

Lewis McCallum  (0009-0007-1181-8034)
 lewis.mccallum@cfh.harvard.edu  lewis-mccallum
 <http://lewismccallum.meikleobney.net>

Keywords (UAT)

847  Interstellar medium
1335  Radiative transfer
2060  Photoionization

Employment History

July 2026 – Present  **Postdoctoral Researcher - Center for Astrophysics | Harvard & Smithsonian** Researcher in the group of Catherine Zucker.

June 2025 – June 2026  **Postdoctoral Researcher - RWTH Aachen University - mw-atlas project**
Employed via ERC Synergy Grant under the directive of mapping the Milky Way in 3D.

Education

2021 – 2025  **PhD, University of St Andrews** Astrophysics
Thesis title: *Simulations of non-equilibrium diffuse ionized gas in star forming galaxies*
Supervisor: *Kenneth Wood*

2015 – 2020  **MPhys (Astrophysics), University of St Andrews**
Thesis title: *Is star formation being hidden in dusty H II regions?*

Research Output

First Author

- 1** **L. McCallum**, P. Frank, S. Hutschenreuter, *et al.*, “The radial component of the local Galactic magnetic field in 3D,” vol. 548, no. 2, *stag640*, *stag640*, May 2026.  DOI: 10.1093/mnras/stag640. arXiv: 2604.01093 [astro-ph.GA].
- 2** **L. McCallum**, K. Wood, R. Benjamin, D. Krishnarao, and A. F. McLeod, “A three-dimensional, multiwavelength view and time-dependent analysis of the Milky Way’s local ionized gas,” vol. 541, no. 3, pp. 2324–2340, Aug. 2025.  DOI: 10.1093/mnras/staf1022. arXiv: 2506.17689 [astro-ph.GA].
- 3** **L. McCallum**, K. Wood, R. A. Benjamin, *et al.*, “The H α sky in three dimensions,” vol. 540, no. 1, pp. L21–L27, Jun. 2025.  DOI: 10.1093/mnrasl/slaf023. arXiv: 2503.14348 [astro-ph.GA].
- 4** **L. McCallum**, K. Wood, R. Benjamin, D. Krishnarao, and B. Vandenbroucke, “Time-dependent metal ionization and the persistence of collisionally excited emission lines in the diffuse ionized gas of star forming galaxies,” Nov. 2024.  DOI: 10.1093/mnras/stae2549. arXiv: 2411.07108 [astro-ph.GA].
- 5** **L. McCallum**, K. Wood, R. Benjamin, *et al.*, “The persistence of high altitude non-equilibrium diffuse ionized gas in simulations of star-forming galaxies,” vol. 530, no. 3, pp. 2548–2564, May 2024.  DOI: 10.1093/mnras/stae988. arXiv: 2404.05651 [astro-ph.GA].

Collaborative Publications

- 1** S. Daley-Yates, R. S. Beckmann, **L. McCallum**, M. M. Jardine, and A. C. Cameron, “WASP-12, shrouded in mystery or just cold gas?,” vol. 545, no. 3, *staf2201*, *staf2201*, Jan. 2026.  DOI: 10.1093/mnras/staf2201. arXiv: 2512.09593 [astro-ph.EP].

- 2 B. A. Gao, C. Zucker, T. K. Sridharan, *et al.*, “Origin of the IRAS Vela Shell: New Insights from 3D Dust Mapping,” vol. 987, no. 1, 73, p. 73, Jul. 2025.  DOI: 10.3847/1538-4357/add7d8. arXiv: 2504.12381 [astro-ph.GA].
- 3 P. Ogle, M. Petersen, T. Schaeffer, *et al.*, “SDSO1 is a Ghost Planetary Nebula Bow Shock in Front of M31,” *arXiv e-prints*, arXiv:2507.15834, arXiv:2507.15834, Jul. 2025.  DOI: 10.48550/arXiv.2507.15834. arXiv: 2507.15834 [astro-ph.GA].
- 4 J. Chastenet, I. De Looze, M. Relaño, *et al.*, “JWST MIRI and NIRCам observations of NGC 891 and its circumgalactic medium,” vol. 690, A348, A348, Oct. 2024.  DOI: 10.1051/0004-6361/202451033. arXiv: 2408.08026 [astro-ph.GA].

Selected Conference Talks

- 1 “Numerical insights into the nature of the diffuse ionized gas,” Jan. 16, 2025, 245th meeting of the American Astronomical Society, National Harbour, Maryland, USA.
- 2 “Numerical insights into the nature of the diffuse ionized gas,” Feb. 11, 2025, Structure and polarization in the interstellar medium: A Conference in Honor of Prof. John Dickey.
- 3 “Numerical simulations of non-equilibrium diffuse ionized gas,” Jun. 9–12, 2024, 244th meeting of the American Astronomical Society, Madison, Wisconsin, USA.
- 4 “Time dependent metal ionization in non-equilibrium diffuse ionized gas,” Sep. 17–19, 2024, UK Galactic Star Formation 2024, Armagh, Northern Ireland, UK.

Research Skills and Highlights

Programming	 C++, Fortran, Python, OpenMP
Skills/Expertise	 Radiative transfer, photoionization, radiation-hydrodynamics simulations of the ISM with focus on the diffuse ionized gas (DIG)
Highlights	 Discovery of the importance of non-equilibrium ionization state calculations in explaining the extent of the DIG (McCallum et al. 2024a).  Discovery of time-dependent effects producing layers of high ionization potential ions without secondary ionization sources (McCallum et al. 2024b).  First simulation of the H α sky from 3D dust maps (McCallum et al. 2025a).

Teaching and Supervision

Teaching

2020–2024	 Monte Carlo Radiation Transport Techniques , Lead Lab Demonstrator, Fortran
	 Computational Physics , Lab Demonstrator, Python
	 Computational Astrophysics , Lab Demonstrator, Fortran

Supervised Students

2026	 Clara Gallego González, M.Sc. , The role of local massive stars in ionizing the Galactic halo
2025	 Heather Thompson, MPhys , The Orion-Eridanus Superbubble
	 Katherine Blackledge, MPhys , The ζ -Ophiuchi H II region
2024	 George Hendry, MPhys , How much ionizing radiation escapes into the ISM due to supernova disruption of a molecular cloud?

Teaching and Supervision (continued)

- 📖 **Jennifer Rodger, MPhys**, Photoelectric heating by dust grains in simulations of the interstellar medium
- 📖 **Lowell Sharpe, BSc**, Holes and bubbles in the turbulent, supernova driven ISM

Industry Experience

2020 – 2021 📖 **Robotic Process Automation Developer** SYKES Digital Services

Awards and Achievements

2020 📖 **Medal**, Highest Achieving Masters Level Astrophysics Student, University of St Andrews.

Press Coverage

September 2025 📖 **ESA Press Release:** *"Fly Through Gaia's 3D Map of Stellar Nurseries"*.