Lachlan Lancaster

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Education

Princeton University **Princeton, NJ**
Master's of Science in Astrophysics *2017-2019*
Ph.D. in Astrophysics *2019-2022*
Advisor: Prof. Eve Ostriker

University of Cambridge **Cambridge, UK**
Master's of Advanced Study in Astrophysics *2016-2017*
Advisors: Prof. Vasily Belokurov and Prof. N. Wyn Evans
Graduated with Merit

Carnegie Mellon University **Pittsburgh, PA**
Bachelor's of Science in Physics *2012-2016*
Specialization in Astrophysics
Minor in Computational Mathematics

Research Positions

University of California, Davis REU **Davis, CA**
Advisors: Prof. Lloyd Knox 2015

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 - 7 Total Refereed - 15 ADS Library
Citations: h-index - 9 Total Citations - 399 Citations to First Author Papers - 175

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

- 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-present
- 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

1. **Lancaster, L.**; Ostriker, E.C.; Kim, J.-G.; Kim, C.-G. *Star Formation Regulation and Self-Enrichment by Stellar Wind Feedback*, ApJL, *submitted*
2. **Lancaster, L.**; Pearson, S.; Williams, B. F.; Johnston, K.; Seth, A.; Starkenburg, T. *A Tool for Predicting Resolved Stellar Population Observations: Application to the Roman Space Telescope*, ApJ, *submitted*
3. Greene, J.E.; **Lancaster, L.**; Ting, Y.-S.; Koposov, 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, (arXiv:2105.04581)
4. **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)
5. **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)
6. 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)
7. 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)
8. **Lancaster, L.**; Greene, J.E.; Ting, Y.-S.; Koposov, 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, (http://arxiv.org/2002.07852)
9. 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)
10. 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)
11. **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)
12. **Lancaster, L.**; Koposov, 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)
13. 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)
14. **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)

15. 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)
16. **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)
17. 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)