PROCEEDINGS OF SCIENCE

RadioNet3

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RadioNet3 coordinates all Europe's leading radio astronomy facilities in an integrated cooperation to achieve transformational improvement in the quality and quantity of the scientific research of European astronomers. *RadioNet3* includes facilitation of research via dedicated Network Activities. It also includes four pathfinders for the SKA in its Transnational Access Programme. Furthermore, it aims to stimulate new Research & Development (R&D) via Joint Research Activities for the already existing radio infrastructures in synergy with ALMA and SKA. The *RadioNet3* programme, briefly described here, aims at ensuring that a healthy scientific and technical community will be ready and prepared for these radio telescopes.

11th European VLBI Network Symposium & Users Meeting
October 9-12, 2012
Bordeaux, France

* Speaker

PoS(11th EVN Symposium)070

1. Introduction

RadioNet3 coordinates Europe's leading radio astronomy institutions to support scientific research by all European astronomers. The *RadioNet3* initiative, funded by the European Commission under the Seven Framework Programme (FP7, Contract no. 283393), builds on the success of its two preceding programmes launched in 2004 and 2009. *RadioNet3* is a Consortium of 27 partners comprising funding Agencies, Universities, Institutes, and Observatories from all over Europe and beyond. In the following, I will briefly summarize governance, goals, and activities of *RadioNet3*. For more information consult **www.radionet-eu.org**.

1.1 RadioNet3

RadioNet3 provides and facilitates access to the key research infrastructures in Europe for advanced radio astronomy, including Very Long Baseline Interferometry. It aims at integrating these facilities and resources with a long-term perspective. Successor of two preceding programmes, *RadioNet3* takes a leap forward as it stimulates new scientific activities with the goal of taking full advantage of new experimental possibilities which will be offered by the Square Kilometre Array (SKA) and Atacama Large Millimeter/submillimeter Array (ALMA). The duration of the programme is four years, from 2012 to 2015. The EC contribution is of 9,500,000 EUR. The Transnational Access programme will absorb 44% of the available funds, Joint Research Activities 40%, Networking Activities 7%, and Management 9%.

1.1.1 Governance

The *RadioNet3* consortium is structured according to the following bodies: the Governing Board, the Coordinator, the Executive Committee and the Management Team.
Each participating institution has one representative into the Governing Board[1]. Out of its members the Board has elected a Chairman and a Vice-Chairman. The Coordinator, Prof. Anton Zensus, is the intermediary between the partners and the European Commission. He is assisted in its work by the Management Team, who also assists the Executive Committee, especially in the execution of the Board decisions as well as in the overall management of *RadioNet3* activities. Members of the Executive Committee are: Coordinator, Chairman of the Board, Joint Research Activities leaders, Transnational Access leader, Project Scientist, and Project Manager.

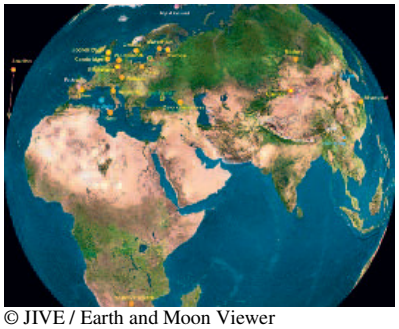
1.1.2 Goals

The above financial resources, provided by EU and by investments from partners, will be addressed to achieve goals that can be summarized as follows: a) provide and facilitate access to the Europe's most powerful radio-astronomical facilities; b) secure a long term perspective on scientific and technical developments in radio astronomy; c) stimulate new R&D activities for the already existing radio infrastructures in synergy with ALMA and with the SKA; d) contribute to the implementation of the vision developed in the ASTRONET Strategic Plan for European Astronomy.

2. Transnational Access

The Transnational Access (TNA) programme of *RadioNet3* is dedicated to stimulate full exploitation of an **open skies policy**. It offers access to several telescopes and arrays operated by European organisations, covering an unprecedented range of frequencies from 10 MHz to 1 THz, and resolving power from arcminutes to milliarcseconds. The TNA programme aims at removing technical, financial and logistical barriers and thereby allows European astronomers to take full advantage of these world-leading facilities. European users are provided with a high level of professional support covering all aspects of the use of facilities, from preparation through observations and to data interpretation. It is worth mentioning that four of the TNA facilities presented below are considered pathfinders of SKA, namely: the European VLBI Network, *e*-MERLIN, LOFAR, and WSRT.

The TNA facilities are:



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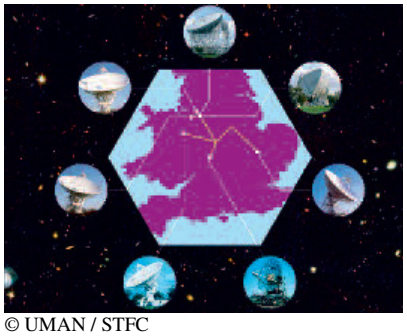
European VLBI Network (EVN)

The EVN is a distributed network of radio telescopes across the Europe and beyond, including Russia, China, South Africa and Puerto Rico. It regularly conducts joint observations with *e*-MERLIN (UK) and NRAO telescopes (U.S.). Signals from each telescope are correlated at a central processing facility at the Joint Institute for VLBI in Europe (JIVE).



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e-MERLIN

The Multi-Element Radio Linked Interferometer Network (*e*-MERLIN) is an interferometer array of radio telescopes spread across England. It provides radio imaging, spectroscopy and polarimetry with 10-150 milliarcsecond resolution and microJansky sensitivity at centimetre wavelengths.

© N. Tacken / MPIfR

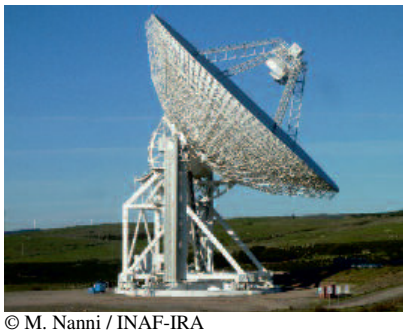
100-m Radio Telescope Effelsberg

The 100-m radio telescope is one of the largest fully steerable antennas on Earth and combines superb sensitivity and wide frequency coverage (0.3 ─ 95 GHz) with versatility.

© LOFAR / ASTRON

Low Frequency Array (LOFAR)

LOFAR is a distributed array of 40 antenna stations operating at low frequencies, 10 ─ 240 MHz. All stations are connected by optical fibres to the central data processing and archive facilities.



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Sardinia Radio Telescope (SRT)

The SRT is a parabolic 64 m diameter dish with the largest active primary surface in Europe. The frequency coverage is between 300 MHz and 100 GHz with single- and multi-beam state-of-the art receivers.

© ASTRON / H.-J. Stiepels, N. Vermaas

Westerbork Synthesis Radio Telescope (WSRT)

The WSRT array has fourteen 25 m antennas providing almost continuous spectral coverage at decimeter and centimeter wavelengths. The field of view of the array will soon be increased with a factor 25, by placing a *focal-plane array* in the focus of each parabolic dish (project Apertif).

© IRAM / Rebus

Plateau de Bure Interferometer (PdBI)

The PdBI has six 15 m antennas equipped with low-noise heterodyne receivers for 3, 2, 1, and 0.8 mm wavelengths. By doubling its number of antennas, IRAM will transform the interferometer into an even more powerful instrument named NOEMA (NOrthern Extended Millimetre Array) by 2018.

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IRAM - 30 m Telescope at Pico Veleta (PV)

The PV 30 m telescope has been designed for observations at 3, 2 and 1 mm. It is the most powerful millimetre single dish telescope in the world.

© ESO

Atacama Pathfinder Experiment (APEX)

APEX is a 12 m sub-mm radio telescope observing with 295-channel 870 μm and 37-channel 350 μm bolometer arrays, plus a 4-channel heterodyne receiver at 230, 350, and 500 GHz, and 1.3 THz.

3. Networking Activities

The Networking Activities (NAs) of *RadioNet3* foster interaction and collaboration among astronomers and engineers, through workshops, conferences and training events. There are six NAs in the programme, namely:

Questions on Structuring European Radio Astronomy (QueSERA) – The field of radio astronomy is set to blossom over the coming decade. ALMA and SKA are expected to become operational. Additionally, some traditional facilities are undergoing important upgrades. Better integration, representation and advertising of the radio astronomical facilities and ambitions is the aim of this NA.

Science Working Group (SWG) – The main goal of this NA is to ensure a central coordination of dissemination of knowledge and scientific results among the partners. SWG organises and supports radio astronomy science-related conferences, workshops and meetings.

New Skills for astronomers (New Skills) – Through this NA, *RadioNet3* aims at equiping astronomers to exploit current and future radio astronomy facilities. New Skills ensures that the innovative data reduction methods are employed wherever appropriate.

Mobility for ALMA Regional Centre Users (MARCUs) – The ALMA Regional Centre (ARC) is a network of (sub-) millimetre astronomy centres of excellence, established to support the European user community for ALMA. This NA supports user visits to the seven nodes of the European ARC network and strengthens the user community.

European Radio Astronomy Technical Forum (ERATec) – The communication, training and scientific interaction between engineers and scientists involved in the development and operation of radio astronomical instruments represents a key issue in keeping these facilities at a world class technical level. ERATec organises technical workshops to promote interactions among engineers and scientists.

Radio Astronomical Spectrum Management – The objective of this NA is to keep the radio astronomy frequency bands free of man-made interferences in order to safe-guard this environment for fundamental astronomical research. To this end, the Spectrum Management interacts with regulatory bodies for the protection of the scientific use of radio astronomy frequency bands.

4. Joint Research Activities

The Joint Research Activities (JRAs) of *RadioNet3* aim to stimulate engineering research and to develop new data processing and analysis methods. There are four JRAs in the programme:

UniBoard[2] – This JRA will create an FPGA-based, generic, scalable, high-performance computing platform with several innovative features for radio astronomical applications. The aim is to have the platform ready for the next generation of astronomical instruments (notably the SKA) till end of the year 2015.

Advanced European Terahertz HEterodyne Receivers (AETHER) – The primary objective is to develop a new generation of instrumentation to extend the performance and scope of ALMA, and of large existing European mm/sub-mm facilities. AETHER will develop innovative heterodyne detectors and devices that yield a maximum gain sensitivity, bandwidth beyond 1 THz, and mapping speed for ALMA.

High performance processing of Large Astronomical Datasets in an Open-source environment (Hilado) – The scientific and technical goal of Hilado is to create optimized prototype software and demonstrator processing pipelines that improve the capabilities of currently planned software packages for existing and emerging radio telescopes.

Developments In VLBI Astronomy (DIVA) – This JRA will develop wide-band dm/cm-receivers with at least 4:1 frequency bandwidth and wide bandwidth / high-bitrate VLBI back-ends.

Acknowledgement
The research leading to these results has received funding from the European Commission Seventh Framework Programme (FP/2007-2013) under grant agreement No 283393 (RadioNet3)

[1] Leading persons in *RadioNet3* Governing Bodies:
Coordinator: Anton Zensus, Max-Planck-Institut für Radioastronomie, Bonn, Germany
Chairman: Rafael Bachiller, Istituto Geografico National, Spain
Vice-Chairman: Patrick Charlot, Université Bordeaux I, France
Management Team: Max-Planck-Institut für Radioastronomie, e-mail: **rn3@mpifr.de**