# ChangHoon Hahn

Department of Astrophysical Sciences, Princeton University
http://changhoonhahn.github.io
changhoon.hahn@princeton.edu

## APPOINTMENTS

Princeton University, Department of Astrophysical Sciences — 2020 -
Postdoctoral Research Associate

Lawrence Berkeley National Laboratory and UC Berkeley — 2017 - 2020
Postdoctoral Fellow

## EDUCATION

New York University — Ph.D. in Physics — 2011 - 2017
*Advisors* : Michael R. Blanton and Roman Scoccimarro
*Thesis* : *Galaxies and their Host Dark Matter Structures*

Rutgers University — B.Sc. in Astrophysics — 2007 - 2011
*Advisors* : Andrew J. Baker and Jerry A. Sellwood

## HONORS AND AWARDS

Dean's Dissertation Fellowship, New York University — 2016
James Arthur Graduate Fellowship, New York University — 2015
Henry M. MacCracken Fellowship, New York University — 2011 - 2015
Dean's Travel Grant, New York University — 2015, 2016
Paul Robeson Scholar, Rutgers University — 2011

## LEADERSHIP AND SCIENTIFIC COLLABORATIONS

Dark Energy Spectroscopic Instrument (DESI) — Continuing Participant
co-chair, Bright Galaxy Survey Working Group — 2019 -
member, Science Committee — 2019 -
member, Outreach Committee — 2020 - 2021

Subaru Prime Focus Spectrograph (PFS) — 2020 -
Sloan Digital Sky Survey-IV
Sloan Digital Sky Survey-III
PRIsm MUlti-object Survey
CAMELS collaboration
Quijote collaboration
IQ collaboratory

## PROFESSIONAL SERVICE

| | | |
|---|---|---|
| Lead Organizer | Winter 2020 Berkeley Cosmology Conference, UC Berkeley, CA | 2020 |
| Member | Equity and Inclusion Committee on Recruitment<br>Princeton University, Dept. of Astrophysical Sciences | 2020 - 2021 |
| Organizer | Bay Area Likelihood-Free Inference Meeting, Berkeley | 2019 |
| Organizer | Likelihood-Free Inference workshop, Flatiron Institute, NYC | 2019 |
| Organizer | Berkeley Lab Institute for Nuclear and Particle Astrophysics Seminar | 2019 - 2020 |
| Organizer | LBNL/BCCP DESI lunch seminar | 2018 - 2020 |

| | | |
|---|---|---|
| Organizer | NYU CCPP Astro Coffee | 2014 - 2017 |
| Member | American Physical Society | |
| Member | Statistics Without Borders | |
| Referee | Monthly Notices of the Royal Astronomical Society | |
| | Journal of Cosmology and Astroparticle Physics | |
| | Astronomy & Astrophysics | |
| | Physical Review D | |
| | Journal of Open Source Software | |
| Reviewer | FINESST grant | 2019 - 2020 |
| | AAS Chambliss Award | 2017 |

## RESEARCH ADVISING

| | | | |
|---|---|---|---|
| Jiaxuan Li | Princeton | graduate | 2021 - |
| James Gyubin Kwon | UC Santa Barbara | graduate | 2019 - |
| Tianshu Wang | Princeton | graduate | 2020 - 2021 |
| Massimo Pascale | UC Berkeley | graduate | 2019 - 2021 |
| Malgorzata Siudek | IFAE Barcelona | postdoctoral | 2019 |
| Arin Avsar | UC Berkeley | undergraduate | 2019 - 2021 |
| Tess Werhane | UC Berkeley | undergraduate | 2019 - 2020 |
| James Zhu | UC Berkeley | undergraduate | 2019 - 2020 |
| Patrick Staudt | Rutgers | undergraduate | 2019 - 2020 |
| | | *now graduate student at UC Irvine* | |

## TEACHING

Co-Instructor, AST541, Princeton University 2021
*Fall 2021 Graduate Seminar in Theoretical Astrophysics: Simulation-Based Inference*

Instructor, DESI Early Career Scientist Workshop 2020
*Virtual workshop on spectral energy distribution (SED) analysis of galaxy spectra*

Instructor, Berkeley Lab In School Settings (BLISS) 2017 - 2019
*Science courses for K-8 classrooms in underserved neighborhoods in the Bay Area*

## OUTREACH

Volunteer, QuarkNet Physics in and Through Cosmology Workshop 2020
Volunteer, Berkeley Lab Exploration of New Discoveries (BLEND): Big Data 2018
Volunteer, UC Berkeley Astro Night 2018 - 2019
Volunteer, Intrepid Museum Kids Week Meet the Scientist 2017
Volunteer, NY Hall of Science Big Data Fest 2015
Appeared in an episode of the NYTimes podcast *Tell Me Something I Don't Know* 2016

## PUBLICATIONS

total: 29 — first author: 13 — total citations 1817, h-index 17, i10-index 21 [ADS] [Google Scholar]

29. **Hahn, C.**; Melchior, P. *Accelerated Bayesian SED Modeling using Amortized Neural Posterior Estimation* ApJ submitted *2022*
(arXiv:2203.07391).

28. **Hahn, C.**; Kwon, K. J.; Tojeiro, R.; Siudek, M.; Canning, R. E. *et al. The DESI PRObabilistic Value-Added Bright Galaxy Survey (PROVABGS) Mock Challenge* ApJ submitted *2022*
(arXiv:2202.01809).

27. Wang, Y.; *et al.* (incl. **Hahn, C.**) *Extracting high-order cosmological information in galaxy surveys with power spectra* Nat. Astron submitted *2022* (arXiv:2202.05248).
26. Villaescusa-Navarro, F.; *et al.* (incl. **Hahn, C.**) *The CAMELS project: public data release 2022* (arXiv:2201.01300).
25. **Hahn, C.**, Villaescusa-Navarro, F.; *Constraining $M_\nu$ with the Bispectrum II: The Total Information Content of the Galaxy Bispectrum* JCAP, 04, 029, *2021* (arXiv:2012.02200).
24. Friedrich, O.; Halder, A.; Boyle, A.; Uhlemann, C.; Britt, D; Codis, S; Gruen, D; **Hahn, C.** *The PDF perspective on the tracer-matter connection: Lagrangian bias and non-Poissonian shot noise* MNRAS, 510, 5069, (arXiv:2107.02300).
23. **Hahn, C.**; Starkenburg, T. K.; Anglés-Alcázar D.; Choi, E.; Davé, R. *et al.* *IQ Collaboratory III: The Empirical Dust Attenuation Framework – Taking Hydrodynamical Simulations with a Grain of Dust* ApJ accepted (arXiv:2106.09741).
22. Dickey, C. M.; Starkenburg, T. K.; Geha, M.; **Hahn, C**; *et al.* *IQ Collaboratory II: The Quiescent Fraction of Isolated, Low Mass Galaxies Across Simulations and Observations* ApJ, 915, 53, *2021* (arXiv:2010.01132).
21. Ruiz-Macias, O. *et al.* (incl. **Hahn, C.**); *et al.* *Characterising the target selection pipeline for the Dark Energy Spectroscopic Instrument Bright Galaxy Survey* MNRAS, 502, 4328, *2021* (arXiv:2007.14950).
20. **Hahn, C.**; Villaescusa-Navarro, F.; Castorina, E.; Scoccimarro R. *Constraining $M_\nu$ with the Bispectrum I: Breaking Parameter Degeneracies* JCAP, 03, 040, *2020* (arXiv:1909.11107).
19. Villaescusa-Navarro, F.; **Hahn, C.**; Massara, E.; Banerjee, A.; Delgado, A. *et al.* *The Quijote Simulation* ApJS, 250, 2, *2020* (arXiv:1909.05273).
18. Alsing, J.; Peiris, Hiranya; Leja, J.; **Hahn, C.**; *et al.* SPECULATOR: Emulating Stellar Population Synthesis for Fast and Accurate Galaxy Spectra and Photometry ApJS, 249, 5, *2020* (arXiv:1911.1178).
17. **Hahn, C.**; Tinker, J.; Wetzel, A. *Constraining Star Formation Histories of Blue Galaxies using the Scatter between Stellar Mass and Halo Mass* (arXiv:1910.01644).
16. **Hahn, C.**; Beutler, F.; Sinha, M.; Berlind, A.; Ho, S.; Hogg, D. W. *Likelihood Non-Gaussianity in Large-Scale Structure Analyses* MNRAS, 485, 2956, *2019* (arXiv:1803.06348).
15. **Hahn, C.**; Starkenburg, T.; Choi, E.; Davé, R.; Dickey, C.; Geha, M. *et al.* *IQ-Collaboratory 1.1: the Star-Forming Sequence of Simulated Central Galaxies* ApJ, 872, 160 *2019* (arXiv:1809.01665).
14. Giusarma, E.; Reyes, M.; Villaescusa-Navarro, F.; He, S.; Ho, S; **Hahn, C.** *Learning neutrino effects in Cosmology with Convolutional Neural Networks*, *2019* (arXiv:1910.04255).
13. Vakili, M.; **Hahn, C.** *How are galaxies assigned to halos? Searching for assembly bias in the SDSS galaxy clustering* ApJ, 872, 115, *2019* (arXiv:1610.01991).
12. Tinker, J.; **Hahn, C.**; Mao, Y.; Wetzel, A. *Halo Histories versus Galaxy Properties at z=0, III: The Properties of Star-Forming Galaxies* MNRAS, 478, 4487, *2018* (arXiv:1705.08458).
11. Tinker, J.; **Hahn, C.**; Mao, Y.; Wetzel, A.; Conroy, C. *Halo Histories versus Galaxy Properties at z=0, II: Large-Scale Galactic Conformity* MNRAS, 477, 935, *2018* (arXiv:1702.01121).
10. **Hahn, C.**; Tinker, J.; Wetzel, A. *Star Formation Quenching Timescale of Central Galaxies in a Hierarchical Universe* ApJ, 841, 6, *2017* (arXiv:1609.04398).
9. Blanton, M. *et al.* (incl. **Hahn, C.**) *Sloan Digital Sky Survey IV: Mapping the Milky Way, Nearby Galaxies, and the Distant Universe* AJ, 154, 28, *2017* (arXiv:1703.00052).

8. **Hahn, C.**; Vakili M.; Walsh, K.; Hearin, A.; Hogg, D. W.; Campbell, D. *Approximate Bayesian Computation in Large Scale Structure: Constraining the Galaxy-Halo Connection* MNRAS, 469, 2791, *2017* (arXiv:1607.01782).
7. Vakili, M. *et al.* (incl. **Hahn, C.**) *Accurate halo-galaxy mocks from automatic bias estimation and particle mesh gravity solvers* MNRAS, 472, 4144, *2017* (arXiv:1701.03765).
6. **Hahn, C.**; Scoccimarro, R.; Blanton, M.; Tinker, J.; Rodríguez-Torres, S. *The Effect of Fiber Collisions on the Galaxy Power Spectrum Multipole* MNRAS, 467, 1940, *2017* (arXiv:1609.01714).
5. Rodríguez-Torres, S. *et al.* (incl. **Hahn, C.**) *Clustering of Quasars in the First Year of the SDSS-IV eBOSS survey: Interpretation and halo occupation distribution* MNRAS, 468, 728, *2017* (arXiv:1612.06918).
4. Zhai, Z.; Tinker, J.; **Hahn, C.** *et al.* *The Clustering of Luminous Red Galaxies at $z \sim 0.7$ from eBOSS and BOSS Data* ApJ, 848, 2, *2017* (arXiv:1607.05383).
3. Rodríguez-Torres, S.*et al.* (incl. **Hahn, C.**) *The clustering of galaxies in the SDSS-III Baryon Oscillation Spectroscopic Survey: modelling the clustering and halo occupation distribution of BOSS CMASS galaxies in the Final Data Release* MNRAS, 460, 1173, *2016* (arXiv:1509.06404).
2. **Hahn, C.**; Blanton, M.; Moustakas, J.; Coil, A.; Cool, R.; Eisenstein, D. *et al.* *PRIMUS: Effects of Galaxy Environment on the Quiescent Fraction at $z < 0.8$* ApJ, 806, 162, *2015* (arXiv:1412.7162).
1. **Hahn, C.**; Sellwood, J.; Pryor C. *Velocity-space substructure from nearby RAVE and SDSS stars* MNRAS, 418, 2459, *2011* (arXiv:1102.4626).

White Papers and Other

**Hahn, C.**; Wilson, M. J.; Ruiz-Macias, O.. *et al.* *DESI: Bright Galaxy Survey Design and Validation* (internal DESI review)

2. Tollerud, E. *et al.* (incl. **Hahn, C.**) *Sustaining Community-Driven Software for Astronomy in the 2020s 2019*
1. Ferraro, S. *et al.* (incl. **Hahn, C.**) *Inflation and Dark Energy from spectroscopy at $z > 2$ 2019* (arXiv:1903.09208).

## SELECTED TALKS

(*: invited)

| | |
|---|---|
| *DESI AI Seminar, Remote | Dec. 2021 |
| Tristate Cosmology Meeting, Flatiron Institute NYC | Nov. 2021 |
| Thunch, Princeton University | Nov. 2021 |
| SpergelFest, Princeton University/Flatiron Institute NYC | Oct. 2021 |
| Learn the Universe, Flatiron Institute NYC | Aug. 2021 |
| COSMO21, University of Illinois, Remote | Aug. 2021 |
| Multi-Object Spectroscopy for Galaxy Evolution, STScI, Remote | May 2021 |
| ESO GALSPEC2021, Remote | Apr. 2021 |
| Galread Seminar, Princeton Unviersity | Mar. 2021 |
| *Astro/Cosmology Seminar, Kavli IPMU | Feb. 2021 |
| *Cosmology-Galaxy-IGM Seminar, UC Santa Cruz | Jan. 2021 |
| *Astro Seminar, University of Waterloo | Oct. 2020 |
| Bahcall Lunch, Institute for Advanced Studies | Sep. 2020 |
| Cosmology at Home, Remote | Aug. 2020 |
| Aspen Galaxy Quenching, Aspen CO | Jan. 2020 |

| | |
|---|---|
| *Cosmology Lunch Seminar, Princeton/Institute for Advanced Study | Dec. 2019 |
| Hernquist group meeting, Harvard Center for Astrophysics | Nov. 2019 |
| Galaxy Lunch, Yale University | Nov. 2019 |
| Morning Tea, Carnegie Observatories | Oct. 2019 |
| *Cosmology Seminar, KIPAC/SLAC/Stanford | Oct. 2019 |
| KICP Chicago | Oct. 2019 |
| CPAC seminar, Argonne National Lab | Oct. 2019 |
| Cosmic Controversies, KICP Chicago | Oct. 2019 |
| *DESI Commissioning and Survey Validation workshop, NOAO AZ | Sep. 2019 |
| DESI Collaboration meeting, Berkeley Lab | Jul. 2019 |
| Cosmology × Data, NYU CCPP | May 2019 |
| *Isolated and Quenched Galaxies Workshop, Flatiron Institute NYC | Dec. 2018 |
| DESI Collaboration Meeting, Tuscon AZ | May 2018 |
| Flatiron Institute NYC | Feb. 2018 |
| Isolated and Quenched Galaxies Workshop, Flatiron Institute NYC | Sep. 2017 |
| *CCAPP seminar, The Ohio State University | Feb. 2017 |
| *seminar, Argonne National Lab | Jan. 2017 |
| American Astronomical Society 229, Grapevine TX | Jan. 2017 |
| *RPM seminar, Berkeley Lab | Dec. 2016 |
| Yale University | Oct. 2016 |
| Seminar, Universidad Nacional de Colombia, Bogota COL | Jun. 2016 |
| Brownbag Lunch, NYU CCPP | Apr. 2016 |
| SDSS Collaboration Meeting, Madrid ESP | Jul |
| Multi-Object Spectroscopy in the Next Decade, Canary Islands ESP | Feb. 2015 |
| Evolving Galaxies in Evolving Environments, Bologna ITA | Sep. 2014 |

## PUBLIC SOFTWARE AND DATA

| | |
|---|---|
| `provabgs` | *python* package for joint SED modeling of galaxy photometry and spectroscopy using neural emulators |
| `pySpectrum` | *python* package for measuring galaxy powerspectrum and bispectrum using Fast Fourier Transforms |
| `starFS` | *python* package for identifying the star-forming sequence using a data-driven approach with Gaussian Mixutre Models |
| Molino | 75,000 mock galaxy catalogs, constructed from full $N$-body simulations, designed to quantify the total cosmological information content of galaxy samples |

## REFERENCES

**Prof. Peter Melchior**
`melchior@astro.princeton.edu`
Department of Astrophysical Sciences, Princeton University

**Prof. Shirley Ho**
`shirleyho@flatironinstitute.org`
Center for Computational Astrophysics, Flatiron Institute

**Prof. David H. Weinberg**
`dhw@astronomy.ohio-state.edu`
Department of Astronomy, The Ohio State University