

Lachlan Lancaster

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 [ltlancas](https://github.com/ltlancas)

Research Positions

Simons Society of Fellows, Junior Fellow

Columbia University
Advisor: Prof. Greg Bryan

New York City, NY

2022-2025

REU Student

University of California, Davis
Advisor: Prof. Lloyd Knox

Davis, CA

2015

Education

Princeton University

Master's of Science in Astrophysics

Ph.D. in Astrophysics

Advisor: Prof. Eve Ostriker

Princeton, NJ

2017-2019

2019-2022

University of Cambridge

Master's of Advanced Study in Astrophysics

Advisors: Prof. Vasily Belokurov and Prof. N. Wyn Evans

Graduated with Merit

Cambridge, UK

2016-2017

Carnegie Mellon University

Bachelor's of Science in Physics

Specialization in Astrophysics

Minor in Computational Mathematics

Pittsburgh, PA

2012-2016

Awards, Fellowships, and Grants

- **2020 Buchalter Cosmology Prize** - As a co-author on work led by Dr. Philip Mocz
- **Martin Schwarzschild Fellowship** - Awarded by the Princeton Astrophysics Department
- **Observing Time on Las Campanas Observatory's DuPont Telescope** - 5 Nights
- **Mellon College of Science's Dean's List with High Honors** 2012-2016

Selected Talks

- *University of Heidelberg Astronomy Colloquium*, Virtual, Nov. 2021
- *Carnegie Mellon University Astronomy Seminar*, Pittsburgh, Oct. 2021
- *University of Amsterdam Astronomy Seminar* Virtual, Sep. 2021
- *Virtual Ringberg Seminar Series*, Virtual, Jun. 2021
- *The Gaia Treasure Hunt*, Cambridge, UK, Sept. 2019
- *Light in the Suburbs*, Sesto, Italy, Jun. 2019
- *L2G2 Meeting*, Columbia University, New York, Nov. 2018

Research Interests

- **Dense Star Clusters:** Stellar Feedback – Stellar Winds – Globular Cluster Formation – Globular Cluster Abundance Patterns – Star Formation in the Early Universe – Extreme Stellar Evolution
- **Galaxy Formation/Dynamics:** Dark Matter – Milky Way Structure and Dynamics – Galactic Stellar Halo – Stellar Streams – Dwarf Galaxies – Near-field Cosmology
- **Cosmology:** Cosmic Microwave Background Radiation – Neutrino Cosmology – The Very Early Universe – Inflation – Novel Dark Matter Theories
- **Data Science:** Statistical Methods – Deep Learning – High-Dimensional Inference

Summary Publication Metrics

Article Counts: First Author Refereed - 9 Total Refereed - 18 [ADS Library](#)

Citations: h-index - 12 Total Citations - 649 Citations to First Author Papers - 306

Relevant Coursework

Astrophysics Summer Schools

- International School of Space Sciences (ISSS) School on Space Astrometry, 2019
- Berlin Summer School on Cosmology and Large Scale Structure, 2018

Theoretical Physics

- Quantum Field Theory (Cambridge)
- General Relativity and Black Holes (Cambridge)
- Galactic Dynamics (Cambridge and Princeton)
- Cosmology (Cambridge and Princeton)
- Stellar Astrophysics (Princeton)
- Physics of the Interstellar Medium (Princeton)
- Statistical Mechanics (Carnegie Mellon)

Mathematics

- Lie Groups, Lie Algebras, and their Representations (Cambridge)
- Partial Differential Equations & Finite Difference Methods (Carnegie Mellon)
- Great Theoretical Ideas in Computer Science (Carnegie Mellon)
- Quantum Computation (Carnegie Mellon)

Computational Skills

- **Programming Languages:** C/C++, Python, Fortran
- **Software:** emcee, Multi-Nest, AstroPy, TensorFlow

Teaching, Outreach, and Organizing Activities

- Teaching Assistant, Black Holes, Princeton, Spring 2022
- Advisor, “*Smoothness of the Milky Way’s Stellar Halo?*”, student Ish Kaul, Spring 2021
- Teaching Assistant, Research Methods in Astrophysics, Princeton, Fall 2020
- Advisor, “*Learning Galactic Foregrounds*”, student T. Lucas Makinen, 2019-2020
- Teaching Assistant, General Relativity, Princeton, Fall 2019, Fall 2021
- Member, Ad-Hoc Committee on Equity and Inclusion in Admissions, Fall 2020

- Member, Graduate Student Committee of the Astrophysics Department, 2018-2021
- Mentor, “Undergraduate Women in Physics” (UWiP) program at Princeton, 2018-2020
- Teacher, Princeton Prison Teaching Initiative (PTI) program, Spring 2018
- Organizer, Star Formation/ISM Rendezvous (SFIR) Seminar Series, Spring 2021-present
- Organizer, COMPuTational ASTrophysics Seminar (COMPASS) at Princeton, 2017-2019

Listed Publications

First Author Publications.....

1. **Lancaster, L.**; Pearson, S.; Williams, B. F.; Johnston, K.; Starckenburg, T.; Kado-Fong, E.; Seth, A.; Bell, E. **walter**: *A Tool for Predicting Resolved Stellar Population Observations with Applications to the Roman Space Telescope*, AJ, Vol. 164, Iss. 4, 2022, ([arXiv:2207.02208](https://arxiv.org/abs/2207.02208))
2. **Lancaster, L.**; Ostriker, E.C.; Kim, J.-G.; Kim, C.-G. *Star Formation Regulation and Self-Enrichment by Stellar Wind Feedback*, ApJL, 922, L3, ([arXiv:2110.05508](https://arxiv.org/abs/2110.05508))
3. **Lancaster, L.**; Ostriker, E.C.; Kim, J.-G.; Kim, C.-G. *Efficiently Cooled Stellar Wind Bubbles in Turbulent Clouds II. Validation of Theory with Hydrodynamic Simulations*, ApJ, Vol. 914, Iss. 2, 2021, ([arXiv:2104.07722](https://arxiv.org/abs/2104.07722))
4. **Lancaster, L.**; Ostriker, E.C.; Kim, J.-G.; Kim, C.-G. *Efficiently Cooled Stellar Wind Bubbles in Turbulent Clouds I. Fractal Theory and Application to Star-Forming Clouds*, ApJ, Vol. 914, Iss. 2, 2021, ([arXiv:2104.07691](https://arxiv.org/abs/2104.07691))
5. **Lancaster, L.**; Greene, J.E.; Ting, Y.-S.; Kuposov, S.; Pope, B.J.S.; Beaton, R.L.; *A Mystery in Chamaeleon: Serendipitous Discovery of a Galactic Symbiotic Nova*, AJ, Vol. 160, Iss. 3, 2020, ([arXiv:2002.07852](https://arxiv.org/abs/2002.07852))
6. **Lancaster, L.**; Giovannetti, C.; Mocz, P.; Kahn, Y.; Mariangela, L.; Spergel, D.N. *Dynamical Friction in a Fuzzy Dark Matter Universe*, JCAP, Iss. 1, 2020, ([arXiv:1909.06381](https://arxiv.org/abs/1909.06381))
7. **Lancaster, L.**; Kuposov, S.; Belokurov, B.; Evans, N.W.; Deason, A.J. *The Halo’s Ancient Metal-Rich Progenitor Revealed with BHB Stars*, MNRAS, Vol. 486, Iss. 1, 2019, ([arXiv:1807.04290](https://arxiv.org/abs/1807.04290))
8. **Lancaster, L.**; Belokurov, V.; Evans, N.W., *Quantifying the Smoothness of the Stellar Halo: A Link to Accretion History*, MNRAS, Vol. 484, Iss. 2, 2019, ([arXiv:1804.09181](https://arxiv.org/abs/1804.09181))
9. **Lancaster, L.**; Cyr-Racine, F.-Y.; Knox, L.; Pan, Z., *A tale of two modes: Neutrino free-streaming in the early universe*, JCAP, Iss. 7, 2017, ([arXiv:1704.06657](https://arxiv.org/abs/1704.06657))

Publications with Major Contributions.....

1. Greene, J.E.; **Lancaster, L.**; Ting, Y.-S.; Kuposov, S.; Danieli, S.; Huang, S.; Jiang, F.; Greco, J.P.; Strader, J. *A Search for Wandering Black Holes in the Milky Way with Gaia and DECaLS*, ApJ, Vol. 917, Iss. 1, 2021, ([arXiv:2105.04581](https://arxiv.org/abs/2105.04581))
2. Makinen, T.L.; **Lancaster, L.**; Villaescusa-Navarro, F.; Melchior, P.; Ho, S; Perreault-Levasseur, L.; Spergel, D. *deep21: A Deep Learning Method for 21cm Foreground Removal*, JCAP, Vol. 2021, Iss. 4, 2021, ([arXiv:2010.15843](https://arxiv.org/abs/2010.15843))
3. Mocz, P.; **Lancaster, L.**; Fialkov, A.; Becerra, F.; Chavanis P.-H., *On the Schrödinger-Poisson–Vlasov-Poisson Correspondence*, Phys Rev D, Vol. 97, Iss. 8, 2018 ([arXiv:1801.03507](https://arxiv.org/abs/1801.03507))
4. Matty, M.; **Lancaster, L.**; Griffin, W.; Swendsen, R.H., *Comparison of canonical and micro-canonical definitions of entropy*, Physica A, Vol. 467, pp. 474-489, 2015, ([arXiv:1511.02830](https://arxiv.org/abs/1511.02830))

Other Co-Authored Publications.....

1. Kado-Fong, E.; Kim, C.-G.; Greene, J.E.; **Lancaster, L.**; *Ultra-Diffuse Galaxies as Extreme Star-forming Environments II: Star Formation and Pressure Balance in HI-Rich UDGs*, ApJ, 2022, ([arXiv:2209.05500](#))
2. Somalwar, J.J.; Greene, J.E.; Greco, J.P.; Huang, S.; Beaton, R.L.; Goulding, A. D.; **Lancaster, L.**; *Hyper Suprime-Cam Low Surface Brightness Galaxies II: A Hubble Space Telescope Study of the Globular Cluster Systems of Ultra-Diffuse Galaxies in Groups*, ApJ, Vol. 902, Iss. 1, 2020, ([arXiv:2008.02806](#))
3. Mocz, P.; Fialkov, A.; Vogelsberger, M.; Becerra, F.; Shen, X.; Robles, V.; Amin, M.A.; Zavala, J.; Boylan-Kolchin, M.; Bose, S.; Marinaccci, F.; Chavanis, P.-H.; **Lancaster, L.**; Hernquist, L.; *Galaxy Formation with BECDM – II. Cosmic Filaments and First Galaxies*, MNRAS, Vol. 494, Iss. 2, 2020, ([arXiv:1911.05746](#))
4. Mocz, P.; Fialkov, A.; Vogelsberger, M.; Becerra, F.; Amin, M.A.; Bose, S.; Boylan-Kolchin, M.; Chavanis, P.-H.; Hernquist, L.; **Lancaster, L.**; Marinaccci, F.; Robles, V.; Zavala, J.; *First Star-Forming Structures in Fuzzy Cosmic Filaments*, Physical Review Letters, 123, 141301, 2019, ([arXiv:1910.01653](#))
5. Deason, A.J.; Belokurov, V.; Koposov, S.; **Lancaster, L.** *Apocenter Pile-up: Origin of the Stellar Halo Density Break*, ApJL, Vol. 862, Iss. 1, 2018 ([arXiv:1805.10288](#))