

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

Education

University of Dublin, Trinity College

Dublin, Ireland

PH.D. IN ASTROPHYSICS; SUPERVISORS: PROF. TOM RAY (DIAS), DR. ANNA SCAIFE (JBCA)

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 and Societies: Central Program Council, Film Committee, The Campus Literary and Art Magazine: The Phoenix, The Society of Physics Students

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 super-computing 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.

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

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

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.

Honours & Awards

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

Organiser for HER+Data MCR , Manchester, UK	2017-pres.
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

Service

Referee , The Astrophysical Journal	2017
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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