DR. RACHAEL E. AINSWORTH

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EXPERIENCE

Postdoctoral Research – Dublin Institute for Advanced Studies 2014–2016

- Part of a worldwide collaboration to develop novel processing and analytical techniques for terabytes of data from the International LOFAR Telescope.
- Performed research to understand young, Sun-like stars through statistical modelling of observational data in a wavelength regime which has been previously unexplored for these objects.
- Achieved the first detection of a young stellar object (YSO) at 2 m (150 MHz) with LOFAR.

Doctoral Research – Dublin Institute for Advanced Studies 2010–2014
Supervisors: Prof. Tom Ray (DIAS), Dr. Anna Scaife (University of Manchester)

- Led three projects performing systematic modelling of multi-wavelength, multi-scale datasets of protostellar jets from three world-class radio interferometers (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.

UT Summer Research Fellowship Program – University of Tennessee 2009
Supervisor: Dr. Michael Guidry (UT)

- Studied the explosion mechanism of Type Ia Supernovae through computational simulations using the FLASH code on the supercomputing facilities at Oak Ridge National Laboratory.
- Scripted pipelines to process data and generate visualisations for various initial conditions.

NASA Undergraduate Student Research Program – NASA JPL/Caltech 2008
Supervisor: Dr. Raghvendra Sahai (JPL/Caltech)

- 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

Doctor of Philosophy Astrophysics 2017
University of Dublin, Trinity College, Ireland
Thesis: "Morphology and Time Evolution of Thermal Jets Associated with Low Mass Young Stars"
Submitted: August 2014 – *Viva voce*: September 2016 – Awarded: April 2017

Bachelor of Science Physics, Studio Art 2010
University of Tennessee, Knoxville, TN, USA
Overall GPA: 3.61/4.0, Honors: *cum laude*

SKILLS

Data Analysis

- Six years of full time experience collecting, cleaning and analysing a wide variety of complex astrophysical datasets.
- Experienced in calibrating and imaging radio interferometric data from AMI, e–MERLIN, GMRT, LOFAR and the VLA.
- Utilised Markov Chain Monte Carlo, Maximum Likelihood and Linear Regression techniques to identify trends and forecast future activity for observing programs.

Communication

- Published research in high-impact, internationally peer-reviewed astrophysical journals.
- Presented analysis and keynotes to a range of audiences (from general public to experts).
- Extensive experience working effectively as part of a team and within larger collaborations.
- Helped to re-define the public communication strategy of the Dublin Institute for Advanced Studies through restructure of the website and social media developments.
- Participated in public outreach at Dunsink Observatory through presentations, projects and interviews.

Leadership

- Initiated and organised Institute-wide group meetings and literature discussions/journal club to stimulate collaboration and communication between members.
- Devised and authored numerous successful observing programs as Principle Investigator.

Technical

- *Computer languages*: Python, Fortran, Bash, C-shell.
- *Data reduction software*: AIPS, CASA, IRAF, REDSPEC.
- *Other tools*: METRO, PyBDSM, FITFLUX, DS9, Karma, LaTex, Microsoft Office, Adobe Illustrator.

OBSERVATIONAL PROGRAMS & PROPRIETARY DATA

(* Data in hand.)

- Co-I: e–MERLIN (PI: J. Greaves, CY5214, 330 hours proposed). Planet-Earth Building Blocks - a Legacy eMERLIN 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.
- 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: 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.*
- e–MERLIN Commissioning data (PI: L. Rodríguez, 17 hours, May 2013). Thermal Jets Legacy Program: Observations of L1551 IRS 5 at 5 GHz.
- GMRT Cycle 23 (PI: A. Scaife, 23_011, 31 hours). Low Frequency Radio Emission from Low Mass YSOs: Pathfinder project to detect low mass YSOs at low frequencies.
- e–MERLIN Commissioning data (PI: J. Greaves, 34 hours, June 2012). PEBBLeS Legacy Program: Observations of DG Tau at 5 GHz.
- AMI (PI: A. Scaife, August–October 2010). Observations of the e–MERLIN Thermal Jets Legacy Program Sample at 16 GHz.

SELECTED PRESENTATIONS

- "Protostellar Jets at Very Low Radio Frequencies", The Accretion/Outflow Connection in YSOs Workshop, ESA/ESTEC, Noordwijk, Netherlands. 28 October 2015.
- "Low mass Star Formation at Low Radio Frequencies", Thüringer Landessternwarte, Tautenburg, Germany. 17 February 2015.
- "Low mass Star Formation at Low Frequency", Leiden Observatory, Netherlands. 13 November 2014.
- "e–MERLIN Measurements of the DG Tau Jet: Status Update from the Thermal Jets Legacy Programme", e–MERLIN Science Meeting, University of Manchester, UK. 11 April 2014.
- "Young, Solar-like Stars at Low Frequencies", Postgraduate Seminar Series, University of Dublin, Trinity College, Ireland. 7 February 2014.
- "The Lowest Frequency Observations of YSOs with the GMRT", The Metrewavelength Sky, NCRA–TIFR, Pune, India. 10 December 2013.
- "The Lowest Frequency Observations of YSOs with the GMRT" (poster), Protostars and Planets VI, Heidelberg, Germany. 15 July 2013.
- "Radio continuum observations of low mass young stars driving outflows", Radio Stars and Their Lives in the Galaxy Workshop, MIT Haystack Observatory, Westford, Massachusetts. 3 October 2012.
- "Radio continuum observations of low mass young stars", Astronomical Science Group of Ireland Spring Meeting, Birr, Ireland. 19 April 2012.
- "Radio continuum observations of low mass young stars" (poster), National Astronomy Meeting of the Royal Astronomical Society, Manchester, UK. 27 March 2012.
- "AMI–LA radio continuum observations of low mass young stars", University of Southampton, Southampton, UK. 7 November 2011.
- "AMI–LA radio continuum observations of low mass young stars: target sample for e–MERLIN legacy project", Young European Radio Astronomers Conference, Manchester, UK. 18 July 2011.

REFEREED PUBLICATIONS

1. 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.

2. **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.

3. **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.

4. **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.

5. **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.

6. **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.

7. 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.

8. 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.

REFERENCES

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