Lehman H. Garrison

Cosmology — Large-Scale Structure
High-Performance Computing —
N-body Simulations

Address: Center for Computational Astrophysics
Flatiron Institute
162 5th Ave., New York, NY 10010

website: lgarrison.github.io

email: lgarrison@flatironinstitute.org

Employment

Flatiron Research Fellow Sept. 2019–present
Cosmology X Data Science Group
Center for Computational Astrophysics
Flatiron Institute, New York, NY

Education

Ph.D., Astronomy and Astrophysics Aug. 2013–May 2019
Harvard University, Cambridge, MA
Thesis: *Computational Modeling of Large-Scale Structure with Abacus*
Advisor: Daniel J. Eisenstein

B.A., Astrophysical Sciences (High Honors) Sept. 2009–June 2013
Princeton University, Princeton, NJ
Thesis: *Galactic Warp Excitation by the Magellanic Clouds*
Advisors: David N. Spergel, Naoki Yoshida (U. Tokyo)

Awards and Honors

Eric Keto Prize April 2019
Best Ph.D. Thesis in Theoretical Astrophysics at Harvard University

Smith Family Graduate Science and Engineering Fellowship
Harvard University 2013

Sigma Xi Book Award June 2013
Best Senior Thesis in Astronomy at Princeton University

Press

Astrophysicists Reveal Largest-Ever Suite of Universe Simulations
Press release on AbacusSummit simulations Oct. 2021

Professional Service

Builder, DESI Collaboration since Dec. 2021
for "outstanding contributions to the analysis pipeline, particularly numerical simulations"

Co-chair, DESI Cosmological Simulations Working Group Oct. 2020–

Referee, MNRAS & ApJ since 2016

Graduate Student Representative, CfA Library Committee 2017–2019

Selected Publications

First Author Publications

8. *Self-similarity of k-nearest neighbor distributions in scale-free simulations*, **Garrison, L. H.**, Abel, T., & Eisenstein, D. J. 2021a, MNRAS, doi: 10.1093/mnras/stab3160

7. *The* Abacus *cosmological N-body code*, **Garrison, L. H.**, Eisenstein, D. J., Ferrer, D., Maksimova, N. A., & Pinto, P. A. 2021b, MNRAS, 508, 575, doi: 10.1093/mnras/stab2482

6. *Good and proper: self-similarity of N-body simulations with proper force softening*, **Garrison, L. H.**, Joyce, M., & Eisenstein, D. J. 2021d, MNRAS, 504, 3550, doi: 10.1093/mnras/stab1096

5. *Checkpointing with cp: the POSIX Shared Memory System*, **Garrison, L. H.**, Eisenstein, D. J., & Maksimova, N. A. 2021c, NERSC First International Symposium on Checkpointing for Supercomputing, arXiv:2102.13140. https://arxiv.org/abs/2102.13140

4. *Generating approximate halo catalogues for blind challenges in precision cosmology*, **Garrison, L. H.**, & Eisenstein, D. J. 2019, MNRAS, 485, 2407, doi: 10.1093/mnras/stz600

3. *A high-fidelity realization of the Euclid code comparison N-body simulation with* Abacus, **Garrison, L. H.**, Eisenstein, D. J., & Pinto, P. A. 2019, MNRAS, 485, 3370, doi: 10.1093/mnras/stz634

2. *The Abacus Cosmos: A Suite of Cosmological N-body Simulations*, **Garrison, L. H.**, Eisenstein, D. J., Ferrer, D., et al. 2018, ApJS, 236, 43, doi: 10.3847/1538-4365/aabfd3

1. *Improving initial conditions for cosmological N-body simulations*, **Garrison, L. H.**, Eisenstein, D. J., Ferrer, D., Metchnik, M. V., & Pinto, P. A. 2016, MNRAS, 461, 4125, doi: 10.1093/mnras/stw1594

Contributing Author Publications

17. *The halo light cone catalogues of ABACUSSUMMIT*, Hadzhiyska, B., **Garrison, L. H.**, Eisenstein, D., & Bose, S. 2021, MNRAS, doi: 10.1093/mnras/stab3066

16. *ABACUSHOD: A highly efficient extended multi-tracer HOD framework and its application to BOSS and eBOSS data*, Yuan, S., **Garrison, L. H.**, Hadzhiyska, B., Bose, S., & Eisenstein, D. J. 2021, MNRAS, doi: 10.1093/mnras/stab3355

15. *Constructing high-fidelity halo merger trees in AbacusSummit*, Bose, S., Eisenstein, D. J., Hadzhiyska, B., **Garrison, L. H.**, & Yuan, S. 2021, submitted, arXiv:2110.11409. https://arxiv.org/abs/2110.11409

14. *COMPASO: A new halo finder for competitive assignment to spherical overdensities*, Hadzhiyska, B., Eisenstein, D., Bose, S., **Garrison, L. H.**, & Maksimova, N. 2022, MNRAS, 509, 501, doi: 10.1093/mnras/stab2980

13. AbacusSummit*: A Massive Set of High-Accuracy, High-Resolution N-Body Simulations*, Maksimova, N. A., **Garrison, L. H.**, Eisenstein, D. J., et al. 2021, MNRAS, doi: 10.1093/mnras/stab2484

12. *Accuracy of power spectrum measurements in dissipationless cosmological simulations*, Maleubre, S., Eisenstein, D., **Garrison, L. H.**, & Joyce, M. 2021, submitted, arXiv:2109.04397. https://arxiv.org/abs/2109.04397

11. *Testing dark matter halo properties using self-similarity*, Leroy, M., **Garrison, L.**, Eisenstein, D., Joyce, M., & Maleubre, S. 2021, MNRAS, 501, 5064, doi: 10.1093/mnras/staa3435
10. *Quantifying resolution in cosmological N-body simulations using self-similarity*, Joyce, M., **Garrison, L.**, & Eisenstein, D. 2021, MNRAS, 501, 5051, doi: 10.1093/mnras/staa3434
9. Corrfunc - *a suite of blazing fast correlation functions on the CPU*, Sinha, M., & **Garrison, L. H.** 2020, MNRAS, 491, 3022, doi: 10.1093/mnras/stz3157
8. *Cosmology with galaxy-galaxy lensing on non-perturbative scales: emulation method and application to BOSS LOWZ*, Wibking, B. D., Weinberg, D. H., Salcedo, A. N., et al. 2020, MNRAS, 492, 2872, doi: 10.1093/mnras/stz3423
7. *A Hybrid Deep Learning Approach to Cosmological Constraints from Galaxy Redshift Surveys*, Ntampaka, M., Eisenstein, D. J., Yuan, S., & **Garrison, L. H.** 2020, ApJ, 889, 151, doi: 10.3847/1538-4357/ab5f5e
6. *KELT-24b: A 5M $_J$ Planet on a 5.6 day Well-aligned Orbit around the Young V = 8.3 F-star HD 93148*, Rodriguez, J. E., Eastman, J. D., Zhou, G., et al. 2019, AJ, 158, 197, doi: 10.3847/1538-3881/ab4136
5. Corrfunc*: Blazing fast correlation functions with AVX512F SIMD Intrinsics*, Sinha, M., & **Garrison, L. H.** 2019, 3, doi: 10.1007/978-981-13-7729-7_1
4. *Emulating galaxy clustering and galaxy-galaxy lensing into the deeply nonlinear regime: methodology, information, and forecasts*, Wibking, B. D., Salcedo, A. N., Weinberg, D. H., et al. 2019, MNRAS, 484, 989, doi: 10.1093/mnras/sty2258
3. *Testing the Detection Significance on the Large-scale Structure by a JWST Deep Field Survey*, Zhang, H., Eisenstein, D. J., **Garrison, L. H.**, & Ferrer, D. W. 2019, ApJ, 875, 132, doi: 10.3847/1538-4357/ab1268
2. *Exploring the squeezed three-point galaxy correlation function with generalized halo occupation distribution models*, Yuan, S., Eisenstein, D. J., & **Garrison, L. H.** 2018, MNRAS, 478, 2019, doi: 10.1093/mnras/sty1089
1. *Using galaxy pairs to investigate the three-point correlation function in the squeezed limit*, Yuan, S., Eisenstein, D. J., & **Garrison, L. H.** 2017, MNRAS, 472, 577, doi: 10.1093/mnras/stx2032

Outreach

Mentor, CUNY Hackathon — Jan. 2021
– Supported weekend hackathon teams at the City University of New York

Comedian, Science Riot/New York Academy of Sciences — July 2020
– Wrote and delivered a short stand-up comedy routine about N-body cosmology

Observer, Harvard Observing Project — 2014–2019

– Taught undergrads and community members how to make scientific measurements on a telescope (approx. a dozen annual sessions)

Volunteer, Cambridge Explores the Universe — Summers 2015–2018
– Ran CfA outreach activities at the Cambridge Science Festival

Author, BiteScis Lesson Plan: Shooting for the Stars — March 2018
– Created an open-access high school physics lesson plan based on Breakthrough Starshot

Guest Instructor, SAO Latino Initiative — Summers 2017 – 2019
– Lectured and tutored on introductory Python

Tutor, Banneker & Aztlán Institute — Summer 2017
– Tutored on introductory Python and physics

Teaching

Organizer, SciWare — 2020–
– Co-organized and taught Flatiron-internal workshops on scientific software best practices (`https://sciware.flatironinstitute.org`)

Instructor, Software Carpentry — since Spring 2021
– Certified instructor for Software Carpentry, a scientific software pedagogy program

Teaching Fellow
– PHYS P-17010 *Introduction to Cosmology* — Summer 2017
– AST S-35 *Fundamentals of Contemporary Astro.* — Summer 2015
– CS 109 *Data Science* — Fall 2013

Lecturer, Wolbach Library at CfA | Harvard-Smithsonian — 2017
– Lecture series on modern Python for astronomy, beginner to expert level