

# 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

POSTDOCTORAL RESEARCHER

Milan, Italy

Sep. 2021 - PRESENT

## 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'
- Advisors: Dr. Ryan Cooke and Prof. Michele Fumagalli

### Lancaster University

MASTER OF PHYSICS (MPHY): 1<sup>st</sup> CLASS (HONS)

Lancaster, UK

Oct. 2012 - Jul. 2016

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

## Awards

- |      |  |                                 |
|------|--|---------------------------------|
| 2021 | <b>Keith Nicholas Prize</b> , Awarded for outstanding overall performance by a postgraduate student.                           | <i>Durham University</i>        |
| 2019 | <b>Durham University Learning and Teaching Award</b> , Awarded for developing dedicated teaching practices.                    | <i>Durham University</i>        |
| 2019 | <b>Martin and Beate Block Award</b> , Awarded to a promising young physicist at the Aspen winter meeting 'Into the Starlight'. | <i>Aspen Centre for Physics</i> |
| 2016 | <b>Azzedine Hammiche Prize</b> , Awarded for exceptional fourth year project work.   | <i>Lancaster University</i>     |

## Talks (4 invited, 23 total)

Most recent:

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

## Proposal History as Principle Investigator

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

## Teaching

2019 - 2021	<b>Demonstrator</b> , Level 2: Stars and Galaxies	Durham University
2018 - 2020	<b>Demonstrator</b> , Level 1: Further Mathematics for Geoscientists	Durham University
2018 - 2019	<b>Demonstrator</b> , Level 1: Maths toolkit for Scientists	Durham University

## Memberships and activities

2022	<b>WMAG 2022</b> , Member of organising committee for conference 'What Matters around Galaxies - 2022'	Italy
2021 -	<b>Peer reviewer</b> , ApJ	
2021 -	<b>Astrocoffee organiser</b> , Organiser of weekly astrocoffee seminars for students, visitors, and postdocs.	Milano-Bicocca
2021 -	<b>INAF associate</b> , Member of INAF - Osservatorio Astronomico di Brera.	Milano
2020 - 2021	<b>OCW social</b> , Member of committee responsible for organising department social events.	Durham University
Jan. 2020	<b>DEX XVI</b> , LOC member for the "2020 Vision: progress and tensions in astronomy" workshop.	Durham University
Aug. 2019	<b>Small Galaxies, Cosmic Questions</b> , LOC member for the "Small Galaxies, Cosmic Questions" conference.	Durham University
2018 - 2019	<b>Astronomy Journal Club</b> , Co-convenor of a weekly meeting of first year postgraduate students.	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  $^{12}\text{C}/^{13}\text{C}$  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