

Danny Horta



Title

Unveiling the mass assembly history of the Milky Way via its stellar halo

Abstract

Stars comprising the Milky Way's stellar halo safeguard important chemo-dynamical information that enables the reconstruction of the mass assembly history of the Galaxy. Of particular importance are the halo populations in the innermost regions of the Milky Way, as they likely retain pivotal information that may help decode the early stages of the formation of the Galaxy, but however have so far been concealed due to the limitations in observing such regions due to high stellar density and dust extinction.

In this talk I will present results from two independent studies aimed at tackling two open questions in Galactic archaeology: "What is the Milky Way's mass assembly history?"; and "How much do globular clusters (GC) contribute to the total stellar halo mass budget?". First, I will provide evidence for the discovery of a new metal-poor substructure that displays chemo-dynamic signatures of accreted populations located within the heart of the Galaxy. Given the properties of this newly identified substructure (dubbed "Heracles"), we conjecture that it is the remnant of an accretion event that occurred in the early life of the Galaxy, which constituted a major building block of the Milky Way halo, and played a major role in the formation of the Milky Way. Following, I will present results on a study focused on assessing the contribution of dissolved and/or evaporated GC stars to the Galactic stellar halo. Using a density modelling procedure, I will show results that suggest there is a much higher contribution of dissolved/evaporated GC stars in the inner regions of the Galaxy when compared to the outer regions.

The results presented in this talk help shed light on the nature of Galactic stellar halo populations and the mass assembly history of the Galaxy.

DANNY HORTA DARRINGTON | CV

Webpage: DHortaD.github.io

Github: github.com/DHortaD

Email: D.HortaDarrington@2018.ljmu.ac.uk

Phone: (+61) 468858685

EDUCATION

Liverpool John Moores University, Liverpool, UK (October 2018- Present)

PhD, Astrophysics

Thesis title: Unravelling the History and Nature of the Milky Way through its stellar halo and its Globular Cluster System using Galactic Surveys and Numerical Simulations

Thesis advisors: Ricardo P. Schiavon, Nate Bastian

Northumbria University, Newcastle, UK (2014-2018)

Master of Physics with Astrophysics (MPhys), 2017-2018

Grade: 1st class honours

Bachelor of Physics with Astrophysics (BSc), 2014-2017

Grade: 1st class honours

RESEARCH INTERESTS

Galactic archaeology; mass assembly of galaxies; galaxy formation & evolution; near-field cosmology; dark matter; stellar populations; chemical tagging; Galactic dynamics; Galactic chemical evolution; first stars; globular clusters

PUBLICATIONS (16 TOTAL, 5 FIRST AUTHOR)

As first author

5. **Horta, D.**, Ness, M., Rybizki, J., Schiavon, R.P., et al. *Neutron-capture elements record the ordered chemical evolution of the disc over time*, under review in MNRAS, ([arXiv:2111.01809](https://arxiv.org/abs/2111.01809)) [cited: 1]
4. **Horta, D.**, Mackereth, J.T., Schiavon, R.P., et al. *The Contribution of N-Rich stars to the Galactic Stellar Halo Using APOGEE Red Giants* (2021), MNRAS ([arXiv:2008.01097](https://arxiv.org/abs/2008.01097)) [cited: 13]
3. **Horta, D.**, Meghan Hughes, Joel Pfeffer, et al. *Linking Globular Cluster Formation at Low and High Redshift Through the Age-Metallicity Relation in E-MOSAICS* (2021), MNRAS ([arXiv:2010.10522](https://arxiv.org/abs/2010.10522)) [cited: 7]
2. **Horta, D.**, Schiavon, R.P., Mackereth, J.T., et al. *Evidence from APOGEE for the presence of a major building block of the halo buried in the inner Galaxy* (2021), MNRAS ([arXiv:2007.10374](https://arxiv.org/abs/2007.10374)) [cited: 34]
1. **Horta, D.**, Schiavon, R.P. Mackereth, J.T. et al., *The Chemical Compositions of Accreted and in situ Galactic Globular Clusters According to SDSS/APOGEE* (2020), MNRAS ([arXiv:2001.03177](https://arxiv.org/abs/2001.03177)) [cited: 33]

As co-author

10. Abdurro'uf., Accetta, K., Aerts, C., (incl. **Horta, D**) et al. *The Seventeenth Data Release of the Sloan Digital Sky Surveys: Complete Release of MaNGA, MaStar and APOGEE-2 Data*, under review in ApJ, ([arXiv:2112.02026](https://arxiv.org/abs/2112.02026))
9. Phillips, S., Schiavon, R.P., Mackereth, T.J., (incl. **Horta, D**) et al. *Detection by APOGEE of N-rich stars in the tidal tails of Palomar 5* MNRAS ([arXiv:2112.02117](https://arxiv.org/abs/2112.02117))
8. Cunningham, E.C., Sanderson, R.E., Johnston, K.V., (incl. **Horta, D**) et al. *Reading the CARDS: the Imprint of Accretion History in the Chemical Abundances of the Milky Way's Stellar Halo* (under review in ApJ), ([arXiv:2110.02957](https://arxiv.org/abs/2110.02957))
7. Ness, M.K., Wheeler, A.J., McKinnon, K., **Horta, D.**, et al. *The homogeneity of the star formation environment of the Milky Way disk over time*, accepted in ApJ, ([arXiv:2109.05722](https://arxiv.org/abs/2109.05722))[cited: 3]
6. Buder, S., Lind, K., Ness, M.K., Feuillet, D.K., **Horta, D.**, et al. *The GALAH Survey: Chemical*

tagging and chrono-chemodynamics of accreted halo stars with GALAH+ DR3 and Gaia eDR3, [MNRAS](#) (arXiv:2109.04059)[cited: 5]

5. Hasselquist, S., Hayes, C.R., Lian, J., Weinberg, D.H., Zasowski, G., **Horta, D.**, et al. *APOGEE chemical abundance patterns of the massive Milky Way satellites*, [ApJ](#), (arXiv:2109.05130)[cited: 1]
4. Geisler, D., Villanova, S., O'Connell, J. E., (incl. **Horta, D.**), et al. *CAPOS: the bulge Cluster APOgee Survey I. Overview and Initial ASPCAP Results* (2021), [A&A](#), (arXiv:2106.00024)[cited: 1]
3. Sheffield, A.A., Subrahimovic, A., Refat, M., (incl. **Horta, D.**), et al. *Chemodynamically Characterizing the Jhelum Stellar Stream with APOGEE-2* (2021), [ApJ](#), (arXiv:2103.07488)
2. Kisku, S.S., Schiavon, R.P., **Horta, D.**, et al. *An enquiry on the origin of N-rich stars in the inner Galaxy based on APOGEE chemical compositions* (2021), [MNRAS](#), (arXiv:2102.06720)
1. Ahumada, R., Allende Prieto, C., Almeida, Andres., (incl. **Horta, D.**), et al. *The Sixteenth Data Release of the Sloan Digital Sky Surveys: First Release from the APOGEE-2 Southern Survey and Full Release of eBOSS Spectra* (2020), [ApJ](#) (arXiv:1912.02905) [cited: 368]

Conference proceedings

- 1 **Horta, D.**, Mackereth, J. T., Schiavon, R. P., SDSS-IV/Apogee Collaboration. *The contribution of Globular Clusters to the stellar halo using APOGEE and Gaia*, 2020, [IAU Symposium](#), 351, 455

AWARDS, GRANTS & HONOURS

Visiting research student, University of Queensland, Brisbane, Australia, 2020-2021
SDSS Early Career Travel Fund Grant, 2019, 1000 USD
LJMU PGR Travel Fund Grant, 2019, 350 GBP
COST Workshop Participation Grant, 450 EUR

SELECTED TALKS

20. **Plenary talk**, *Astronomical Society of Australia meeting* (ASA), 2021
19. **Contributed talk**, *"A holistic view of the Milky Way"*, EAS 2021, July 2021
18. **Invited seminar**, University of Sydney, April 2021
17. **Invited seminar**, University of New South Wales, April 2021
16. **Invited seminar**, Macquarie University, April 2021
15. **Contributed talk**, *"Penn Dynamics Research Symposium"*, April 2021
14. **Contributed seminar**, *ECR Astronomers in Australia Seminar Series*, April, 2021, ([Link](#))
13. **Invited seminar**, University of St. Andrews, March 2021
12. **Contributed talk**, *"Streams 21" conference*, Flatiron Institute (New York), February 2021
11. **Contributed talk**, *"Milky Way Gaia Workshop on the Galactic Centre and Inner Galaxy"*, Heidelberg, Germany, February 2021
10. **Invited lunch talk**, Australian National University, Australia, December 2020
9. **Contributed talk**, *"Linking the Galactic and Extragalactic"* conference, Wollongong, Australia, November 2020 ([Link](#))
8. **Invited lunch talk**, University of Queensland, Australia, November 2020
7. **ARI research talks**, Liverpool John Moores University, UK, October 2020
6. **Invited journal club talk**, *Dynamics group at CCA*, New York, September 2020
5. **Invited lunch talk**, University of Birmingham, UK, August 2020
4. **Invited lunch talk**, University of Cambridge, UK, August 2020
3. **Contributed talk**, SDSS-IV/V Collaboration Meeting, New York, July 2020
2. **ARI research talks**, Liverpool John Moores University, UK, October 2019
1. **Contributed talk**, SDSS-IV Collaboration Meeting, Ensenada, Mexico, June 2019

TEACHING, ACADEMIC SERVICE & AFFILIATIONS

Teaching and mentoring

Co-Mentor (with Yuan-Sen Ting), **Anne Xie** (undergraduate student, Australian National University), 2021-2022

Teaching Assistant, *Astrophysical Concepts*, Liverpool John Moores University, 2021-2022

Teaching Assistant, *Stellar Physics*, Liverpool John Moores University, 2020-2021

Senior Demonstrator, *Practical Astrophysics*, Liverpool John Moores University, 2019-2020 & 2020-2021

Teaching Assistant, *Introduction to Astrophysics*, Liverpool John Moores University, 2018-2019

Academic service

Journal Referee: ApJ

Contributor to APOGEE DR17 globular cluster value added catalogue

Workshops

"*Milky Way size galaxy formation and high performance computing*" workshop, Barcelona, 2020.

Affiliations

SDSS-IV/APOGEE-2 collaboration – team member

SDSS "Milky Way as a Galaxy" working group – team member

E-MOSAICS collaboration – team member

Public Outreach

Public talk, Brisbane Astronomical Society, "Unmasking the Milky Way from the inside-out", 2021

Teaching assistant and public science talks, *work experience week*, Liverpool, 2021

PRESS COVERAGE & HIGHLIGHTS

Research highlight in Nature Astronomy, "*Excavating a Galactic tomb*", [Link](#)

Press Release, "*Astronomers Discover New "Fossil Galaxy" Buried Deep Within the Milky Way*", [Link](#)

Article in Sky & Telescope, "*Astronomers Discover Galactic "Fossil" inside the Milky Way*", [Link](#)

Article in Media INAF, "*Una galassia fossile nel cuore della Via Lattea*", [Link](#)

Article in Forbes magazine, "*We've found an ancient 'fossil Galaxy' inside our Milky Way, say scientists*", [Link](#)

Article in The Independent, "*Fossil Galaxy" found hidden in the Milky Way*", [Link](#)

Interview on "Principio de incertidumbre", Canal Extremadura, Spanish News (2020), "*Heracles, un fósil galáctico en el interior de la Vía Láctea*", [Link](#)

Invited contribution to "*The Magellanic Clouds Newsletter*" (MC News), [Link](#)

SKILLS

Programming

Python: for data-driven modelling, interpretation of data, visualisation

Topcat: for manipulation of large data, visualisation

L^AT_EX: for contextualising results leading towards scientific publications in journals; for preparing and disseminating teaching material

Microsoft Teams/Word/Excel/PowerPoint: for delivering and marking teaching material

HTML: for development of personal website

Languages

Native: English, Spanish, Catalan

Beginner: Portuguese, Italian