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Research Projects

ALMA studies of high-redshift galaxies: 2016–present

- I have been awarded ALMA time on multiple projects, both as principal- and co-investigator, and have reduced and analysed the data on two projects, with results currently being prepared for publication.

JCMT Legacy Survey and East Asian Observatory: 2015–present

- I am involved in several large surveys on the James Clerk Maxwell Telescope, including the SCUBA-2 Cosmology Legacy Survey (CLS) and its successors in the East Asian Observatory (EAO)
- I am currently working on a number of projects that exploit the synergy between these surveys and some of the best multi-wavelength data sets available for high-redshift astronomy
- In addition to leading a major paper on the star-formation history of the Universe (described below), I have contributed to several other papers through my collaborations with team members worldwide
- I maintain collaborations within the JINGLE consortium, an EAO survey of molecular gas and dust in the low-redshift Universe, and the S2COSMOS and STUDIES consortia, which focus on star formation in the high redshift Universe. Through these collaborations I plan to apply techniques developed in my previous research to new, extensive data sets. For example, my de-confusion work with AstroDEEP will be valuable in the S2COSMOS and STUDIES surveys, while my research on CO in local galaxies in H-ATLAS is relevant to the JINGLE survey (see further details below)

AstroDEEP/SCUBA-2 Cosmology Legacy Survey: 2013–2016

- I was a very active member of the AstroDEEP consortium, which was a project that aimed to consolidate multi-wavelength data sets from many instruments with widely varying angular resolutions. I develop, test and apply computational techniques for tackling faint-source confusion in sub-millimetre imaging in order to measure emission from galaxies that cannot be probed with traditional methods.
- By applying these techniques to data from the SCUBA-2 CLS, I studied the dust emission of distant galaxy samples selected in optical surveys, in order to understand how dust obscuration affects measurements of star-formation rates and the integrated star-formation history of the Universe.
- I published a paper which used this analysis to measure obscured star-formation rates in distant galaxies and to recover the total cosmic star formation density up to redshift 6 in stellar-mass-selected galaxies.

Herschel-ATLAS core team & GAMA matching team: 2012–2016

- As a central member of the H-ATLAS core data-processing team, I produced catalogues of multi-wavelength counterparts for the Phase 1 internal and public data releases, collating data from many different surveys. I wrote the catalogue description paper for the first full public data release of the H-ATLAS survey.
- As a member of the H-ATLAS/GAMA matching team, I worked closely with the management of both consortia, by consulting on optimal photometry techniques for low-redshift, partially-resolved and blended sub-millimetre galaxies. I produced a matched catalogue of Herschel photometry for GAMA galaxies, which is incorporated in the GAMA Panchromatic Data Release.

Herschel-ATLAS science projects: 2010–2014

- I completed an original study of the statistical impact of gravitational lensing on identification rates of H-ATLAS sources, and on astrometric offsets to optical counterparts.
- I led a joint H-ATLAS/GAMA paper to carry out a complete census of cold dust in optically-selected galaxies. This remains the largest unbiased survey of sub-mm emission from ordinary, low-redshift galaxies yet accomplished.
- I prepared an observing proposal with my supervisor and collaborators to map CO emission lines in local dusty galaxies selected from Herschel-ATLAS, using 30 hours on heterodyne instruments at JCMT. I gained experience of millimetre spectral-line observing and data reduction, and I published the results in a paper analysing relationships between dust mass, star-formation rate, and molecular and atomic gas.

Infrared-to-radio study of high-redshift galaxies: 2008–2010

- I conducted a novel statistical study of the correlation between far-infrared and radio tracers of star formation, and of infrared spectral energy distributions of high-redshift galaxies, combining data from Spitzer, the VLA and GMRT.

Other collaborations: Ongoing

- I maintain numerous collaborations with researchers in other institutes through my involvement in several consortia (H-ATLAS, GAMA, AstroDEEP, S2-CLS, S2-COSMOS, STUDIES, JINGLE, VANDELS) and as a result of networking at conferences.
- This involves providing assistance or support with survey data that I have produced or have expertise with; assisting with the preparation of papers and proposals led by collaborators; providing my codes and algorithms for others to use and develop; and using my own tools to conduct analyses which contribute to their research.

Public Engagement

Informal activities:

I interact with the public by contributing to forum discussions on websites such as *ResearchGate* and *Thinkable*, as well as by email when I am occasionally contacted directly with questions regarding current paradigms in astronomy. I have interacted with journalists as a result of my involvement of a press release for the H-ATLAS data release in 2016.

Royal Observatory open days: Sept 2014, Sept 2016

At the ROE open days I presented several talks to the public about current research in galaxy evolution, I also spoke informally with members of the public, answered questions, and I assisted with interactive exhibits on *Zooniverse* projects and astronomy arts and crafts.

Edinburgh International Science Festival: April 2014

I worked on the Royal Observatory's stall at the science festival, which involved interacting with the public about the work on astronomy research and technology developed at the Observatory, demonstrating interactive exhibits and answering questions.

MOOC Teaching Assistant: Spring 2014; Spring 2015

While a postdoc in Edinburgh I contributed to the "Massive Open Online Course" (MOOC) *AstroTech*. This was an open-access learning initiative set up by the University of Edinburgh to teach the technology behind astronomical discoveries. As a teaching assistant I wrote quizzes and helped students with questions on online forums.

Mayfest open day: May 2013

I ran an astronomy Q&A stall and assisted with operating a mobile planetarium at a public outreach event organised by the University of Nottingham.

Exploring Physics workshop: March 2013

I was a demonstrator in a workshop for around 200 16-18 year olds. I ran an astronomy computing practical session demonstrating techniques used in astronomy.

Teaching & Supervision

Senior Honours project supervision: Jan – Mar 2017
I supervised a 4th year undergraduate student over a 10-week project, which involved project management, regular supervision meetings, face-to-face support and assessment and marking of the submission.

Summer project supervision: 2014, 2015, 2016, 2017
Each year I organise and supervise undergraduate vacation projects, which involves planning and advertising the projects, selecting candidates, applying for funding with a student, and supervising them for 8 weeks full-time. In 2015 I co-supervised the student with a colleague, which required collaboration in developing the project, interviewing candidates, and supervising the student.

Lab Demonstrator: University of Nottingham 2009–2010
Working in the second-year undergraduate laboratory, I supported students in experimental physics by demonstrating experimental techniques, marking and giving written and oral feedback on lab books.

Coursework marking: University of Nottingham 2008–2009
I graded first-year undergraduate coursework and provided written feedback to the students.

Organisational & other roles

Edinburgh Extragalactic Reading Group: Jan 2014 – present
I organise a weekly discussion group, which involves planning and organising the discussions, hosting the meetings on alternate weeks, giving frequent informal presentations, and planning reviews of broad subject areas for the other members of the group.

Summer projects coordinator: Jan 2017 – present
I manage the programme of vacation projects at the Institute for Astronomy, a role which involves organisation and administration of supervisors and students, beginning in January with the collection and advertisement of projects from potential supervisors.

DEX meeting SOC/LOC: Oct 2016 – Jan 2017
I took a central part in organising the 2017 Durham-Edinburgh Extragalactic Meeting (DEX), including managing the website and registrations, and helping design the science program.

Refereeing:
I have refereed several papers for the Astrophysical Journal, Astronomy & Astrophysics, the Monthly Notices of the Royal Astronomical Society, and observing proposals for the JCMT and the WHT.

Postgraduate Committee: University of Nottingham 2009–2012
I was active in the School Postgraduate Committee for three years, representing postgraduate students in the Astronomy and Particle Theory groups.

Employment History

Postdoc. Research Assistant: Royal Observatory Edinburgh Oct 2013 – present
Projects with AstroDEEP, SCUBA-2 and Herschel collaborations, as well as independent, self-directed research – see details above.

Postdoc. Research Fellow: University of Nottingham Dec 2012 – Sept 2013
Projects within the Herschel-ATLAS survey – see details above.

Teaching Assistant: University of Nottingham Sept – Nov 2012
I led problems workshops for Physics undergraduates covering the second-year core syllabus, and I managed a team of postgraduate demonstrators and markers, administering the coursework marking for around 180 students. This part-time role comprised approximately 20 hours/week.

Graduate Researcher: TRL Ltd (The Transport Research Laboratory) 2006–2008
I was employed in a professional position for almost two years directly after graduating from my first degree. This was a strongly research-oriented role in transportation and network performance, which involved analysing large amounts of traffic data, modelling networks and designing software to optimise efficiency. I left this job in 2008 to pursue a career in academic research.

Education PhD Astronomy July 2013
 “No Smoke Without Fire: Cosmic Dust Emission as a Tracer of Star Formation in Galaxies”
 University of Nottingham

MPhys (Hons) Physics with Astrophysics July 2006
 First Class Honours
 University of Leicester

Refereed Publications I have co-authored a total of 71 refereed journal papers since 2009, including six as first author, with a total of 1175 citations and an *h*-index of 18 (data from SAO/NASA ADS as of March 2017). Below is a list of my first-author publications:

- *Evolution of cosmic star formation in the SCUBA-2 Cosmology Legacy Survey*. N. Bourne, J.S. Dunlop, E. Merlin, S. Parsa, C. Schreiber, *et al.* (2017) MNRAS.
- *The Herschel-ATLAS Data Release 1 - II. Multi-wavelength counterparts to submillimetre sources*. N. Bourne, L. Dunne, S.J. Maddox, S. Dye, C. Furlanetto, C. Hoyos, *et al.* (2016) MNRAS 462 (2), 1714-1734
- *Colour matters: the effects of lensing on the positional offsets between optical and submillimetre galaxies in Herschel-ATLAS*. N. Bourne, S.J. Maddox, L. Dunne, S. Dye, S. Eales, C. Hoyos, *et al.* (2014) MNRAS 444 (2), 1884-1892
- *Herschel-ATLAS: correlations between dust and gas in local submm-selected galaxies*. N. Bourne, L. Dunne, G.J. Bendo, M.W.L. Smith, C.J.R. Clark, D.J.B. Smith, *et al.* (2013) MNRAS 436 (1), 479-502
- *Herschel-ATLAS/GAMA: a census of dust in optically selected galaxies from stacking at submillimetre wavelengths*. N. Bourne, S.J. Maddox, L. Dunne, R. Auld, M. Baes, I.K. Baldry, D.G. Bonfield, *et al.* (2012) MNRAS 421 (4), 3027-3059
- *Evolution of the far-infrared-radio correlation and infrared spectral energy distributions of massive galaxies over $z=0-2$* . N. Bourne, L. Dunne, R.J. Ivison, S.J. Maddox, M. Dickinson, D.T. Frayer (2011) MNRAS 410 (2), 1155-1173

Oral Presentations I have presented my research in the following conferences and meetings:

- Invited talk at “*The Growth of Galaxies in the Early Universe III*”, Sesto, Italy, January 2017
- Cormack Astronomy Meeting, Royal Society of Edinburgh, November 2016
- Invited talk at “*Physical Characteristics of Normal Galaxies at $z>2$* ” Lorentz Center workshop, Leiden, The Netherlands, October 2016
- “*Signals from the Deep Past*”, Valletta, Malta, July 2016
- Invited talk at “*The Cosmic Far-Infrared Landscape*”, Lisbon, Portugal, May 2016
- “*The early growth of galaxies: The HST, Spitzer and Herschel joint legacy*”, Sesto, Italy, January 2016
- DEX (Durham-Edinburgh Extragalactic Meeting), Durham, January 2016
- AstroDEEP consortium meeting, Edinburgh, November 2015
- UK *National Astronomy Meeting*, Llandudno, July 2015
- “*Back at the Edge of the Universe*”, Sintra, Portugal, March 2015
- “*Spectral Energy Distribution of High Redshift Galaxies*”, Sesto, Italy, January 2015
- AstroDEEP consortium meeting, Rome, September 2014
- AstroDEEP consortium meeting, CEA Saclay, Paris, January 2014
- Herschel-ATLAS consortium meeting, Cardiff, July 2012
- “*Infrared Emission, ISM and Star Formation*”, Heidelberg, Germany, February 2010

I have also given regular departmental talks and seminars on my work:

- Undergraduate Research Seminar, University of St Andrews, November 2016
- Institute “Stobie” talk, ROE, February 2016
- Public talks, ROE Open Day, September 2014
- Institute “Stobie” talk, ROE, December 2013
- Seminar, ICRAR, University of Western Australia, June 2013
- Seminar, University of Hertfordshire, January 2013
- Coffee talk, ROE, December 2012
- Seminar, University of St Andrews, December 2012
- Seminar, Durham University, November 2012
- Lunch talk, University of Nottingham, December 2011
- Lunch talk, University of Nottingham, March 2011
- Lunch talk, University of Nottingham, February 2010
- Lunch talk, University of Nottingham, June 2009

Poster Presentations

I have presented my research in posters at the following conferences:

- UK *National Astronomy Meeting*, Llandudno, July 2015
- “*The Formation and Growth of Galaxies in the Young Universe*”, Obergurgl, Austria, April 2014
- UK *National Astronomy Meeting*, St Andrews, July 2013
- UK *National Astronomy Meeting*, Manchester, March 2012
- “*Unveiling the Far-IR and Sub-mm Extragalactic Universe: Herschel, ALMA, CCAT, SPICA, and Beyond*”, Irvine, CA, May 2011
- RAS Specialist Discussion: “*The Early Impact of Herschel*”, London, January 2011

Awards and Grants

Telescope proposals:	2011 – present
I have considerable experience of applying for telescope time, including leading successful proposals for ALMA and JCMT, and contributing to proposals on many facilities including ALMA, VLA, JCMT, VLT.	
University of Nottingham Kilby Scholarship	March 2012
Royal Astronomical Society Grant	March 2011
University of Nottingham Kilby Scholarship	March 2011
Royal Astronomical Society Grant	March 2010
Institute of Physics C.R. Barber Trust Grant	January 2010

Observing Experience

Aug 2016: 8 partial nights on VLT for VANDELS: optical spectroscopy
Mar 2016: 6 nights on IRAM 30m: millimetre spectroscopy
Dec 2013: 7 nights on JCMT using SCUBA-2 and heterodyne instruments for Legacy Survey: submillimetre imaging and spectroscopy
Apr 2011: 5 nights on JCMT for my own scheduled project: submillimetre spectroscopy
Dec 2009: 6 nights on UKIRT for UKIDSS: infrared imaging

Computer Skills

Programming: Python, IDL, Java, Visual Basic, C, Fortran
Scripting: Bash, Stilts, \LaTeX , HTML, Regex, SQL
Software: Topcat, Starlink (Kappa, Gaia, etc), DS9, SPSS, MS Excel (advanced), MS Access

Languages

English	Mother tongue
French	Beginner/intermediate (GCSE/high school equivalent)
German	Beginner/intermediate (GCSE high school qualification)
Spanish	Beginner (evening course)