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RadioNet: Advanced Radio Astronomy in Europe

Radio astronomy can probe the distant universe, but it also has Earth-based applications, such as studying the movement of continents. Networking is a natural part of radio astronomy because a group of radio telescopes can perform better than each of its members alone. The EU-funded RadioNet project will give European radio astronomers the infrastructure they need to work effectively with colleagues across the world. New digital electronics, fibre-optic communications links, human networks and better user support are some of the benefits.

● WATCHING THE SKY WITH A HUNDRED EYES

In January 2005, a global network of radio telescopes in Australia, China, Japan and the US tracked the European Space Agency's Huygens probe as it parachuted onto the surface of Titan, the largest moon of Saturn. Besides collecting the images and scientific data sent back by the probe, the radio telescopes were able to calculate the position of the landing site to an accuracy of around one kilometre. At a distance of 1 200 million kilometres from Earth, that is quite an achievement.

Radio telescopes, like their optical counterparts, gather radiation from distant objects. Instead of visible light, however, they cover the radio region of the electromagnetic spectrum, which characterises many astronomical objects, such as pulsars and quasars. Astronomers can learn much about the make-up of the universe by studying the frequency, power and timing of these radio signals.

A radio telescope uses a reflector shaped like a dish or trough to concentrate faint radio waves onto a receiver. The larger the dish, the more sensitive the telescope. Until recently the world's largest

single steerable radio telescope was the 100m-diameter dish at Effelsberg, Germany. It is hard to make a steerable dish much larger than this, so for better performance, individual dishes are linked to form an array that behaves like a "super-telescope".

In early arrays, the individual telescopes were close together and linked by cables. An alternative system, known as Very Long Baseline Interferometry (VLBI), uses simultaneous observations from radio telescopes hundreds or thousands of kilometres apart to improve performance still further. This was the technique radio astronomers used to track Huygens with awesome precision.

With such benefits to be gained from collaboration, projects like RadioNet are the logical future for Europe's radio astronomers. RadioNet brings together all of Europe's leading radio astronomy facilities to improve the quality and quantity of European astronomical science. The Huygens observations were organised by a member of RadioNet, the Joint Institute for VLBI in Europe (JIVE), based in the Netherlands.

● COLLABORATION FOR THE DIGITAL FUTURE

RadioNet has over 20 participants, ranging from operators of radio telescopes to laboratories specialising in microelectronics, including monolithic microwave integrated circuits (MMICs) and superconducting components. The project has created a unique partnership that builds on and extends a series of existing, smaller collaborations.

RadioNet has three parts: eight Networking Activities, seven Transnational Access Activities and three Joint Research Activities. The main objective is to create an integrated radio astronomy network giving European scientists access to world-class facilities and an R&D plan to support these facilities. It will develop networks for collaboration in engineering, software, user support and astronomical science, and train the next generation of users,

both astronomers and engineers.

The project will prepare European astronomers for the next generation of radio telescopes, including the massive Atacama Large Millimeter Array (ALMA) in Chile, and the most sensitive radio telescope ever built, the Square Kilometre Array (SKA), as well as developing links with EU-backed astronomy projects OPTICON and ILIAS.

Digital electronics and fibre-optic communications are revolutionising radio astronomy. RadioNet is creating the links needed to transform radio telescopes from national institutions into global arrays.



EUROPEAN COMMISSION

● ADVANCED RADIO ASTRONOMY IN EUROPE IN SUMMARY

Project acronym: RadioNet

Funding scheme (FP6): Integrated Infrastructures Initiative (I3)

EU financial contribution: €12 396 990

EU project officer: Elena Righi-Steele

Duration: 60 months

Start date: 1 January 2004

Completion date: 31 December 2008

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