Callum T. Donnan

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Research Interests

Galaxy formation & evolution, first stars & galaxies, cosmic reionization, stellar populations, large-scale structure, galaxy-halo connection

Education

2021–present **PhD Astrophysics**, *Institute for Astronomy, University of Edinburgh*, Edinburgh, UK.
Thesis: *"Exploring the formation of the first galaxies with VISTA and JWST"*,
Supervisors: James Dunlop, Ross McLure, Derek McLeod

2016–2021 **MPhys (Honours) Astrophysics**, *University of St Andrews*, St Andrews, UK.
First Class, Awarded prize for best MPhys Astrophysics thesis.
Thesis: *"The gas content of galaxies in the cosmic web"*,
Supervisor: Rita Tojeiro

2010–2016 **Monifieth High School**, Monifieth, UK.
Advanced Higher: AA *Higher:* AAAAAB

Research Employment

2021 **Research Student**, *University of St Andrews*.
The gas content of galaxies in the cosmic web. **Supervisor: Rita Tojeiro**

2020 **Institute of Astronomy Summer Research Programme**, *University of Cambridge*.
Spectroscopic redshifts of $z \geq 8$ galaxies with X-Shooter. **Supervisor: Nicolas Laporte**

2019 **Summer Research Project**, *University of St Andrews*.
Galaxy-halo connection in Illustris TNG. **Supervisors: Rita Tojeiro, Chris Duckworth**

Skills

Data Analysis **Image reduction/processing** (SWarp, SCAMP, PENCIL, PSF convolution),
Photometry (SExtractor, astropy, TPHOT, catalogue creation),
SED fitting (EAZY, BAGPIPES)

Coding Python (numpy, scipy, astropy, matplotlib), FORTRAN, SQL, C++

Awards & Scholarships

2021 Prize for best MPhys Astrophysics thesis.

(2016-2021) Dean's List (awarded for averaging a first class across the academic year.)

2019 Cormack Vacation Scholarship from the Royal Society of Edinburgh

2019 School of Physics & Astronomy Student Staff Council Vacation Award

2017/18 Medal (Astronomy and Astrophysics Second Level)

2016/17 Medal (Astronomy and Astrophysics First Level)

2016/17 Margaret Stewart Prize (Awarded to the best First Year student in Astronomy and Astrophysics)

Presentations

2024 **St Andrews Astronomy Colloquium**, St Andrews, UK, invited talk
JWST PRIMER: A multifield determination of the galaxy UV luminosity function at $z \simeq 9-15$

2024 **The Growth of Galaxies in the Early Universe – IX**, Sesto, IT, contributed talk
JWST PRIMER: A multifield determination of the galaxy UV luminosity function at $z \simeq 9-15$

2024 **Durham-Edinburgh Extragalactic workshop - XX**, Durham, UK, contributed talk
JWST PRIMER: A multifield determination of the galaxy UV luminosity function at $z \simeq 9-15$

2023 **National Astronomy Meeting**, Cardiff, UK, contributed talk
The evolution of the galaxy UV luminosity function at $z \simeq 8-15$

2023 **First Light**, Boston, USA, contributed poster
The evolution of the galaxy UV luminosity function at $z \simeq 8-15$

2023 **A new era in extragalactic astronomy: early results from the James Webb Space Telescope**, Cambridge, UK, contributed talk
The evolution of the galaxy UV luminosity function at $z \simeq 8-15$

2023 **The Growth of Galaxies in the Early Universe – VIII**, Sesto, IT, contributed talk
The evolution of the galaxy UV luminosity function at $z \simeq 8-15$

2023 **Durham-Edinburgh Extragalactic workshop - XIX**, Durham, UK, contributed talk
The evolution of the galaxy UV luminosity function at $z \simeq 8-15$

2022 **National Astronomy Meeting**, Warwick, UK, contributed talk
The search for $z \geq 7.5$ *galaxies in a range of degree-scale ground-based surveys*

2022 **Durham-Edinburgh Extragalactic workshop - XVIII**, Virtual, contributed talk
The Role of the Cosmic Web in the Scatter of the Galaxy Stellar Mass - Gas Metallicity Relation

2022 **Harvard CfA Galaxy Cluster Group**, Virtual, invited talk
The Role of the Cosmic Web in the Scatter of the Galaxy Stellar Mass - Gas Metallicity Relation

Observing Proposals

2024 **CO-I**, The CANDELS-Area Prism Epoch of Reionization Survey (CAPERS)
JWST/NIRSpec, Cycle 3, 194 hours, PI: M. Dickinson

2024 **CO-I**, Dead or alive? Unveiling the nature of massive galaxies in the early Universe
JWST/NIRSpec, Cycle 3, 10.3 hours, PI: L. Barrufet

2023 **CO-I**, EXCELS: The Early eXtragalactic Continuum and Emission Line Survey, core team member
JWST/NIRSpec, Cycle 2, 72.3 hours, PI: A. Carnall & F. Cullen

2023 **CO-I**, Spectroscopic follow-up of ultra-high-z candidates in CEERS: Characterizing true $z > 12$ galaxies and $z \sim 4-7$ interlopers in preparation for JWST Cycle 2
JWST/NIRSpec, DDT, 8.2 hours, PI: P. Arrabal Haro

2021 **CO-I**, The AURORA Survey: First Direct Metallicity Calibrations at High Redshift
JWST/NIRSpec, Cycle 1, 63 hours, PI: A. Shapley & R. Sanders

2021 **CO-I**, PRIMER: Public IMaging for Extragalactic Research, core team member
JWST/NIRCam, Cycle 1, 196 hours, PI: J. Dunlop

Teaching/Outreach

2021-present Teaching Assistant: Physics 1A, Discovering Astronomy, Observational Astronomy

2023 Royal Observatory open day, JWST presentation to members of the public

2023 Blairgowrie High School, Presentation on role of computing in astronomy

2017/18 Assisted with Monifieth High School's Advanced Higher Physics class research projects.

Press

2024 **Physics magazine**, JWST Sees More Galaxies than Expected, link

2023 **Physicsworld**, JWST spectrometer refines redshifts of distant galaxies, link

2023 **Le Parisein**, Distant galaxies: the James Webb Telescope defies all odds, link

2022 **Nature News**, Four revelations from the Webb telescope about distant galaxies, link

2022 **BBC News**, Scottish astronomers push James Webb deeper back in time, link

2022 **VICE**, A Cosmic Web Connecting the Universe Shapes Dark Matter in Galaxies, Study Finds, link

Publications (14, 4 as first author, h-index: 9, citations: 684)

First author

1. **Donnan, C.T.**, McLure R. J., Dunlop J. S., et al., (2024) *arXiv:2403.03171*, JWST PRIMER: A new multi-field determination of the evolving galaxy UV luminosity function at redshifts $\mathbf{z \simeq 9-15}$
2. **Donnan, C.T.**, McLeod, D. J., McLure R. J., et al., (2023) *MNRAS, 520, 4554*, The abundance of $z \geq 10$ galaxy candidates in the HUDF using deep JWST NIRCam medium-band imaging.
3. **Donnan, C.T.**, McLeod, D. J., Dunlop J. S., et al., (2023) *MNRAS, 518, 6011*, The evolution of the galaxy UV luminosity function at redshifts $z \simeq 8-15$ from deep JWST and ground-based near-infrared imaging.
4. **Donnan, C.T.**, Tojeiro, R., Kraljic, K., (2022) *Nature Astronomy, 6, 599*, The role of the cosmic web in the scatter of the galaxy stellar mass - gas metallicity relation.

Co-author

5. Varadaraj, R. G., Bowler, R. A. A., Jarvis, M. J., et al., (2024) *arXiv:2401.15971*, The sizes of bright Lyman-break galaxies at $z \simeq 3-5$ with JWST PRIMER
6. McLeod, D. J., **Donnan, C.T.**, McLure R. J, et al., (2024) *MNRAS, 527, 5004*, The galaxy UV luminosity function at $z \simeq 11$ from a suite of public JWST ERS, ERO, and Cycle-1 programs
7. Begley, R., Cullen, F., McLure, R.J., (2024) *MNRAS, 527, 4040*, Connecting the escape fraction of Lyman-alpha and Lyman-continuum photons in star-forming galaxies at $z \simeq 4-5$
8. Cullen, F., McLeod, D. J., McLure, R.J., (2023) *arXiv:2311.06209*, Evidence for the emergence of dust-free stellar populations at $z > 10$
9. Arrabal Haro, P., Dickinson, M., Finkelstein, S. L., (2023) *Nature, 622, 707*, Confirmation and refutation of very luminous galaxies in the early Universe

10. Carnall, A. C., McLure, R. J., Dunlop, J. S., (2023) *Nature, 619, 716*, A massive quiescent galaxy at redshift 4.658
11. Hamadouche, M. L., Carnall, A. C., McLure, R. J., (2023) *MNRAS, 521, 5400*, The connection between stellar mass, age, and quenching time-scale in massive quiescent galaxies at $z \simeq 1$
12. Carnall, A. C., McLeod, D. J., McLure, R. J., (2023) *MNRAS, 520, 3974*, A surprising abundance of massive quiescent galaxies at $3 < z < 5$ in the first data from JWST CEERS
13. Cullen, F., McLure, R. J., McLeod, D. J., (2023) *MNRAS, 520, 14*, The ultraviolet continuum slopes (β) of galaxies at $z \simeq 8 - 16$ from JWST and ground-based near-infrared imaging
14. Carnall, A. C., Begley, R., McLeod, D. J., (2023) *MNRAS, 518, 45*, A first look at the SMACS0723 JWST ERO: spectroscopic redshifts, stellar masses, and star-formation histories