Christopher Clark

Curriculum Vitæ (April 2024)

Galaxy Evolution | Interstellar Medium | Evolved Stars | Data Pipelines

Contact Information

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Science Highlights

Clark et al. (2023) & Clark et al. (2021) **Revealing dramatic evolution in the dust-to-gas ratio in the Local Group**
With custom *Herschel* reductions for Local Group galaxies, combined in Fourier space with *Planck*, IRAS, and COBE data, I show that the dust-to-gas ratio can vary by over a factor of 20 within a galaxy, demonstrating the dramatic importance of interstellar grain-growth.

Clark et al. (2019) **The first maps of the dust mass absorption coefficient in nearby galaxies**
Created maps of the notoriously poorly-constrained dust mass absorption coefficient, in M 74 and M 83; I find a very unexpected inverse correlation with density.

Clark et al. (2015) **Uncovering a previously-overlooked population of blue and dusty gas-rich galaxies**
Assembled the first blind *Herschel* galaxy sample at low-z, finding it dominated by a class of intermediately-evolved galaxies sharing unusual set of traits; HI-dominated but metal-rich, with very little attenuation despite abundant dust and plentiful star-formation.

Academic & Employment History

2023– | European Space Agency / AURA Astronomer | Space Telescope Science Institute

2018–2023 | Postdoctoral Fellow | Space Telescope Science Institute
Supervisor: Dr Julia Roman-Duval | (+1) 410 338 4351 | duval@stsci.edu

2014–2018 | Postdoctoral Research Associate | Cardiff University
Supervisor: Prof Jonathan Davies†

2011–2015 | PhD Astronomy | Cardiff University | ADS Link to Thesis
Thesis: *On the Origins of Cosmic Dust and the Evolution of Nearby Galaxies with Herschel*
Supervisor: Prof Haley Gomez | (+44) 29 2087 4058 | haley.gomez@astro.cf.ac.uk

2007–2011 | MPhys Astrophysics | Cardiff University
MPhys with honours, upper division, 2nd class

Teaching & Mentoring

Courses Taught

2016–2017 *Computational Skills for Problem Solving* | Lab lecturer, Cardiff University
2011–2014 *Observational Techniques in Astronomy* | Lab assistant, Cardiff University
2013 *Planetary Physics* | Teaching assistant, Cardiff University
2011-2012 *Mathematics for Physical Scientists* | Teaching assistant, Cardiff University

Students Mentored

2015–2016 **Jennifer Millard** | Master's project primary supervisor, Cardiff University
Stacking Far-Infrared Observations of High Galactic Latitude Stars

2015–2016 **Franziska Zaunig** | Master's project co-supervisor, Cardiff University
Mapping Star Formation in the Galactic Plane

2014–2015 **Rhian Miles** | Undergraduate project co-supervisor, Cardiff University
Evolved Stars in Herschel-ATLAS

2014–2015 **Lewyse Lee** | Undergraduate project co-supervisor, Cardiff University
Evolved Stars in Herschel-ATLAS

2014–2015 **Jennifer Millard** | Undergraduate project co-supervisor, Cardiff University
Evolved Stars in Herschel-ATLAS

Grants & Awards

2023 **$299 686** | NASA
JWST General Observer Grant (Program GO-03429)

2022 **$224 979** | NASA
HST Archival Research Grant | *Tackling the Mysteries of BADGRs' Bizarre ISM Using Extinction Mapping*

2021 **$113 800** | NASA
SOFIA Observer Grant (Program 09-0030)

2020 **$92 047** | NASA
HST General Observer Grant (Program GO-16222)

2019 **1000 TB hrs** | National Science Foundation
Computing time awarded by NSF's XSEDE supercomputing facility

2016 **£12 205** | Cardiff Data Innovation Research Institute
Seedcorn Fund | *Astronomical Oncology – Astronomical Image Analysis Techniques for Cancer Microscopy*

2013 **£400** | Cardiff University
Bessie Jones Prize for Most Outstanding Research Student

Observing Programmes

JWST **PI: 24 hours** | Co-I: 93 hours
- 2021 (Cycle 3) **PI** | *One-Stop Shopping: Pan-Metallicity PAH Benchmarking in M101*
- 2021 (Cycle 1) *The Resolved Properties of PAHs at Low Metallicity*
- 2021 (Cycle 1) *Structure Formation and Baryonic Cycling in the Edge-On Galaxy NGC 891*

HST **PI: 6 orbits** | Co-I: 577 orbits
- 2020 (Cycle 28) **PI** | *Extinction Mapping in Leo P: The Lowest-Metallicity ISM in the Local Universe*
- 2019 (Cycle 27) *Scylla: A Parallel Multi-Headed Attack on Dust Evolution in ULLYSES Galaxies*
- 2019 (Cycle 27) *METAL-Z: Metal Evolution, Transport, and Abundance at Low metallicity (Z)*

SOFIA **PI: 12 hours**
- 2021 (Cycle 9) **PI** | *An Unambiguous Measurement of Carbon Depletion, via 158μm [CII] Absorption*

IRAM 30 m **PI: 19 hours** | Co-I: 215 hours | Nights at telescope: 6
- 2018–present *IMEGIN: Interpreting the Millimetre Emission of Galaxies with IRAM and NIKA2*
- 2017 **PI** | *A Pilot Study for Nearby Galaxy Observations with NIKA2*

JCMT 'Architect': 780 hours | Co-I: 1000+ hours | Nights at telescope: 22
- 2017–present *NESS: the Nearby Evolved Stars Survey*
- 2016–present *JINGLE: JCMT dust and gas In Nearby Galaxies Legacy Exploration*

Example Scholarly Presentations

2024 **Talk** | *Evolution in the Dusty ISM Across the Local Group*
Milky Clouds Over Manhattan | Flatiron Institute

2022 **Invited Colloquium** | *Evolution in the Dusty ISM Across the Local Group*
University of Maryland | College Park

2022 **Talk** | *Evolution in the Dusty ISM Across the Local Group*
The Interstellar Institute 5 | Paris-Saclay

2022 **Press Panel & Image Release** | *The Stardust Ecosystem in our Galactic Neighbours*
240th American Astronomical Society Meeting | Pasadena

2022 **Invited Seminar** | *Evolution in the Dusty ISM Across the Local Group*
University of Exeter | Exeter

2022 **Colloquium** | *Evolution in the Dusty ISM Across the Local Group*
Max-Planck-Institut für Astronomie | Heidelberg

2022 **Seminar** | *Evolution in the Dusty ISM Across the Local Group*
Yale University Galaxy Lunch | New Haven
2021 **Seminar** | *Evolution in the Dusty ISM Across the Local Group*
UCLA | Los Angeles
2019 **Colloquium** | *The Quest For The Missing Flux*
East Asian Observatory | Hilo
2019 **Talk** | *The First Maps of κ_d in Nearby Galaxies*
Linking the Milky Way and Nearby Galaxies | Helsinki
2019 **Colloquium** | *The First Maps of κ_d in Nearby Galaxies*
University College London | London
2018 **Symposium Chair** | *The ISM as a Window onto Galaxy Evolution*
European Week of Astronomy and Space Science 2018 | Liverpool
2015 **Talk** | *A Blind Survey of the Local Dusty Universe with Herschel-ATLAS*
Gas, Dust, and Star-Formation in Galaxies from the Local to Far Universe | Crete

Technical Experience

Programming Languages	Python, IDL, R, FORTRAN90
Other Computing	Git, Bash, Slurm, LaTeX, XSEDE, TFLearn
Astronomical Tools	HIPE, TOpCaT, SWarp, Montage, DS9, Glue, SIAP/STAP, Kappa, STILTS, SPLAT
Data Experience	JWST, *Hubble*, *Swift*, GALEX, SDSS, SkyMapper, DSS, VISTA, UKIRT, 2MASS, COBE, WISE, *Spitzer*, IRAS, *Herschel*, JCMT, ALMA, *Planck*, Mopra, IRAM, VLA

Community Service

2024	Reviewer, ESA Archival Research Visitor Programme
2024	Reviewer, Space Astronomy Summer Program, STScI
2022–Present	Referee, Journals of the AAS
2021–Present	Member, Research Computing Forum, STScI
2019–Present	Referee, Astronomy & Astrophysics
2022–2023	Postdoc Member, Science Staff Executive Committee, STScI
2020–2023	Panel Support, JWST & *Hubble* time allocation committees, STScI/NASA
2020	White Paper Author, Astro2020 Decadal Survey, National Academy of Sciences
2020	Review Panellist, ROSES Grant Panel, NASA
2020	Co-organiser, JWST Proposal Planning Workshop, University of Maryland
2018–2020	Organiser, Galaxies Seminar Series & Journal Club, Johns Hopkins University & STScI
2017–2019	External reviewer, time allocation committee, James Clerk Maxwell Telescope
2018	Chair, special symposium *The ISM as a Window onto Galaxy Evolution*, EWASS
2015	Local organising committee, STFC PhD Summer School in Astronomy 2015

Selected Public Outreach

2024	Public talk, *Interstellar Cosmic Star Dust*, Baltimore Chapter of Astronomy on Tap
2019–Present	Co-organiser, Astronomy on Tap @ Baltimore
2019-2022	Coordinator of science education activities, *Soaring Eagles Learning Camp*, Baltimore
2022	Image Release & Press Panel, 240th American Astronomical Society Meeting
2017–2018	Volunteer, *Physics In A Field* @ The Royal Welsh Show, Institute of Physics
2017	Public talk, *Herschel: Revealing the Dusty Universe Near & Far*, Manchester Students' Union Astronomy Society
2016	Public talk, *The Origins of Stardust*, Monmouth Astronomical Research Society
2015	Public talk, *The Origins of Stardust*, Society for Popular Astronomy
2012–2014	Presenter, *BBC Stargazing Live*, National Museum of Wales
2012–2013	Presenter, *The Christmas Lectures*, Cardiff University
2012	Science writer, Cardiff University Students' Union newspaper *Gair Rhydd*

Publications

First Author

Clark, C. J. R., et al., 2023 *The Quest for the Missing Dust: II – Two Orders of Magnitude of Evolution in the Dust-to-Gas Ratio Resolved Within Local Group Galaxies*, ApJ 946 42 ADS Link |

Clark, C. J. R., et al., 2021, *The Quest for the Missing Dust: I – Restoring Large Scale Emission in Herschel Maps of Local Galaxies*, ApJ 921 35 ADS Link |

Clark, C. J. R., et al., 2019, *The First Maps of κ_d – the Dust Mass Absorption Coefficient – in Nearby Galaxies, with DustPedia*, MNRAS 489 5256 ADS Link |

Clark, C. J. R., et al., 2018, *DustPedia: Multiwavelength Photometry and Imagery of 875 Nearby Galaxies in 42 Ultraviolet–Microwave Bands*, A&A 609 A37 ADS Link |

Clark, C. J. R., et al., 2016, *An Empirical Determination of the Dust Mass Absorption Coefficient, κ_d, Using the Herschel Reference Survey*, MNRAS 459 1646 ADS Link |

Clark, C. J. R., et al., 2015, *Herschel-ATLAS: The Surprising Diversity of Dust-Selected Galaxies in the Local Submillimetre Universe*, MNRAS 452 397 ADS Link |

Clark, C. J. R., 2015, *On the Origins of Cosmic Dust and the Evolution of Nearby Galaxies with the Herschel Space Observatory*, PhD Thesis ADS Link |

Non-Peer-Reviewed

Clark, C. J. R., et al., 2019, *Astro2020: Unleashing the Potential of Dust Emission as a Window onto Galaxy Evolution*, Science white paper, Astro2020 Decadal Survey on Astronomy & Astrophysics ADS Link |

Clark, C. J. R., et al., 2014, *A Blind Survey of the Local Dusty Universe with Herschel-ATLAS*, in proceedings of 'The Life Cycle of Dust in the Universe', PoS LCDU2013 073 ADS Link |

Co-Author

Murray, C. E., et al., 2024, *Scylla I: A pure-parallel, multi-wavelength imaging survey of the ULLYSES fields in the Magellanic Clouds*, submitted for publication in ApJ ADS Link |

Wallstrom, S., et al., 2024, *The Nearby Evolved Stars Survey III: A heterodyne pipeline for the JCMT and initial results*, submitted for publication in MNRAS ADS Link |

Ejlali, G., et al., 2024, *Constraining dust physical properties and tracing molecular gas and star formation rate in galaxies with NIKA2 millimeter observations*, submitted for publication in A&A ADS Link |

Katsioli, S., et al., 2023, *The stratification of ISM properties in the edge-on galaxy NGC 891 revealed by NIKA2*, A&A 679 A7 ADS Link |

Casasola, V., et al., 2022, *The resolved scaling relations in DustPedia: Zooming in on the local Universe*, A&A 668 A130 ADS Link |

Roman-Duval, J., et al., 2022, *METAL: The Metal Evolution, Transport, and Abundance in the Large Magellanic Cloud Hubble Program. IV. Calibration of Dust Depletions versus Abundance Ratios in the Milky Way and Magellanic Clouds and Application to Damped Lyα Systems*, ApJ 935 105 ADS Link |

Bianchi, S., et al., 2022, *Dust emissivity in resolved spiral galaxies*, A&A 664 A187 ADS Link |

Roman-Duval, J., et al., 2022, *METAL: The Metal Evolution, Transport, and Abundance in the Large Magellanic Cloud Hubble program. IV. Calibration of Dust Depletions vs Abundance Ratios in the Milky Way and Magellanic Clouds and Application to Damped Lyman-alpha Systems*, arXiv:2206.03639 ADS Link |

Scicluna, P., et al., 2022, *The Nearby Evolved Stars Survey II: Constructing a volume-limited sample and first results from the James Clerk Maxwell Telescope*, MNRAS 512 1091 ADS Link |

Roman-Duval, J., et al., 2022, *METAL: The Metal Evolution, Transport, and Abundance in the Large Magellanic Cloud Hubble Program. III. Interstellar Depletions, Dust-to-Metal, and Dust-to-Gas Ratios versus Metallicity*, ApJ 928 90 ADS Link |

Smith, M. W. L., et al., 2021, *The HASHTAG Project: The First Submillimeter Images of the Andromeda Galaxy from the Ground*, ApJS 257 52 ADS Link |

Nersesian, A., et al., 2021, *Probing the spectral shape of dust emission with the DustPedia galaxy sample*, MNRAS 506 3986 ADS Link |

Roman-Duval, J., et al., 2021, *METAL: The Metal Evolution, Transport, and Abundance in the Large Magellanic Cloud Hubble Program. II. Variations of Interstellar Depletions and Dust-to-gas Ratio within the LMC*, ApJ 910 95 ADS Link |

Nersesian, A., et al., 2020, *High-resolution, 3D radiative transfer modelling. V. A detailed model of the M 51 interacting pair*, A&A 643 A90 ADS Link |

Baes, M., et al., 2020, *Nonparametric galaxy morphology from UV to submm wavelengths*, A&A 641 A119 ADS Link |

De Looze, I., et al., 2020, *JINGLE - IV. Dust, H I gas, and metal scaling laws in the local Universe*, MNRAS 496 3668 ADS Link |

Viaene, S., et al., 2020, *High-resolution, 3D radiative transfer modelling. IV. AGN-powered dust heating in NGC 1068*, A&A 638 A150 ADS Link |

Verstocken, S., et al., 2020, *High-resolution, 3D radiative transfer modelling. II. The early-type spiral galaxy M 81*, A&A 637 A24 ADS Link |

Nersesian, A., et al., 2020, *High-resolution, 3D radiative transfer modelling. III. The DustPedia barred galaxies*, A&A 637 A25 ADS Link |

Dobbels, W., et al., 2020, *Predicting the global far-infrared SED of galaxies via machine learning techniques*, A&A 634 A57 ADS Link |

Casasola, V., et al., 2020, *The ISM scaling relations in DustPedia late-type galaxies: A benchmark study for the Local Universe*, A&A 633 A100 ADS Link |

Gao, Y., et al., 2019, *Estimating the Molecular Gas Mass of Low-redshift Galaxies from a Combination of Mid-infrared Luminosity and Optical Properties*, ApJ 887 172 ADS Link |

Bianchi, S., et al., 2019, *Dust emissivity and absorption cross section in DustPedia late-type galaxies*, A&A 631 A102 ADS Link |

Lamperti, I., et al., 2019, *JINGLE - V. Dust properties of nearby galaxies derived from hierarchical Bayesian SED fitting*, MNRAS 489 4389 ADS Link |

Smith, M. W. L., et al., 2019, *JINGLE, a JCMT legacy survey of dust and gas for galaxy evolution studies: II. SCUBA-2 850 μm data reduction and dust flux density catalogues*, MNRAS 486 4166 ADS Link |

Davies, J. I., et al., 2019, *DustPedia: the relationships between stars, gas, and dust for galaxies residing in different environments*, A&A 626 A63 ADS Link |

Nersesian, A., et al., 2019, *Old and young stellar populations in DustPedia galaxies and their role in dust heating*, A&A 624 A80 ADS Link |

De Vis, P., et al., 2019, *A systematic metallicity study of DustPedia galaxies reveals evolution in the dust-to-metal ratios*, A&A 623 A5 ADS Link |

Mosenkov, A. V., et al., 2019, *Dust emission profiles of DustPedia galaxies*, A&A 622 A132 ADS Link |

Bianchi, S., et al., 2018, *Fraction of bolometric luminosity absorbed by dust in DustPedia galaxies*, A&A 620 A112 ADS Link |

Saintonge Ame, , et al., 2018, *JINGLE, a JCMT legacy survey of dust and gas for galaxy evolution studies - I. Survey overview and first results*, MNRAS 481 3497 ADS Link |

Eales, S. A., et al., 2018, *The causes of the red sequence, the blue cloud, the green valley, and the green mountain*, MNRAS 481 1183 ADS Link |

Rho, J., et al., 2018, *A dust twin of Cas A: cool dust and 21 μm silicate dust feature in the supernova remnant G54.1+0.3*, MNRAS 479 5101 ADS Link |

Dunne, L., et al., 2018, *The unusual ISM in blue and dusty gas-rich galaxies (BADGRS)*, MNRAS 479 1221 ADS Link |

Mosenkov, A. V., et al., 2018, *HERschel Observations of Edge-on Spirals (HEROES). IV. Dust energy balance problem*, A&A 616 A120 ADS Link |

Rigby, A. J., et al., 2018, *A NIKA view of two star-forming infrared dark clouds: Dust emissivity variations and mass concentration*, A&A 615 A18 ADS Link |

Beeston, R. A., et al., 2018, *GAMA/H-ATLAS: the local dust mass function and cosmic density as a function of galaxy type - a benchmark for models of galaxy evolution*, MNRAS 479 1077 ADS Link |

De Vis, P., et al., 2017, *Using dust, gas and stellar mass-selected samples to probe dust sources and sinks in low-metallicity galaxies*, MNRAS 471 1743 ADS Link |

Casasola, V., et al., 2017, *Radial distribution of dust, stars, gas, and star-formation rate in DustPedia face-on galaxies*, A&A 605 A18 ADS Link |

Davies, J. I., et al., 2017, *DustPedia: A Definitive Study of Cosmic Dust in the Local Universe*, PASP 129 044102 ADS Link |

De Vis, P., et al., 2017, *Herschel -ATLAS: revealing dust build-up and decline across gas, dust and stellar mass selected samples - I. Scaling relations*, MNRAS 464 4680 ADS Link |

Bianchi, S., et al., 2017, *The Herschel Virgo Cluster Survey. XX. Dust and gas in the foreground Galactic cirrus*, A&A 597 A130 ADS Link |

Eales, S., et al., 2015, *H-ATLAS/GAMA: quantifying the morphological evolution of the galaxy population using cosmic calorimetry*, MNRAS 452 3489 ADS Link |

Rowlands, K., et al., 2014, *Herschel-ATLAS: properties of dusty massive galaxies at low and high redshifts*, MNRAS 441 1017 ADS Link |

Pearson, E. A., et al., 2013, *H-ATLAS: estimating redshifts of Herschel sources from sub-mm fluxes*, MNRAS 435 2753 ADS Link |

Bourne, N., et al., 2013, *Herschel-ATLAS: correlations between dust and gas in local submm-selected galaxies*, MNRAS 436 479 ADS Link |

Agius, N. K., et al., 2013, *GAMA/H-ATLAS: linking the properties of submm detected and undetected early-type galaxies - I. $z \leq 0.06$ sample*, MNRAS 431 1929 ADS Link |

Lopez-Caniego, M., et al., 2013, *Mining the Herschel-Astrophysical Terahertz Large Area Survey: submillimetre-selected blazars in equatorial fields*, MNRAS 430 1566 ADS Link |

Gomez, H. L., et al., 2012, *A Cool Dust Factory in the Crab Nebula: A Herschel Study of the Filaments*, ApJ 760 96 ADS Link |

Gomez, H. L., et al., 2012, *Dust in historical Galactic Type Ia supernova remnants with Herschel*, MNRAS 420 3557 ADS Link |