Louise **Welsh**

Astronomer

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Summary

In my research, I study chemical evolution across cosmic time as well as the first stars and galaxies. Primarily, I use the largest optical telescopes in the world to study some of the least chemically evolved gas 2 billion years after the Big Bang. The gas clouds are encoded with information about their star formation history and can, in combination with a chemical enrichment model that I have developed, reveal the mass distribution of ancient stellar populations. This information is invaluable because the properties of the first stellar populations are still shrouded in mystery. This work is possible through a process known as quasar absorption line spectroscopy – where gas between a bright background galaxy and our telescope can be seen, and subsequently studied, in absorption.

Employment

University of Milano Bicocca — *Milan, Italy*

Postdoctoral Researcher — *Sep. 2021 - PRESENT*

Education

Centre for Extragalactic Astronomy, Durham University — *Durham, UK*

PhD in Astrophysics — *Oct. 2017 - Sep. 2021*

- Thesis: 'A window to the first stars: An investigation of chemically near-pristine environments'
- Advisors: Prof. Ryan Cooke and Prof. Michele Fumagalli

Lancaster University — *Lancaster, UK*

Master of Physics (MPhys): 1st Class (Hons) — *Oct. 2012 - Jul. 2016*

- Thesis: 'Investigating cold dark matter candidates'
- Advisor: Dr. John McDonald

Awards and Fellowships

2021	**Keith Nicholas Prize**, Awarded for outstanding overall performance by a postgraduate student.	*Durham University*
2019	**Associate Fellow of the Higher Education Academy**, through the Durham Excellence in Learning and Teaching Awards scheme.	
2019	**Martin and Beate Block Award**, Awarded to a promising researcher at the Aspen winter meeting 'Into the Starlight'.	*Aspen Centre for Physics*
2016	**Azzedine Hammiche Prize**, Awarded for exceptional fourth year project work.	*Lancaster University*

Talks (4 invited, 25 total)

Most recent:

Oct. 2022	**INAF**, Using ESPRESSO and the most metal-poor DLAs to probe the first stars (invited)	*Trieste*
Sep. 2022	**ESO Santiago**, Using ESPRESSO and the most metal-poor DLAs to probe the first stars	*Chile*
Sep. 2022	**WMAG 2022**, Tracing chemical evolution and the first stars with the most metal-poor DLAs	*Italy*
Jun. 2022	**FSTG II**, Tracing the first stars with [O/Fe]	*Sweden*
Jan. 2022	**NOAO FLASH**, Oxygen-enhanced EMP DLAs as probes of the first stars (invited)	*Virtual*

Proposal History as Principle Investigator

2022	**VLT/UVES**, 10 hours, P110.	*ESO*
2022	**VLT/ESPRESSO 1-UT**, 7 hours, P109.	*ESO*
2022	**VLT/ESPRESSO 4-UT**, 1/2 night, P109.	*ESO*
2021	**VLT/UVES**, 18 hours, P108.	*ESO*
2021	**Keck I/HIRES**, 1 night, 2021B.	*NOAO*
2020	**VLT/ESPRESSO 1-UT**, 9 hours, P105.	*ESO*
2020	**VLT/UVES**, 20 hours, P105.	*ESO*
2019	**WHT/ISIS**, 7 nights, 2019B.	*ING*

Teaching

2021	**Advisor**, Nuffield Research Placement	*Durham University*
2019 - 2021	**Demonstrator**, Level 2: Stars and Galaxies	*Durham University*
2018 - 2020	**Demonstrator**, Level 1: Further Mathematics for Geoscientists	*Durham University*
2018 - 2019	**Demonstrator**, Level 1: Maths toolkit for Scientists	*Durham University*

Memberships and activities

2022	**WMAG 2022**, Organising committee member for the 'What Matters around Galaxies - 2022' conference.
2021 -	**WEAVE**, Member of the WEAVE-QSO survey.
2021 -	**Peer reviewer**, Astrophysical Journal.
2021 -	**Astrocoffee**, Organiser of weekly astrocoffee seminars at Milano-Bicocca.
2021 -	**INAF**, Associate member of INAF - Osservatorio Astronomico di Brera.
2020 - 2021	**OCW social**, Member of committee responsible for organising department social events.
2020	**DEX XVI**, LOC member for the '2020 Vision: progress and tensions in astronomy' workshop.
2019	**Small Galaxies, Cosmic Questions**, LOC member for the 'Small Galaxies, Cosmic Questions' conference.
2018 - 2019	**Journal Club**, Convener of a weekly meeting of postgraduate students at Durham University.

Outreach

Planetarium *North East, UK*

Show provider *Oct. 2018 - Sep. 2020*

Delivered shows on the constellations and planets at events (including multiple science festivals) and local schools using an inflatable planetarium.

Computing Skills

Programming Python, git, LaTeX, Jupyter notebooks, slurm batch systems, RStudio.

Publications

- R. Cooke et al. (2022) "Primordial helium-3 redux: The helium isotope ratio of the Orion nebula", ApJ, 932, 60
- **L. Welsh**, R. Cooke, M. Fumagalli, & M. Pettini (2022) "Oxygen-enhanced EMP DLAs: A signpost of the first stars?", ApJ, 929, 158
- **L. Welsh**, R. Cooke, & M. Fumagalli (2021) "The stochastic enrichment of Population II stars", MNRAS, 500, 5214
- R. Cooke, **L. Welsh**, M. Fumagalli, & M. Pettini (2020) "A limit on Planck-scale froth with ESPRESSO", MNRAS, 494, 4884
- **L. Welsh**, R. Cooke, M. Fumagalli, & M. Pettini (2020) "A bound on the $^{12}C/^{13}C$ ratio in near-pristine gas with ESPRESSO", MNRAS, 494, 1411
- **L. Welsh**, R. Cooke, & M. Fumagalli (2019) "Modelling the chemical enrichment of Population III supernovae: the origin of the metals in near-pristine gas clouds", MNRAS, 487, 3363