Report from the event supported by RadioNet

TITLE: INTERFEROMETRIC DATA PROCESSING WORKSHOP FOR EMERLIN & ALMA: DUBLIN

DATE: 10-12 SEPTEMBER 2018

LOCATION: DUBLIN, IRELAND

MEETING WEBPAGE: *http://www.alma.ac.uk/index.php/meetings/uk-arc-node-meetings/256-alma-interferometric-data-processing-workshop-dublin-10-12-sept-20178*

HOST INSTITUTE: DUBLIN INSTITUTE OF ADVANCED STUDIES, DUBLIN

RADIONET BENEFICIARY / NO: *DIAS/16*

Report:

1 SCIENTIFIC SUMMARY

The RadioNet supported event *"INTERFEROMETRIC DATA PROCESSING WORKSHOP FOR e-MERLIN & ALMA"* had a primary goal of being a training workshop covering the fundamentals of radio interferometry for astronomers based in Ireland. However, ultimately involvement was expanded to anyone wishing to attend the workshop, not just those based in Ireland.

The workshop was instigated after requests to members of the Jodrell Bank Centre for Astrophysics (JBCA) for such a workshop. Despite the several astronomy departments in Ireland and the recently inaugurated LOFAR station there are, or have been, relatively few resources dedicated to training in interferometry available in Ireland.

The workshop was split between "lecture" sessions and "hands-on" sessions. The topics covered during lectures at the workshop were:

- An introduction to the principles of interferometry, covering measuring complex visibilities, uv-coverage, the Fourier relation of visibilities to the sky brightness distribution and the effects of array configuration on imaging capabilities.
- An introduction to the standard calibration process for interferometric, e.g. flux scaling, bandpass corrections and complex gain calibration.
- The basics of imaging interferometric data, covering CLEAN algorithms, image analysis and self-calibration techniques.
- Working with the CASA data reduction software.

These four topics are fundamental to anyone working, or planning to work, with interferometric data and will allow those who attended to make informed and rigorous decisions when applying for observing time with interferometric instruments, such as those included in the RadioNet Infrastructure.

The workshop tutors from JBCA work primarily with e-MERLIN (part of the RadioNet infrastructure) or ALMA, as such these two telescopes were used as the basis for hands-on examples. These sessions covered, for both instruments, calibration of an example dataset and imaging of the resultant calibrated data using the CASA software. The use of two datasets allowed the attendees experience working with different types of interferometric data e.g. cm-wavelength data from a long baseline and sparsely filled array (e-MERLIN) and mm-wavelength data from a relatively compact and populated array (ALMA) highlighting that the fundamental principles are the same whilst specific instrument to instrument knowledge is required.

Additional short session were dedicated introducing the telescopes for the hands-on sessions, to how to apply for observing time on both telescopes and advanced imaging techniques applicable to any interferometer.

It is hoped that this event will have introduced those in attendance to a field of astronomical observation that they previously would not have used, particularly those at early stages of the academic lives (~70% of attendees being PhD or MSc students). This will have a beneficial impact on the RadioNet community by increasing the number of astronomers with the knowledge of interferometric observations techniques and opening up a wider user base within Ireland.

Event webpage: http://www.alma.ac.uk/index.php/meetings/uk-arc-node-meetings/256-alma-interferometric-data-processing-workshop-dublin-10-12-sept-20178

2 AGENDA OF THE EVENT

The lectures and hands-on tutorials for this event were given by:

Adam Avison, UK ALMA Regional Centre Node, JBCA, UMAN, UK (hereafter **AA**)
George Bendo, UK ALMA Regional Centre Node, JBCA, UMAN, UK (hereafter **GJB**)
Javier Moldon, e-MERLIN National Facility, JBCA, UMAN, UK (hereafter **JM**)

The below agenda follows the agenda 'as given' and differs slightly from the published agenda as some hands on session took longer than anticipated.

Monday 10 September

09:30: Welcome – **AA** & Alessio Caratti o Garatti (DIAS , Ireland)

09:45: Introduction to e-MERLIN – **JM**

10:15: Introduction to ALMA - **GJB**

10:45: Break

11:15:   The fundamentals of interferometry – **AA** (included a short hands on simulation)

12:00:   Introduction to the Datasets and Source

    - Introduction to IRAS16293-2422 - **AA**
    - What is in the ALMA dataset - **GJB**
    - What is in the e-MERLIN dataset (3C277.1) - **JM**
    - Introducing the CASA Measurement Set structure - **GJB**

12:30:   Lunch

13:30:   Introduction to Calibration: General calibration principles for interferometry - **AA**

14:30:   Introduction to Calibration: Apriori calibration steps

    - Apriori steps for e-MERLIN. - **JM**
    - Preforming the ALMA Apriori Calibration steps (hands on). – **GJB**

16:00:   Proposal preparation: Introduction to the software tools for proposing for
    e-MERLIN or ALMA observations – **JM** & **AA**

17:00:   End

Tuesday 11 September

09:00:   Interferometric data reduction Part 1: Calibration ALMA – **led by GJB**

    - Hands on calibration of ALMA IRAS16293 data. (Hands on assisted by **AA** & **JM**)

12:10: Special topic short talk: ALMA Science - GJB

12:30:   LUNCH

13:30:   Interferometric data reduction Part 2: Calibration e-MERLIN – **led by JM**

    - Hands on calibration of e-MERLIN 3C277.1 data. (Hands on assisted by **AA** &
GJB)

17:30:   End

Wednesday 12 September

09:00: Introduction to Imaging: General imaging principles for interferometry - **AA**

10:30: Interferometric data reduction Part 2: Imaging

- Hands on imaging of the IRAS16293 data.

- ALMA (IRAS16293) – **led by AA**

- e-MERLIN (3C277.1) – **led by JM**

12:30: LUNCH

13:30: Interferometric data reduction Part 2: continued.

- During this session we will present the e-MERLIN pipeline - **JM**

17:00: End

3 PARTICIPANTS

The workshop had a total attendance of 14 participants and 3 tutors. The attendees were primarily from Ireland, with the majority based at institutes within Dublin. Of these 8 attendees were from DIAS (the host institute), 2 from the Institute of Technology, Tallaght, Dublin, and 1 from University College Dublin. The remainder of attendees from Ireland (2) were from NUI Galway (both of whom were supported by RadioNet). One participant travelled from the Nicolaus Copernicus University, Poland to attend the meeting (also supported by RadioNet).

The level of attendees ranged from Masters students through PhD to postdoctoral researchers academic staff, with the majority being PhD students (1 Msc, 9 PhD, 3 postdocs and 1 academic staff member (also studying for and astronomy/astrophysics PhD)). The gender balance was 2:5 female to male.

All three tutors (who are receiving RadioNet support) were from the Jodrell Bank Centre for Astrophysics, University of Manchester.

Conference Picture:

4   RADIONET FINANCIAL CONTRIBUTION

The financial support from RadioNet (2400€) was used to allow attendees and tutors from outside of Dublin to travel to and stay within the city during the workshop. We list in the table below the names of attendees receiving support, their nationality and reason for support award.

5   PUBLICATIONS

No peer reviewed or other academic proceedings are to be made from the meeting. Though all slides used are available on the conference website and we note that the RadioNet Acknowledgement is included in all presentations given during the meeting.