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Broadband networks transform radio astronomy

Astronomers from CSIRO, the Swinburne University of Technology and the University of Tasmania have made the first broadband hook-up between Australian radio telescopes, doing in just hours an experiment that would previously have taken weeks.

Data from four telescopes – near Parkes, Narrabri, Coonabarabran and Hobart – were streamed to CSIRO's Parkes Observatory, where they were processed in software developed at the Swinburne University of Technology.

"Broadband networks are revolutionising astronomy," says Dr Tasso Tzioumis, VLBI operations and development manager at CSIRO's Australia Telescope National Facility. "We can now do experiments on very short time-scales with real-time transfer of data between telescopes."

This experiment was the first to make extensive use of dedicated 1 Gbps (gigabit per second) networks that now link the CSIRO observatories in NSW to Sydney and beyond. Installed in 2006, the links were funded by CSIRO and provided by AARNet (the Australian Academic Research Network).

Called VLBI (Very Long Baseline Interferometry), this technique traditionally produced results very slowly, usually taking at least a few weeks. Data would be recorded on tapes or disks at each telescope, along with time signals from atomic clocks. The tapes or disks would then be shipped to a central processing facility to be combined.

The VLBI-over-broadband (e-VLBI) technique has also been tested and is used in Europe and the USA, at similar data rates.

Past VLBI experiments have used special-purpose hardware, called a correlator, to combine the various data streams. But in this experiment a sophisticated software correlator was used, running on a cluster of computers – a world first for e-VLBI.

The software correlator was developed at Melbourne's Swinburne University of Technology, in a group led by Associate Professor Steven Tingay in the Centre for Astrophysics and Supercomputing.

Being able to ship data around in vast quantities will be crucial to the operation of future radio telescopes such as MIRA, the Mileura International Radio Array, soon to be built in Western Australia, where each of 30 dishes will be delivering a terabyte of data per second.

Broadband networks are also transforming astronomy by allowing telescopes to be operated remotely.

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