Dr. Rachael E. **Ainsworth**

Research Associate in Long Baseline Radio Interferometry | JBCA-ICE Open Science Champion

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Profile

Astrophysics PhD with 8+ years of experience solving complex data challenges in Astronomy. First to successfully model properties of young stars at metre wavelengths using terabytes of data from next-generation radio telescopes. Skilled in data collection, cleaning, analysis, visualisation, statistics and communicating insights to both technical and non-technical audiences. Certified FOSTER Open Science Trainer, passionate about promoting openness, inclusion and wellbeing in science and technology. Organiser of the women in data meetup group HER+Data MCR, member of the first cohort of Tech Future Female Leaders, and frequent attendee at other local data science and tech events (Open Data MCR, PyData MCR, Solidarity MCR, MancML, JBCA Machine Learning Club, She Says MCR, Tech Events NW).

Experience

Jodrell Bank Centre for Astrophysics (JBCA), University of Manchester — *Manchester, UK*

Research Associate — *June 2017 - present*

- Leading a project to reduce and analyse *e*MERLIN data on the Cloud through integration of the CASA pipeline with Project Jupyter.
- Member of the H2020 RadioNET RINGS project working to develop an algorithm for calibrating dispersive delay corrections in long baseline interferometry, for low frequency radio telescopes such as LOFAR.
- Interferometry Centre for Excellence (ICE) Open Science Champion to advocate, train colleagues, give presentations and organise events relating to Open Science in Astronomy.
- Disseminating research insights through invited seminars, talks at international conferences, interviews and public outreach.

Dublin Institute for Advanced Studies (DIAS) — *Dublin, Ireland*

Postdoctoral Research Fellow — *October 2014 - October 2016*

- Impact: Our team was the first to successfully detect and model the properties of a young star with the International Low-Frequency Array (LOFAR) Telescope using the facilities at the Irish Centre for High End Computing (ICHEC).
- I pioneered the collection, cleaning, analysis/statistical modelling and visualisation of radio data for young stars at previously unexplored wavelengths.
- Part of a worldwide collaboration to develop novel processing and analytical techniques for terabytes of data from LOFAR.
- Member of the Communications Working Group to re-define the public communication strategy of DIAS through restructure of the website and social media developments.

Ph.D. Student; Supervisors: Prof. Tom Ray (DIAS), Prof.. Anna Scaife (JBCA) — *November 2010 - September 2014*

- Led three projects performing systematic modelling of multi-wavelength, multi-scale datasets of protostellar jets from AMI, *e*MERLIN & GMRT to disentangle competing radiation processes and investigate the jet launching mechanism.
- Involved in the commissioning of *e*MERLIN, which included the reduction and analysis of legacy data (Thermal Jets, PEBBLeS) intermediate to the original MERLIN and the fully upgraded *e*MERLIN.
- Published the first investigations of YSOs at metre wavelengths and pioneered to characterise this very long wavelength emission through follow-up observing campaigns on the GMRT and LOFAR.

University of Tennessee (UT) — *Knoxville, TN, USA*

Summer Research Fellow; Supervisor: Prof. Michael Guidry (UT) — *May 2009 - August 2009*

- Studied the explosion mechanism of Type Ia Supernovae through computational simulations using the FLASH code on the supercomputing facilities at Oak Ridge National Laboratory.

Undergraduate Student Researcher; Supervisor: Prof. Michael Guidry (UT) — *June 2008 - August 2008*

- Studied the interactions between colliding galaxies using computational simulations developed by the UT Astrophysics Group.

NASA Jet Propulsion Laboratory / California Institute of Technology (JPL/Caltech) — *Pasadena, CA, USA*

Undergraduate Student Research Program Intern; Supervisor: Dr. Raghvendra Sahai (JPL/Caltech) — *September 2008 - December 2008*

- Developed and applied a procedure for the reduction and calibration of near-infrared echelle spectroscopic data for (a) a sample of pre-planetary nebulae to look for the signatures of high-velocity outflows that shape the resulting planetary nebula, and (b) stellar interlopers: young stars with winds speeding through and interacting with dense interstellar clouds.

Education

University of Dublin, Trinity College
Dublin, Ireland

Ph.D. in Astrophysics — *2017*

- Thesis: *Morphology and Time Evolution of Thermal Jets Associated with Low Mass Young Stars*
- Submitted: August 2014 – *Viva voce*: September 2016 – Awarded: April 2017

University of Tennessee
Knoxville, TN, USA

B.Sc. in Physics, Minor in Studio Art (Photography) — *2010*

- Overall GPA: 3.61/4.0, Honours: *cum laude*
- Activities, Awards and Societies: 2010 UT Chancellor's Honours Award for Extraordinary Professional Promise, Phi Eta Sigma Freshman Honours Fraternity, The Society of Physics Students, Central Program Council, Film Committee, The Campus Literary and Art Magazine: The Phoenix

Volunteer Work

HER+Data MCR
Manchester, UK

Organiser — *July 2017 - present*

- Established the Manchester chapter of HER+Data, a meetup group to bring together women who work with and love data - to support one another, inspire each other, share experiences and talk data (`https://meetup.com/HER-Data-MCR`).
- Organising cross-city events and meetups: event planning and promotion, coordinating with sponsors, venues and speakers, and working with and managing a team of co-organisers.
- Identifying new partners to work with, creating opportunities for collaboration and support, and connecting tech companies, industry stakeholders and academic institutions with our 500 members to cultivate a community that actively supports women in STEM.
- Responsible for content creation and management of social media (@herplusdatamcr).

Mozilla Foundation
Manchester, UK

Mentor and Cohort Host — *February - May 2018*

- Invited to act as Mentor and Cohort A Host during Round 5 of Mozilla's Open Leadership Training.
- Reviewed and rated Round 5 Project Lead applications.
- Met with my assigned Project Lead every two weeks to provide support and guidance as they went through the training and learned how to work openly on their projects.
- Hosted Full Cohort meetings (60 - 90min, 35 participants) every two weeks, which involved emceeing/moderating each of the calls for Cohort A, and providing support/setting the tone for a cohort to bond together as a group during the program.
- Gained valuable coaching skills and connections across the Mozilla and open source community.
- Hosted a local site and participated in the Global Sprint (May 10-11, 2018, `http://bit.ly/MozSprintMCR`).

Open Project Lead — *September - December 2017*

- Selected for Round 4 of Mozilla's Open Leadership program where I received training and developed skills in open leadership, project management, building communities, open communications and running awesome events. ("Open" refers to working collaboratively, making outputs freely accessible for others to use in order to maximise impact, and promoting inclusion, equity and diversity.)
- Founded *Resources for Open Science in Astronomy* (`https://github.com/rainsworth/ROSA`), an ongoing program to enable a more collaborative and open culture in academia (`https://bit.ly/ROSAinterview`).
- Designed and hosted a 1 hour session at Mozilla Festival 2017 to engage 20 participants in a discussion on how to best advocate Open Science to researchers (`https://bit.ly/MozFestRecap`).
- Strong communicator to a range of stakeholders and audiences (researchers, advocates, policy makers, general public) through interviews, blog posts, social media, podcasts, online project demonstrations and fostering our cohort's Twitter community: #RebelFoxes.

Skills

Programming: Python (intermediate); R (beginner); Fortran (beginner); Bash (intermediate); C-shell (intermediate).
Operating Systems: macOS, Linux, Microsoft Windows.
Software: Radio Astronomy software (AIPS, CASA, eMERLIN CASA Pipeline); Containerisation (Docker, Singularity); Version Control (Git); GitHub; Project Jupyter; Markdown; Microsoft Office; LaTex; Adobe Acrobat, Illustrator and Photoshop.
Communication: Presented research insights at 9 international conferences (50+ attendees), 7 invited seminars, and to non-technical audiences through public outreach (interviews, podcasts, meetups); Published 5 first-author articles in high-impact, internationally peer-reviewed journals (with 57 citations to date; co-authored 5 others); Worked independently, on small teams, and within large international collaborations.
Leadership: Principal Investigator for 7 observing programmes totalling 116 hours of time on multi-million pound facilities; Mentored 10 student projects (ages 15-50); Completed Mozilla Open Leadership Training and the Tech Future Female Leaders programme.

Publications

Refereed

10. A. Feeney-Johansson, S. J. D. Purser, T. P. Ray, J. Eislöffel, M. Höft, A. Drabent and **R. E. Ainsworth**, "Measuring the magnetic field in the jet of a low-mass young stellar object", *Astrophysical Journal*, 2018, submitted.
9. S. J. D. Purser, **R. E. Ainsworth**, T. P. Ray, D. A. Green, A. M. Taylor and A. M. M. Scaife, "Constraining the nature of DG Tau A's thermal and non-thermal radio emission", *Monthly Notices of the Royal Astronomical Society*, 481, 5532–5542, 2018.
8. C. P. Coughlan, **R. E. Ainsworth**, J. Eislöffel, M. Höft, A. Drabent, A. M. M. Scaife, T. P. Ray, et al., "A LOFAR Detection of the Low Mass Young Star T Tau at 149 MHz", *Astrophysical Journal*, 834, 206–213, 2017.
7. **R. E. Ainsworth**, C. P. Coughlan, D. A. Green, A. M. M. Scaife and T. P. Ray, "A GMRT survey of regions towards the Taurus molecular cloud at 323 and 608 MHz", *Monthly Notices of the Royal Astronomical Society*, 462, 2904–2917, 2016.
6. **R. E. Ainsworth**, A. M. M. Scaife, D. A. Green, C. P. Coughlan and T. P. Ray, "GMRT detections of low mass young stars at 323 and 608 MHz", *Monthly Notices of the Royal Astronomical Society*, 459, 1248–1258, 2016.
5. **R. E. Ainsworth**, A. M. M. Scaife, T. P. Ray, A. M. Taylor, D. A. Green and J. V. Buckle, "Tentative evidence for relativistic electrons generated by the jet of the young Sun-like star DG Tau," *Astrophysical Journal*, 792, L18–L22, 2014.
4. **R. E. Ainsworth**, T. P. Ray, A. M. M. Scaife, J. S. Greaves and R. J. Beswick, "Sub–arcsecond high sensitivity measurements of the DG Tau jet with e–MERLIN," *Monthly Notices of the Royal Astronomical Society*, 436, L64–L68, 2013.
3. **R. E. Ainsworth**, A. M. M. Scaife, T. P. Ray, et al., "AMI radio continuum observations of young stellar objects with known outflows," *Monthly Notices of the Royal Astronomical Society*, 423, 1089–1108, 2012.
2. A. M. M. Scaife, J. Hatchell, **R. E. Ainsworth**, et al., "AMI–LA radio continuum observations of Spitzer c2d small clouds and cores: Serpens region," *Monthly Notices of the Royal Astronomical Society*, 420, 1019–1033, 2012.
1. A. M. M. Scaife, J. V. Buckle, **R. E. Ainsworth**, et al., "Radio continuum observations of Class I protostellar disks in Taurus: constraining the greybody tail at centimetre wavelengths," *Monthly Notices of the Royal Astronomical Society*, 420, 3334–3343, 2012.

Unrefereed

2. **R. E. Ainsworth**, A. M. M. Scaife, T. P. Ray, D. A. Green and J. V. Buckle, "The Lowest Frequency Observations of YSOs with the GMRT", Protostars and Planets VI, Heidelberg, July 15-20, 2013. Poster #1H019.
1. R. Sahai, M. Claussen, M. Morris and **R. E. Ainsworth**, "Ballistic Stellar Interlopers producing Bow-Shocks in the Interstellar Medium", American Astronomical Society Meeting #213, *Bulletin of the American Astronomical Society*, 41, 465, 2009.

Press Releases

1. R. Sahai, M. Morris, M. Claussen and **R. E. Ainsworth**, "Hubble Finds Stars That 'Go Ballistic' ", NASA Jet Propulsion Laboratory, 7 January 2009. `https://www.jpl.nasa.gov/news/news.php?release=2009-002`

Observing & High-Performance Computing Programmes

Co-I: VLA Cycle 2018A (PI: H. Liu, 18A-243, 18 hours), Properties of the hot inner disks in accretion outburst young stellar objects at X, Ka and Ku-band, A-config to expand the sample of radio continuum spectra of such hot inner disks.
Co-I: *e*MERLIN (PI: J. Greaves, CY5214, 330 hours), Planet-Earth Building Blocks - a Legacy e–MERLIN Survey.
Co-I: *e*MERLIN (PI: J. Greaves, CY4211, 12 hours), What planets for DG Tau?: Observations of DG Tau at 21–24 GHz to investigate dust concentration in the circumstellar disk.
PI: VLA Cycle 2016A (16A-051, 6.5 hours), Confirming Cosmic Ray Production in a Protostellar Jet: Observations of DG Tau at C and X-band, C-config to measure the bow shock proper motion.
PI: LOFAR Cycle 5 (LC5_004, 8 hours), VLBI Investigations of a Protostellar Jet with LOFAR: Low-frequency, high-resolution observations of T Tau.
Co-I: ICHEC 2016 (PI: C. Coughlan, dsast016b, class: B, 600000 CPU hours on Fionn), New Discoveries at Low Frequencies - Searching for Young Stellar Objects and Exoplanets with LOFAR, Irish Centre for High-Performance Computing.
PI: VLA Cycle 2015A (15A-143, 2 hours), Cosmic Rays Generated in the Jet of a Young Sun-like Star?: Observations of DG Tau at S-band, A-config to confirm synchrotron nature of bow shock.
PI: ICHEC 2015 (dsast014c, class: C, 6000 CPU hours on Fionn), Calibrating LOFAR Observations of Young Stellar Objects, Irish Centre for High-Performance Computing.
PI: VLA Cycle 2014A (14A-439, 14 hours), Polarisation Measurements of Protostellar Jets: Observations of 3 YSOs at L and S-band, A-config to detect linearly polarised emission.
PI: VLA Cycle 2014A (14A-457, 6 hours), Radio Continuum Observations of FU Orionis Stars: Observations of 4 FUors at X and Ku-band, A-config to detect individual ejection episodes.
Co-I: LOFAR Cycle 1 (PI: J. Eislöffel, LC1_001, 17 hours), Low Frequency Observations of Jets from Young Stars in Taurus: To follow up the low frequency GMRT observations at 150 MHz, confirm the emission mechanism at low frequency, and study outflow structure.
PI: GMRT Cycle 25 (25_072, 22 hours), Low Frequency Radio Emission from the Youngest Low Mass Protostars: To extend the GMRT pathfinder program to Class 0 objects at 325 and 610 MHz.
PI: GMRT Cycle 25 (25_066, 58 hours), Blind Survey of the NGC 1333 Star Forming Region at Low Frequencies: To perform a radio census of Class 0–III YSOs at 610 MHz.

Presentations

4IR CDT Annual Meeting, Invited talk, University of Manchester, Manchester, UK 2018
Innovatively Open, Invited talk, University of Nottingham, Nottingham, UK 2018
Data Science for Experimental Design, Invited talk, Alan Turing Institute, London, UK 2018
JBCA Internal Seminar, University of Manchester, Manchester, UK 2018
Cosmic Rays: The salt of the star formation recipe, Contributed talk, Florence, Italy 2018
EWASS 2018, Contributed talk, Liverpool, UK 2018
High Resolution Surveying with International LOFAR, Invited talk, Lorentz Centre, Leiden, Netherlands 2018
Invited Seminar, National University of Ireland Maynooth, Ireland 2018
Invited Seminar, Imperial College London, UK 2017
Radio Stars from kHz to THz Workshop, Contributed talk, MIT Haystack Observatory, MA, USA 2017
Open Research Forum, University of Manchester, Manchester, UK 2017
Science Tea talk, Jodrell Bank Observatory, Cheshire, UK 2016
The Accretion/Outflow Connection in YSOs Workshop, Contributed talk, ESA/ESTEC, Noordwijk, Netherlands 2015
Invited Seminar, Thüringer Landessternwarte, Tautenburg, Germany 2015
Lunch talk, Leiden Observatory, Leiden, Netherlands 2014
*e***MERLIN Science Meeting, Contributed talk**, University of Manchester, Manchester, UK 2014
Postgraduate Seminar Series, Seminar, University of Dublin, Trinity College, Dublin, Ireland 2014
The Metrewavelength Sky Conference, Contributed talk, NCRA–TIFR, Pune, India 2013
Protostars and Planets VI, Poster, Heidelberg, Germany 2013
Radio Stars and Their Lives in the Galaxy Workshop, Contributed talk, MIT Haystack Observatory, MA, USA 2012
Astronomical Science Group of Ireland Spring Meeting, Contributed talk, Birr, Ireland 2012
Seminar, Dublin Institute for Advanced Studies, Dublin, Ireland 2012
National Astronomy Meeting of the Royal Astronomical Society, Poster, University of Manchester, Manchester, UK 2012
Seminar, University of Southampton, Southampton, UK 2011
Young European Radio Astronomers Conference, Contributed talk, University of Manchester, Manchester, UK 2011

Honours & Awards

Making a Difference Awards for Outstanding Contribution to Equality, Diversity and Inclusion Nominee, University of Manchester 2019
Better World Showcase Award for Outstanding Contribution to Equality, Diversity and Inclusion Nominee (shortlist), University of Manchester 2019
Tech Future Female Leader, TechReturners 2018
Sponsorship to attend FOSTER Open Science Trainer Bootcamp, FOSTER Open Science 2018
Sponsorship to attend OpenCon, University of Manchester Library, UK 2017
Mozilla Open Leader, Mozilla 2017
Agent of Change Nominee, Northern Power Women Awards 2017
Ph.D. scholarship (4 years), Dublin Institute for Advanced Studies 2010
UT Chancellor's Honours Award for Extraordinary Professional Promise, University of Tennessee 2010
Summer Research Fellowship, University of Tennessee 2009
Undergraduate Student Research Program, National Aeronautics and Space Administration 2008
Phi Eta Sigma Freshman Honours Fraternity, University of Tennessee 2006
Smith Book Award for outstanding academic achievement and leadership, Smith College 2005

Teaching & Supervising

Academic Supervisor for Summer Student Placement, University of Manchester, UK 2018
Mentor for Mozilla Open Leadership training Round 5, Mozilla Foundation 2018
4IR CDT GitHub Workshop, University of Manchester, UK 2018
Supervisor for Transition Year Students (15-17 yo), Dublin Institute for Advanced Studies, Dublin, Ireland 2015 - 2017
Exam invigilator, University of Dublin, Trinity College, Dublin, Ireland 2013 - 2014
Physics Lab Demonstrating for Junior Freshman Engineering, University of Dublin, Trinity College, Dublin, Ireland 2012 - 2013

Outreach

Women In Tech Panel, Digital Gurus, Manchester, UK	2018
Mozilla Festival session facilitator, Ravensborn University, London, UK	2017 - 2018
Hacktoberfest event co-organiser, Manchester Technology Centre, UK	2018
PyData MCR lightning talk, University of Manchester, UK	2018
Women in Physics Careers Panel, School of Physics & Astronomy, University of Manchester, UK	2017 - 2018
Volunteer for SKA at Bluedot Festival, Jodrell Bank Observatory, Cheshire, UK	2017 - 2018
JBCA Representative for UK Prime Minister Theresa May's visit, Jodrell Bank Observatory, Cheshire, UK	2018
The Jodcast, Jodrell Bank Centre for Astrophysics, University of Manchester, UK	2018
Speaker on Public Open Nights, Dunsink Observatory, Dublin, Ireland	2011 - 2017
Judge, SciFest@School, Santa Sabina Sutton Secondary School, Sutton, Ireland	2017
Interviewed for The DeTECHtives TV show, Raidió Teilifís Éireann (RTÉ), Dublin, Ireland	2017
President of Ireland Michael D. Higgins hosted DIAS on the 75th Anniversary of its foundation, Áras an Uachtaráin, Dublin, Ireland	2015
Volunteer, European Science Open Forum, Dublin Convention Centre, Dublin, Ireland	2012
Photographer, lecture by NASA Astronaut Shane Kimbrough, Dublin City University, Dublin, Ireland	2011
Photographer, "Exploring the Final Frontier: Fifty Years On" lecture with Russian Cosmonaut Mikhail Kornienko, Dublin City University, Dublin, Ireland	2011

Service

EWASS 2019 session co-organiser, Lyon, France	2018 - 2019
Machine Learning Conference (MLCon), Jodrell Bank Centre for Astrophysics, University of Manchester, UK	2018
Internal Symposium organiser, Jodrell Bank Centre for Astrophysics, University of Manchester, UK	2018
Colloquium organiser, Jodrell Bank Centre for Astrophysics, University of Manchester, UK	2018 - pres.
Referee, The Astrophysical Journal	2017 - pres.

References

Prof. Anna Scaife, Jodrell Bank Centre for Astrophysics, University of Manchester, Manchester, UK ✉ anna.scaife@manchester.ac.uk
Prof. Tom Ray, School of Cosmic Physics, Dublin Institute for Advanced Studies, Dublin, Ireland ✉ tr@cp.dias.ie
Prof. Luke Drury, School of Cosmic Physics, Dublin Institute for Advanced Studies, Dublin, Ireland ✉ ld@cp.dias.ie
Dr. David Green, Cavendish Laboratory, University of Cambridge, Cambridge, UK ✉ dag@mrao.cam.ac.uk
Dr. Raghvendra Sahai, Jet Propulsion Laboratory/Caltech, Pasadena, CA, USA ✉ raghvendra.sahai@jpl.nasa.gov