Report on

European Radio Interferometry School 2015

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The sixth European Interferometry School (ERIS2015) was held at ESO for the first time. As usual the school was aimed at graduate students and early-career postdocs, but this year the emphasis was on enhanced wide-bandwidth interferometers covering metre to submillimetre wavebands. More than 100 participants attended ERIS2015. The topics of the school are briefly described here. They covered a wide range, from an introduction to radio interferometric techniques through packages for data reduction and analysis to hands-on workshop sessions and proposal writing.

This was the sixth European Radio Interferometry School, a series which started in 2005 with the organisation undertaken, in turn, by major European radio astronomy centres. Previous schools have been run by Manchester University; the Max-Planck-Institut für Radioastronomie (MPIfR), Bonn; Oxford University; INAF–Istituto di Radioastronomia (held in Rimini); and the Netherlands Institute for Radio Astronomy (ASTRON)/Joint Institute for VLBI in Europe (JIVE). With the Atacama Large Millimeter/submillimeter Array (ALMA) coming into full operation and the availability of space in the new Headquarters Building, we felt that it would be appropriate for ESO to organise ERIS in 2015.

ERIS provided five days of lectures and tutorials on how to obtain scientific results from radio interferometry at metre to submillimetre wavelengths. It was primarily intended for graduate students and beginning postdoctoral fellows. The emphasis was on the generation of new and greatly enhanced interferometers that have recently become available to European astronomers, including the Low Frequency ARray (LOFAR), the extended Multi-Element Radio Linked Interferometer Network (eMERLIN), the European VLBI Network (EVN), the Jansky Very Large Array (JVLA), ALMA and the Institut de Radioastronomie Millimétrique (IRAM) Plateau de Bure/the NOrthern Extended Millimeter Array (NOEMA). The school also covered the use of archive data and looked forward to the Square Kilometer Array (SKA) and its precursors.

The programme was developed from those of earlier ERIS schools, with an increased emphasis on wide-bandwidth interferometers and on the use of the Common AStronomy Applications (CASA) package for data-reduction tutorials (the Astronomical Image Processing System [AIPS] was still used, but only for Very Long Baseline Interferometry [VLBI] data). We felt that it was essential for the students to learn techniques appropriate to modern arrays from the start, but took the decision to switch from older, narrowband data with some trepidation as the sizes of the tutorial datasets increased substantially, causing problems with distribution and processing speed. Students were expected to bring their own laptops with the standard software already installed; support was available from ESO and the National Radio Astronomy Observatory (NRAO, USA) to help with installation problems and ESO provided a number of loan laptops. In the end, we believe that the change was well worth the additional effort.

We decided that any attempt to cover the science enabled by radio interferometry in depth would take too long and was, in any case, better integrated with perspectives from other techniques. The school therefore started with two lectures on the fundamentals of radio interferometry (a gentle introduction for beginners, followed by a more mathematical underpinning) and an overview of modern radio interferometers. The programme went on to cover the generic data-reduction process for radio interferometry through a mix of lectures and hands-on tutorials. The main areas were: editing and removal of radio-frequency interference; calibration of continuum, spectral-line and polarisation data; imaging and deconvolution; and extraction of information from images or datacubes. The special problems of observing at very high (ALMA) and low (LOFAR) frequencies were also covered. Parallel tutorials allowed students to follow their own interests in advanced topics or to continue working on the basic tutorials.

One aspect of radio interferometry that prospective users often find obscure is the choice of instrument, frequency, spectral configuration and observing time. As well as lectures on the concepts, we also held a special tutorial in which students divided into small groups to write the technical case for an observing proposal on a topic of their choice. These proposals were presented at the end of the school. This exercise, which we first introduced at the Oxford ERIS, proved to be popular, and resulted in some excellent proposals.

On reflection, after the school, it became clear to us that the techniques of (sub) millimetre and centimetre-wave interferometry have now converged and can be taught together quite effectively. There are some obvious differences, mostly connected with the malign effects of the atmosphere at shorter wavelengths, but the main data-reduction steps are identical and the same package, CASA, can be used for both. However, wide-field imaging at low frequencies does require a different approach, because of the size of the datasets and the need for specialised software. This might argue for a different split in topics for future interferometry schools.

Lectures and most tutorials for ERIS 2015 took place in the new Eridanus auditorium, with parallel tutorials being held in neighbouring meeting rooms. There were 113 students (a new record for ERIS — see Figure 1). Of these, 95 came from EU member states and the rest were from Switzerland, the Russian Federation, Turkey, Brazil, Chile, Colombia, Korea, Japan, India and South Africa. The majority were doctoral or masters students or early-career postdoctoral researchers. A few more senior participants attended the school: established researchers changing field, radio astronomy software developers and observatory support staff. Thirty-seven participants were female (33 %) and a significant proportion were non-white.

Figure 1. Participants at ERIS 2015 photographed outside the new ESO Headquarters building.

Social events included two buffet suppers at ESO (one a magnificent Bavarian barbecue). These were each followed by evening science lectures, by Katherine Blundell from the University of Oxford on the Galactic microquasar SS433 and by Tim de Zeeuw on the work of ESO. Both events proved very popular with the students and the nature of the questions suggested that we had (on average, if not for every individual) provided the right amount of alcohol beforehand. We decided that forcing the students to visit the local LOFAR station on their "free" afternoon was a bad idea, given the competition from other attractions in Munich, and gave them a U-Bahn ticket for the central zone instead. All arrived promptly at ESO the next morning, so this was probably the right decision!

Further information, including all of the lectures, tutorial scripts and datasets can be found at the school home page[1].

Acknowledgements

The meeting was co-sponsored by ESO and Radionet3, an EU Integrated Infrastructure Initiative to coordinate access, development, and training for radio astronomy facilities in Europe[2]. RadioNet3 has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 283393. We are grateful to the members of the Local and Scientific Organising Committees and to all of the lecturers, tutors and ESO helpers for their work in designing and presenting a coherent programme. Many other people helped to make the school a success. We would particularly like to thank: Tim de Zeeuw and Katherine Blundell for their after-dinner talks; Berkan Maruthadiyan and Tamas Tutundiscz for audio-visual and laptop support; Ana Vukovic for keeping us supplied with coffee; Andrea Dinkel and colleagues for sorting out the finances; and Wolfgang Wild for agreeing to the substantial ESO contribution. Finally, at every meeting there is usually one person without whom the whole organisation would have fallen apart. In our case, this was Elena Zuffanelli, who worked long and hard to make the school a success.

Links

[1] ERIS 2015 school home page: http://www.eso.org/sci/meetings/2015/eris2015.html
[2] Radionet3: http://www.radionet-eu.org

The AstroMundus–ESO Connection

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The AstroMundus Programme is an E+ Erasmus Mundus Joint Masters Degree course in astronomy and astrophysics offered by a consortium of European universities and research institutes. In 2014 and 2016, AstroMundus Masters students visited ESO and participated in proposal-writing sessions, during which groups of students speed-wrote complete ALMA proposals, before presenting them to a pseudo Time Allocation Committee providing on-the-spot feedback. The AstroMundus visit of 25–26 January 2016 is described.

Nine students from the AstroMundus Programme[1] visited ESO during the afternoon of Monday 25 January 2016, with a welcome and introduction to ESO given by Eric Emsellem. Annalisa De Cia, Alexis Lavail and Jason Spyromilio then took