Dr. Rachael E. **Ainsworth**

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

Jodrell Bank Centre for Astrophysics, School of Physics and Astronomy, The University of Manchester

Alan Turing Building, Oxford Road, Manchester, M13 9PL

rachael.ainsworth@manchester.ac.uk | rainsworth.github.io | rainsworth | rachaelainsworth | rachaelevelyn

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. Passionate about promoting openness, diversity and inclusion in science and technology. Organiser of the women in data meetup group Her+Data MCR and frequent attendee at other local data science and tech events (JBCA Hacknights, TechNW, Open Data MCR, She Says MCR, MancML).

Experience

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

Research Associate — *June 2017 - present*

- Interferometry Centre for Excellence (ICE) Open Science Champion to advocate, give presentations and organise events relating to open science in astronomy.
- Developing standardised software for calibrating dispersive delay corrections in long baseline interferometry, for low frequency radio telescopes such as LOFAR, as part of the H2020 RadioNET RINGS project.
- Conducting research to exploit the polarisation capabilities of the e–MERLIN telescope.

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

Postdoctoral Research Fellow — *October 2014 - October 2016*

- Member of a team to develop novel processing and analytical techniques for terabytes of data from the International LOFAR Telescope to detect very faint radio sources with this next-generation instrument.
- Collaborated with Thüringer Landessternwarte in the use of LOFAR data to help understand the generation of outflows from young stars: achieved the first detection of a young stellar object (YSO) at 2 m (150 MHz).
- 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), Dr. 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: Dr. 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: Dr. 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

Mozilla Foundation *Manchester, UK*

Mentor and Cohort Host *February 2017 - present*

- Invited to act as Mentor and Cohort A Host during Round 5 of Mozilla's Open Leadership Training.
- Meeting with my assigned Project Lead every two weeks to provide support and guidance as they go through the training and learn to work openly on their projects.
- Hosting Full Cohort meetings (60 - 90min, 35 participants) every two weeks, which involves 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.
- Gaining valuable coaching skills and connections across the Mozilla and open source community.
- Participating in the Global Sprint (May 10-11, 2018).

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.)
- Established *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.

HER+Data MCR *Manchester, UK*

Organiser *July 2017 - present*

- Lead the Manchester chapter of HER+Data, a meet-up group to bring together women from across the North West who work with and love data - to support one another, inspire each other, share experiences and talk data (`https://meetup.com/HER-Data-MCR`).
- Organise cross-city events and meet-ups which involves event planning and promotion, coordinating with sponsors, venues and speakers, and working with and managing a team of co-organisers.
- Identify new partners to work with, create opportunities for collaboration and support, and connect tech companies, industry stakeholders and academic institutions with our 200+ members to cultivate a community that actively supports women in STEM.
- Responsible for content creation and management of social media (@herplusdatamcr).

Publications

Refereed

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`

Presentations

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, Contact Theatre, University of Manchester Library, UK 2017
Tea time talk, Jodrell Bank Observatory, Cheshire, UK 2016
The Accretion/Outflow Connection in YSOs Workshop, Contributed talk, ESA/ESTEC, Noordwijk, Netherlands 2015
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

Sponsorship to attend FOSTER Open Science Trainer Bootcamp, FOSTER Open Science 2018
Sponsorship to attend OpenCon, University of Manchester Library, UK 2017
Mozilla Festival Session Facilitator, Mozilla 2017
Mozilla Open Leader, Mozilla 2017
Ph.D. funding (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 Honors Fraternity, University of Tennessee 2006

Outreach

4IR CDT GitHub Workshop, University of Manchester, UK 2018
Women in Physics Careers Panel, School of Physics & Astronomy, University of Manchester, UK 2017
Interviewed for the Jodcast podcast, Jodrell Bank Centre for Astrophysics, University of Manchester, UK 2017
Volunteer for SKA at Bluedot Festival, Jodrell Bank Observatory, Cheshire, UK 2017
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
Volunteer, European Science Open Forum, Dublin Convention Centre, Dublin, Ireland 2012

Teaching

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

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.

Service

Referee, The Astrophysical Journal 2017

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