJ** (1905.02734): "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** (1811.01139): "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** (1906.05876): "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** (1904.02116): "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** (1810.12919): "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** (1904.00011): "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** (1905.04310): "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" **[Blog: AAS NOVA]**

20. Hikage, C. **et al.** [35 additional co-authors], **PASJ** (1809.09148): "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** (1812.05608): "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** (1902.01425): "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** (1811.03637): "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** (1803.08931): "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** (1706.00427): "Source Selection for Cluster Weak Lensing Measurements in the Hyper Sprime-Cam Survey"

14. Oguri, M. **et al.** [24 additional co-authors], **PASJ** (1701.00818): "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** (1705.06745): "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** (1704.05988): "Photometric Redshifts for the Hyper Suprime-Cam Subaru Strategic Program Data Release 1"

11. Aihara, H. **et al.** [108 additional co-authors], **PASJ** (1702.08449): "First Data Release of the Hyper Suprime-Cam Subaru Strategic Program"

10. Aihara, H. **et al.** [142 additional co-authors], **PASJ** (1704.05858): "The Hyper Suprime-Cam SSP Survey: Overview and Survey Design"

2017:

9. **Speagle, J. S.** & Eisenstein, D. J., **MNRAS** (1510.08080): "Deriving Photometric Redshifts with Fuzzy Archetypes and Self-Organizing Maps II. Implementation"

8. **Speagle, J. S.** & Eisenstein, D. J., **MNRAS** (1510.08073): "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** (1508.02484): "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** (1506.01377): "The Impossibly Early Galaxy Problem"

2015:

5. Masters, D. C. **et al.** [19 additional co-authors], **ApJ** (1509.03318): "Mapping the Galaxy Color-Redshift Relation: Optimal Photometric Redshift Calibration Strategies for Cosmology Surveys"

2014:

4. Steinhardt, C. L. & **Speagle, J. S.**, **ApJ** (1409.2883): "A Uniform History for Galaxy Evolution"

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

2. **Speagle, J. S.**; Steinhardt, C. L.; Capak, P. L.; & Silverman, J. D., **ApJS** (1405.2041)**:** "A Highly Consistent Framework for the Evolution of the Star-Forming 'Main Sequence' from z~0-6" **[~450 citations]**

2011:

1. **Speagle, J. S.**; Kaplan, D. L.; & van Kerkwijk, M. H., **ApJ** (1111.2877): "The X-ray Counterpart of the High-*B* Pulsar J0726-2612"

SELECTED PRESENTATIONS

Key: **Invited** **Talk** **Poster**

Oct. 2019: **Villanova**, **Colloquium**: "Exploring the Galaxy Near and Far in the Age of Gaia"

Jun. 2019: **Harvard**, **Summer Colloquium**: "Charting Nearby Molecular Clouds with Gaia: A New Map of Our Local Interstellar Medium" (joint talk with Catherine Zucker)

May 2019: **GitHub Satellite 2019** (invited participant in Keynote Address for open source code contributions to the Even Horizon Telescope collaboration) [Video]

Apr. 2019: **Cambridge**, **Data Intensive Science Seminar**: "Mapping the 3-D Distribution of Dust in the Milky Way with Stellar Photometry"

Aug. 2018: **Harvard**, **CMSA Big Data Conference**: "Revealing the Milky Way's Dust-iny" [Video]

Mar. 2018: **Bayes Comp 2018**: "Dynamic Nested Sampling with *dynesty*"

Oct. 2017: **U. of Mass. Amherst**, **Data Science Tea**: "Big Data Inference: Combining Hierarchical Bayes and Machine Learning to Improve Photometric Redshifts"

May 2016: **COSMO21**: "Improving Photometric Redshifts for Hyper Suprime-Cam"

Jan. 2014: **AAS 223**: "Parallel Galaxy Main Sequence and Quasar Evolution from z=0-6" (AAS Chambliss Award Honorable Mention)

Aug. 2013: **U. of Tsukuba**: "The Evolution of Star-Forming Galaxies Over Cosmic Time"

Jan. 2012: **AAS 219**: "The X-ray Counterpart of the High-*B* Pulsar J0726-2612" (AAS Chambliss Award)