Sheridan B. Green

Curriculum Vitae

+1 (704) 305-7565 – sheridan.green@yale.edu – https://sheridan.green

OVERVIEW

- Fourth-year Ph.D. Student and NSF Graduate Research Fellow in the Department of Physics at Yale University using numerical simulations of dark matter halo evolution to constrain the nature of dark matter.
- My research is statistical in nature, employing tools from machine learning (random forests and convolutional neural networks) and topological data analysis (persistent homology).
- Experienced with `Python` (four years) and distributed computing systems and familiar with `C/C++` and parallel/GPU-computing.
- Since beginning graduate school, I have lead-authored four scientific publications and co-authored an additional five; I am very capable of remaining productive while collaborating on several research projects simultaneously.

EDUCATION

Doctor of Philosophy, Physics expected 2022

Master of Philosophy, Physics expected 2020

Master of Science, Physics 2018

Yale University

Dissertation: "The tidal evolution of dark matter substructure: a data-driven semi-analytical model and its applications to small-scale cosmology"
Advisor: Prof. Frank C. van den Bosch
Committee: Profs. Daisuke Nagai, Jessi Cisewski-Kehe, and Nikhil Padmanabhan
GRE Physics: 990/990 (94%)

Credential of Readiness (CORe), Business Administration 2020

Harvard Business School Online

Bachelor of Science, Physics and Mathematics 2017

The University of North Carolina at Chapel Hill

Concentration in Astrophysics
Highest honors in physics, highest distinction, GPA: 3.93/4.00
Thesis: "Constraining an Early Matter-Dominated Era through Cosmological Simulations"
Advisor: Prof. Adrienne L. Erickcek

RESEARCH INTERESTS

Constraining cosmology and probing the nature of dark matter with idealized numerical simulations and analytical approaches, dark matter substructure, ultralight bosonic dark matter, applications of machine learning, artificial intelligence, and topological data analysis to cosmology and (extra)galactic astrophysics

HONORS AND AWARDS

- 2019 McDougal Teaching Fellowship (Yale) – $5k/yr
- 2019 National Science Foundation Graduate Research Fellowship – $138k
- 2017 Paul E. Shearin Outstanding Senior Award in Physics (UNC-Chapel Hill) – $500
- 2013–2017 Dean's List Honoree (UNC-Chapel Hill)
- 2016 Skynet Undergraduate Research Scholarship (UNC-Chapel Hill)

- 2016 Designated a Carolina Research Scholar
- 2016 Elected to Phi Beta Kappa Academic Honor Society
- 2015 NOAA Ernest F. Hollings Undergraduate Scholarship – $28k

PUBLICATIONS [scholar][ADS][arXiv][ORCiD]

PEER-REVIEWED ARTICLES

5. Tim B. Miller, Frank C. van den Bosch, **Sheridan B. Green**, and Go Ogiya, "Dynamical self-friction: how mass loss slows you down", accepted to *MNRAS*, in press (2020).
4. **Sheridan B. Green**, Michelle Ntampaka, Daisuke Nagai, Lorenzo Lovisari, Klaus Dolag, Dominique Eckert, and John A. ZuHone, "Using X-Ray Morphological Parameters to Strengthen Galaxy Cluster Mass Estimates via Machine Learning", *The Astrophysical Journal* **884**, 33 (2019).
3. **Sheridan B. Green** and Frank C. van den Bosch, "The tidal evolution of dark matter substructure – I. Subhalo density profiles", *MNRAS* **490**, 2091 (2019).
2. Xin Xu, Jessi Cisewski-Kehe, **Sheridan B. Green**, and Daisuke Nagai, "Finding filament loops and cosmic voids using topological data analysis", *Astronomy and Computing* **27**, 34 (2019).
1. Go Ogiya, Frank C. van den Bosch, Oliver Hahn, **Sheridan B. Green**, Tim B. Miller, and Andreas Burkert, "DASH: a library of dynamical subhalo evolution", *MNRAS* **485**, 189 (2019).

SUBMITTED PRE-PRINTS

2. **Sheridan B. Green**, Han Aung, Daisuke Nagai, and Frank C. van den Bosch, "Scatter in Sunyaev–Zel'dovich effect scaling relations explained by inter-cluster variance in mass accretion histories", *arXiv:2002.01934*, submitted to *MNRAS*.
1. Fangzhou Jiang, Avishai Dekel, Jonathan Freundlich, Frank C. van den Bosch, **Sheridan B. Green**, Philip F. Hopkins, Andrew Benson, and Xiaolong Du, "SatGen: a semi-analytical satellite galaxy generator – I. The model and statistics of Local-Group satellites", *arXiv:2005.05974*, submitted to *MNRAS*.

MANUSCRIPTS IN PREP

8. Jack Ross, **Sheridan B. Green**, Michelle Ntampaka, Daisuke Nagai, and John A. ZuHone, "Galaxy Cluster Mass Estimates via X-ray Photon Point Cloud Regression", to be submitted to *The Astrophysical Journal*.
7. Han Aung, **Sheridan B. Green**, Michelle Ntampaka, Daisuke Nagai, and John A. ZuHone, "Galaxy cluster mock observations generated by a variational autoencoder", to be submitted to *The Astrophysical Journal*.
6. Dhruba Dutta Chowdhury, **Sheridan B. Green**, Uddipan Banik, Frank C. van den Bosch, and Hsi-Yu Schive, "Constraining fuzzy dark matter via the dynamical friction on globular clusters", to be submitted to *MNRAS*.
5. **Sheridan B. Green**, Priyanka Singh, Xun Shi, Alex Saro, Daisuke Nagai, and Klaus Dolag, "Correcting the hydrostatic mass bias in the Sunyaev–Zel'dovich effect scaling relation of *Magneticum* clusters", to be submitted to *MNRAS: Letters*.
4. Nir Mandelker, Frank C. van den Bosch, **Sheridan B. Green**, and others, "The phase structure of cosmic filaments", to be submitted to *MNRAS*.
3. Jessi Cisewski-Kehe, **Sheridan B. Green**, Mike Wu, Brittany T. Fasy, Wojciech Hellwing, Mark R. Lovell, Alessandro Rinaldo, and Larry Wasserman, "Topological Hypothesis Tests for the Large-Scale Structure of the Universe", to be submitted to *Annals of Applied Statistics*.
2. **Sheridan B. Green**, Michelle Ntampaka, Daisuke Nagai, John A. ZuHone, and Han Aung, "Accurate Sunyaev–Zel'dovich Galaxy Cluster Mass Estimation via Convolutional Neural Networks", to be submitted to *The Astrophysical Journal Letters*.
1. **Sheridan B. Green**, Fangzhou Jiang, and Frank C. van den Bosch, "The tidal evolution of dark matter substructure – II. A physical model of subhalo mass loss", to be submitted to *MNRAS*.

OTHER PUBLICATIONS

2. **Sheridan B. Green**, Abby Mintz, Xin Xu, and Jessi Cisewski-Kehe, "Topology of Our Cosmology with Persistent Homology", *CHANCE* **32:3**, 6 (2019).
1. Jenny Farmer, **Sheridan B. Green**, and Donald J. Jacobs, "Distribution of volume, microvoid percolation, and packing density in globular proteins", *arXiv:1810.08745*, *software whitepaper and technical report*.

PRESENTATIONS

13. "On the tidal evolution of dark matter substructure", Yale Wright Lab Weak Interaction Discussion Group, New Haven, CT, *to be scheduled*
12. "Scatter in Sunyaev–Zel'dovich effect scaling relations explained by inter-cluster variance in mass accretion histories", European Astronomical Society Annual Meeting, given remotely, June 30, (2020)
11. "Scatter in Sunyaev–Zel'dovich effect scaling relations explained by inter-cluster variance in mass accretion histories", Baryon Pasters Collaboration Meeting, Teleconference, February 21, (2020)
10. "Introduction to Topological Data Analysis and Persistent Homology", Yale Graduate Analytical and Numerical Research Methods Seminar, New Haven, CT, October 22, (2018)
9. "Simulations of Microhalo Formation After an Early Matter-Dominated Era", American Physical Society April Meeting, Columbus, OH, April 14-17, (2018)
8. "The Dark Matter Annihilation Boost from an Early Matter-Dominated Era", Honors thesis defended at UNC-Chapel Hill, Chapel Hill, NC, April 8, (2017)
7. "A Comparison of Two Chemical Mechanisms Using Data from the Southern Oxidant and Aerosol Study", 16th Annual AMS Student Conference, Seattle, WA, January 22 - 26, (2017)
6. "A Comparison of Two Chemical Mechanisms Using Data from the Southern Oxidant and Aerosol Study", 2016 American Geophysical Union Fall Meeting, San Francisco, CA, Dec. 12-16, (2016)
5. "A Comparison of Two Chemical Mechanisms Using Data from the Southern Oxidant and Aerosol Study", 2016 NOAA Student Science & Education Symposium, Silver Spring, MD, Aug. 2 - 4, (2016)
4. "On-Sky and Laboratory Characterizations of Next-Generation Evryscope Prototype", UNC Society of Physics Students Panel Talks, Chapel Hill, NC, August 29, (2016)
3. "On-Sky and Laboratory Characterizations of Next-Generation Evryscope Prototype", UNC Celebration of Undergraduate Research Symposium, Chapel Hill, NC, April 18, (2016)
2. "The Effects of an Early Matter-Dominated Era on Microhalo Populations and Substructure", UNC Society of Physics Students Panel Talks, Chapel Hill, NC, March 28, (2016)
1. "Analysis of Cavity Volumes in Proteins Using Percolation Theory", American Physical Society March Meeting, Baltimore, MD, March 14-18, (2016)

SELECTED COURSEWORK

- Bayesian Probability and Statistics
- Group Theory
- Linear Algebra
- Mathematical Methods of Physics
- Real Analysis
- Time Series with R/Python
- Financial Markets
- SQL for Data Science
- Data Structures

TEACHING

COURSES TAUGHT

- Graduate Teaching Fellow at Yale University (Fall 2017 – Summer 2020)
    8. Summer 2 2020: **PHYS 166L:** ***General Physics Laboratory II***
    7. Summer 1 2020: **PHYS 165L:** ***General Physics Laboratory I***
    6. Summer 2 2019: **PHYS 166L:** ***General Physics Laboratory II***
    5. Summer 1 2019: **PHYS 165L:** ***General Physics Laboratory I***
    4. Spring 2019: **PHYS 166L:** ***General Physics Laboratory II***
       Head Teaching Fellow
       Course evaluations (received rating 4.8/5 by students)
    3. Fall 2018: **PHYS 165L:** ***General Physics Laboratory I***
       Head Teaching Fellow
       Course evaluations (received rating 4.8/5 by students)
    2. Spring 2018: **PHYS 166L:** ***General Physics Laboratory II***
       Course evaluations (received rating 4.9/5 by students)
    1. Fall 2017: **PHYS 165L:** ***General Physics Laboratory I***
       Course evaluations (received rating 4.6/5 by students)
- Undergraduate Learning Assistant at UNC-Chapel Hill
    - Spring 2017: **PHYS 119:** ***Introductory Calculus-based Electromagnetism and Quanta***
    - Spring 2017: **Peer Tutor Staff in UNC Mathematics & Physics Help Center**

TEACHING PRACTICE DEVELOPMENT

- McDougal Teaching Fellow at the Yale Poorvu Center for Teaching and Learning (Fall 2019 – Present), having *taught* the following:
    4. Teaching Quantitative Reasoning (Spring 2020)
    3. Contemporary Controversies in Pedagogy Advanced Series (Spring 2020)
    2. Teaching and Mentoring in the Laboratory Environment (Fall 2019)
    1. Fundamentals of Teaching Physics Series (Fall 2019)
- Pursuing the Certificate of College Teaching Preparation at Yale University
- Pursuing the CIRTL Scholar qualification at the Center for the Integration of Research, Teaching, and Learning

STUDENTS SUPERVISED

2. Jack Ross – BS 05/22 “Galaxy Cluster Mass Estimates via X-ray Photon Point Cloud Regression" *Yale*
    - Awarded Yale College Dean’s Research Fellowship for full-time summer research on this project
1. Abby Mintz – BS 05/21 “Topology of Our Cosmology with Persistent Homology" *Yale*

EXTERNAL FUNDING

1. NSF XSEDE Startup Grant TG-AST190030: “Dynamical signatures of fuzzy dark matter: core-stalling and the dispersion of stellar streams”, awarded 2,500 GPU-hours on Comet GPU (value of $889)

PROFESSIONAL ACTIVITIES

COLLOQUIUM & SEMINAR ORGANIZATION

- Yale Graduate Analytical and Numerical Research Methods Seminar (Fall 2018 – Spring 2019)
- Yale Special Topics in Cosmology Graduate Seminars (Summer 2018 – Fall 2018)

PUBLIC OUTREACH

- Volunteer at Yale Girls' Science Investigations (Spring 2019 – Present)
- Volunteer at CT SEED: Students Exploring Engineering Day (Spring 2019 – Present)
- Contributor to Science Haven community outreach initiative (Summer 2018 – Present)
- Volunteer at the Yale Physics Olympics (Fall 2017 – Present)

RESEARCH WORKSHOPS ATTENDED

- 2019 Santa Cruz Galaxy Workshop (Santa Cruz, CA; Aug. 5–9, 2019)
- GANocracy: Workshop on Theory, Practice and Artistry of Deep Generative Modeling (MIT–IBM Watson AI Lab; May 31, 2019)

TEACHING WORKSHOPS ATTENDED

- CIRTL Course: Advancing Learning Through Evidence-Based STEM Teaching (Jan. 31 – Mar. 31, 2018)
- Yale Poorvu Center for Teaching and Learning Advanced Teaching Workshops *attended*:
  - Gender in the Classroom (Nov. 30, 2017)
  - Peer Observation Strategies (Oct. 5, 2017)
  - Undergraduate Mentorship Strategies (Oct. 26, 2017)
  - Transitioning to Instructor of Record (Apr. 18/25, 2018)
  - Teaching as Research (Jan. 31, 2018)
  - Writing Across the Disciplines (Feb. 18, 2020)

REFEREE

CHANCE (Special Edition on Astrostatistics)

UNIVERSITY SERVICE

- Member of Student Advisory Committee for the Yale Poorvu Center for Teaching and Learning (Fall 2019 – Present)
- Member of Student Advisory Committee for the Yale Office of Career Strategy (Fall 2019 – Spring 2020)
- Senator in the Yale Graduate and Professional Student Senate (Fall 2019 – Spring 2020)
  - Member of Professional Development committee
- Graduate Affiliate of Yale Benjamin Franklin College (Spring 2018 – Present)

DEPARTMENTAL SERVICE

- Member of Yale Physics Graduate Student Advisory Committee (Spring 2020 – Present)
- Volunteer for 2020 Conference for Undergraduate Women in Physics hosted by Yale Physics (Jan. 17–19, 2020)
- Lead Instructor for the *Fundamentals of Teaching Physics for First-Year PhD Students* short seminar series (Fall 2018 – Present)
- Yale Physics Happy Hour organizer (Fall 2018 – Summer 2019)

PROFESSIONAL SOCIETY MEMBERSHIP

- Nomination to Associate Membership, Sigma Xi (2019)
- Member, American Physical Society (2015 – Present)
- Member, Society of Physics Students
  - Resource Officer for UNC SPS Chapter (2015 – 2016)

LANGUAGES

- Natural – English (native), French (limited)
- Programming – Python, C/C++, UN*X, Bash, Mathematica, LaTeX, R
- Scientific Computing – Slurm, NumPy, SciPy, matplotlib, scikit-learn, Numba, pandas, seaborn, git

REFERENCES

- Prof. Frank C. van den Bosch
  Departments of Astronomy & Physics
  Yale University
  52 Hillhouse Ave.
  New Haven, CT 06511
  203-432-0196
  frank.vandenbosch@yale.edu

- Prof. Daisuke Nagai
  Departments of Physics & Astronomy
  Yale University
  56 Hillhouse Ave.
  New Haven, CT 06511
  203-432-5370
  daisuke.nagai@yale.edu

- Prof. Jessi Cisewski-Kehe
  Department of Statistics and Data Science
  Yale University
  24 Hillhouse Ave.
  New Haven, CT 06511
  203-436-9612
  jessica.cisewski@yale.edu

- Dr. Michelle Ntampaka
  Institute for Theory and Computation
  Center for Astrophysics
  Harvard-Smithsonian
  60 Garden St.
  Cambridge, MA 02138
  michelle.ntampaka@cfa.harvard.edu