

Louise Welsh

ASTRONOMER

Centre for Extragalactic Astronomy, Durham University, South Road, Durham, UK, DH1 3LE

✉ louise.amber.welsh@gmail.com | 🏠 lawelsh.github.io | 🌐 Louise Welsh | 🆔 0000-0003-3174-7054

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. This field will soon be revolutionised thanks to upcoming spectroscopic surveys that will produce datasets of unprecedented quality and scope. Furthermore, in the next decade, we will see the advent of the next generation of ground-based telescopes with apertures 3 times greater than the current state-of-the-art. My current research is focused on maximally utilising these technological advances to reveal the properties of the first stars. This research is essential to understand the first instances of chemical enrichment and galaxy formation in the early Universe.

Employment

Centre for Extragalactic Astronomy

CEA POSTDOCTORAL FELLOW

Durham, UK

Jan. 2025 - PRESENT

INAF Astronomical Observatory of Trieste

POSTDOCTORAL RESEARCHER

Trieste, Italy

Sep. 2023 - Dec. 2024

University of Milano Bicocca

POSTDOCTORAL RESEARCHER

Milan, Italy

Sep. 2021 - Sep. 2023

Education

Centre for Extragalactic Astronomy, Durham University

PHD IN ASTROPHYSICS

Durham, UK

Oct. 2017 - Sep. 2021

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

Lancaster University

MASTER OF PHYSICS (MPHY): 1st CLASS (HONS)

Lancaster, UK

Oct. 2012 - Jul. 2016

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

Awards and Fellowships

- | | | |
|------|---|---------------------------------|
| 2025 | CEA Fellowship , Awarded to pursue observationally based independent research for 3 years. | <i>Durham University</i> |
| 2021 | Keith Nicholas Prize , Awarded for outstanding overall performance by a postgraduate student. | <i>Durham University</i> |
| 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'. | <i>Aspen Centre for Physics</i> |
| 2016 | Azzedine Hammiche Prize , Awarded for exceptional fourth year project work. | <i>Lancaster University</i> |

Talks (8 invited, 40 total)

Most recent:

Dec. 2024	Galaxies in the Cosmic Web , The clustering of C IV at the end of reionization	Italy
Dec. 2024	BBGB2024 , The clustering of C IV at the end of reionization	India
Sep. 2024	Astrophysical origins of Carbon , Near pristine DLAs and their chemistry (invited)	Japan
Aug. 2024	Small Galaxies Cosmic Questions II , Near pristine DLAs and their chemistry	UK
Aug. 2024	Isotopes as a Probe of the Growth of Galaxies , The carbon isotopes of the first stars (invited - postponed)	Italy
July 2024	BRIDGCE2024 , Near pristine DLAs and their chemistry	UK
May 2024	First Stars VII , [O/Fe] enhancement in the most metal-poor DLAs	New York
May 2024	CGMENV , The clustering of C IV at the end of reionization	Italy

Proposal History as Principle Investigator

2025	Keck II/KCWI , 1/2 night, 2025A.	NOIRLab
2024	VLT/XSHOOTER , 8 hours, P113.	ESO
2023	VLT/ESPRESSO 4-UT , 1.2 nights, P112.	ESO
2023	VLT/UVES , 10 hours, P111.	ESO
2023	Keck I/HIRES , 1 night, 2023A.	NOIRLab
2022	VLT/UVES , 10 hours, P110.	ESO
2022	VLT/ESPRESSO 1-UT , 7 hours, P109.	ESO
2022	VLT/ESPRESSO 3-UT , 8 hours, P109.	ESO
2021	VLT/UVES , 18 hours, P108.	ESO
2021	Keck I/HIRES , 1 night, 2021B.	NOIRLab
2020	VLT/ESPRESSO 1-UT , 9 hours, P105.	ESO
2020	VLT/UVES , 20 hours, P105.	ESO
2019	WHT/ISIS , 7 nights, 2019B.	ING

Proposal History as Primary Scientific Investigator

2023	WEAVE/LIFU , 21 hours, 2023B.	UK PATT
2020	Palomar/Hale , 7 night, 2020A.	Caltech

Teaching

2023	Advisor , Student bachelor thesis in physics	Milano-Bicocca U.
2022 - 2023	Demonstrator , Laboratory of Data Acquisition (postgraduate course)	Milano-Bicocca U.
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

2023 -	IFPU , Affiliated member of the Institute for Fundamental Physics in the Universe	
2023 -	WEAVE , IFU Working Group Member for WEAVE QSO survey.	
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, Astronomy & Astrophysics, MNRAS.	
2021 - 2023	Astrocoffee , Organiser of weekly astrocoffee seminars at Milano-Bicocca.	
2021 - 2023	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

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, high-performance computing, batch systems, RStudio.

Publications

- R. Cooke & **L. Welsh** (2025) “A determination of the cosmic microwave background temperature using Galactic molecules”, MNRAS, 536, 1980
- **L. Welsh** et al. (2024) “A survey of extremely metal-poor gas at cosmic noon: evidence of elevated [O/Fe]”, A&A, 691, 285
- D. Milakovic et al. (2024) “Isotopic abundance of carbon in the DLA towards QSO B1331+170”, MNRAS, 534, 12
- E. Nunez et al. (2024) “KBSS-InCLOSE I: Design and First Results from the Inner CGM of QSO Line Of Sight Emitting Galaxies at $z \sim 2-3$ ”, ApJ, 976, 41
- **L. Welsh**, R. Cooke, M. Fumagalli, & M. Pettini (2023) “Towards ultra metal-poor DLAs: linking the chemistry of the most metal-poor DLA to the first stars”, MNRAS, 525, 527
- A. Longobardi et al. (2023) “Towards an automatic approach to modelling the circumgalactic medium: new tools for mock making and fitting of metal profiles in large surveys”, RASTI, 2, 470
- 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 $^{12}\text{C}/^{13}\text{C}$ 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

My ADS publication library can be found here: <https://tinyurl.com/louiseadslibrary>.