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1 Document information

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Type Report

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1.1 Dissemination Level

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

1.2 Content

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2 Report

The Modern Radio Universe 2013 has been organised by the Max-Planck-Institut für Radioastronomie (MPIfR) and took place in April at the LVR - Landesmuseum, Colmantstrasse, Bonn, Germany. The conference started at 9:00 AM on Monday the 22nd of April and ended on Friday the 26th at 16:15 PM.

The initial goal of the - Modern Radio Universe 2013 - was to highlight the original and exciting science currently being produced by radio astronomical telescopes, such as the GBT, Effelsberg, LOFAR, ALMA, JVLA, GMRT, e-MERLIN, EVN, VLBA, as well as pathfinder experiments of the SKA, and others. This goal has been archived with a very dense scientific programme of almost 100 oral contributions and 100 posters, covering cosmology, galaxy evolution, AGN & compact objects, star formation, the interstellar medium, Galactic science, radio transients, fundamental, extreme physics and associated theory. Furthermore, the conference provided an update on the newest technical developments at various facilities. Apart from the scientific programme included the 5-days conference several sub-meetings such as: an open discussion of the ASTRONET European Radio Telescope Review Committee, the annual meeting of the European SKA Consortium (ESKAC), and the German CTA & SKA industry day.

In addition to the scientific programme a visit to the radio telescope in Effelsberg, the conference dinner, and some social events have been organised. The schematic overview of the agenda of the conference is shown in the figure 1.

The webpage of the conference is hosted at the MPIfR for at least the next 3 years:

<https://indico.mpifr-bonn.mpg.de/indico/conferenceDisplay.py?ovw=True&confId=21>

At the webpage the following information can be found: the conference booklet, the group pictures of the participants, an overview of the agenda, the science programme and the individual talk of the participants (please note that some of the participants have explicitly stated that they do not want their presentation available online, because it contains information that has not been published yet.). In addition, most of the posters shown in the poster session are available in the conference booklet and in a poster booklet.

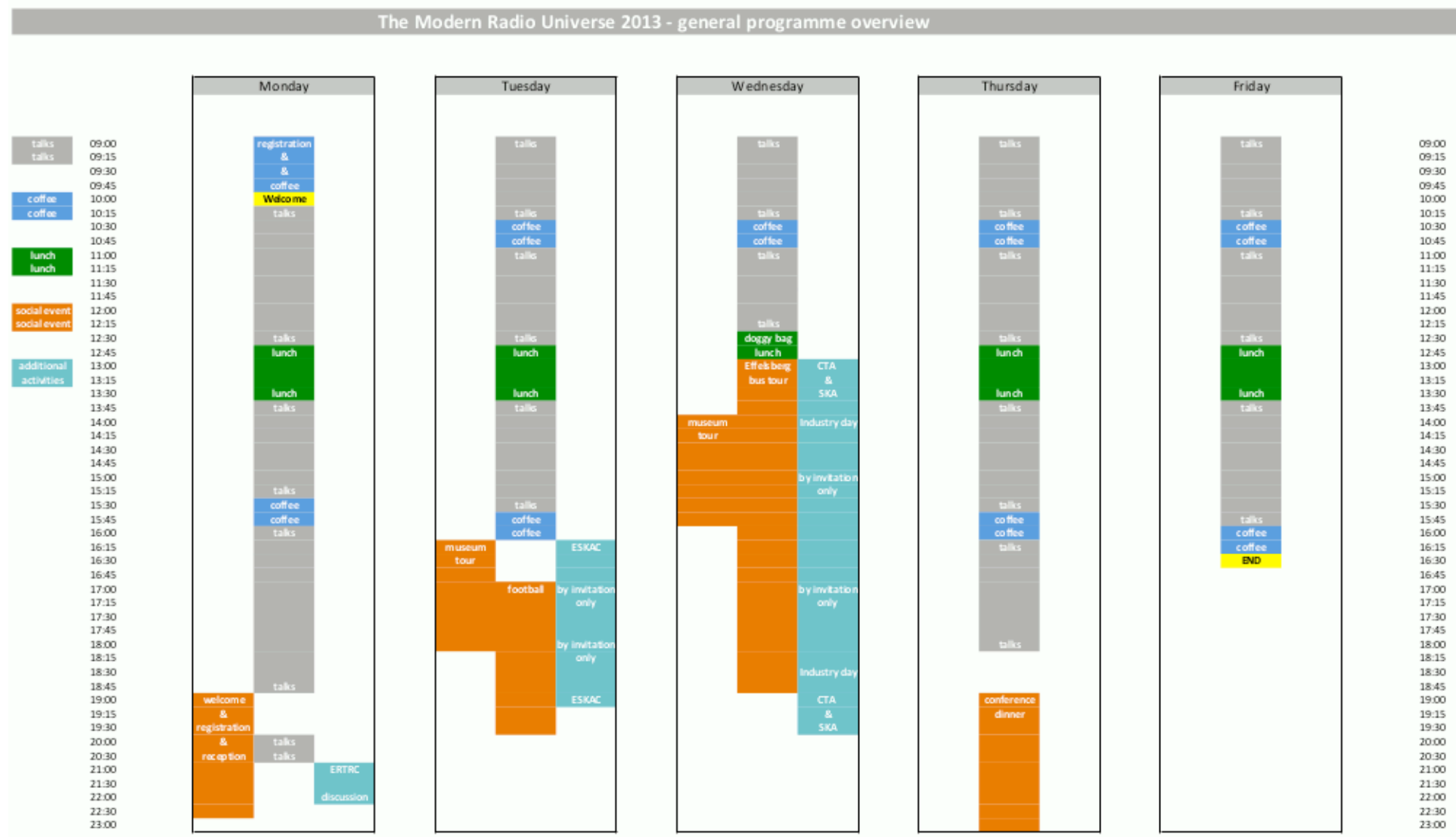


Fig. 1 The schematic overview of the agenda of the conference MRU2013.

2.1 Programme of the meeting

The scientific programme consists of 94 talks including 16 invited contributions. The 78 remaining talks have been selected from 160 abstracts by the SOC using a point system and competitive selection criteria. In addition to the oral contributions the conference compromised a poster session with almost 100 posters.

LINK:

The scientific presentations are available online via:

<https://indico.mpifr-bonn.mpg.de/indico/conferenceTimeTable.py?confId=21#20130422>

Monday 22 April 2013

Welcome (10:00-10:15)

- FALCKE / KLOECKNER

Radio AGN populations in the nearby Universe, and their evolution (10:15-10:40)

- PHILIP, Best (IfA Edinburgh)

Towards the discovery of the first radio galaxies (10:40-10:55)

- AFONSO, Jose (Centre for Astronomy and Astrophysics, University of Lisbon)

Active black holes in radio surveys: from the local universe to high-redshift (10:55-11:10)

- VAN VELZEN, Sjoert (Radboud University)

Hello Source Counts, My Old Friend (11:10-11:25)

- Dr. IAN, Heywood (University of Oxford)

Cosmic radio dipole from NVSS and WENSS (11:25-11:40)

- RUBART, Matthias (Bielefeld University)

The modern deep radio sky (11:40-11:55)

- Dr. PADOVANI, Paolo (ESO)

More than LESS: First results from the ALMA survey of the Extended Chandra Deep Field South (11:55-12:10)

- Dr. KARIM, Alexander (ICC Durham/AlfA Bonn)

The Deepest View of the Radio Universe at 3 GHz (12:10-12:25)

- VERNSTROM, Tessa (University of British Columbia)

LOFAR MSSS: Overview and Survey Progress (12:25-12:40)

- Dr. HEALD, George (ASTRON)

Unification (13:45-14:10)

- KOERDING, Elmar (Radboud Universiteit Nijmegen)

mJIVE-20: finding AGN far and wide with a shallow VLBI survey (14:10-14:25)

- Dr. DELLER, Adam (ASTRON)

The AGN component of the faint radio source population (14:25-14:40)

- Dr. MIDDELBERG, Enno (Astronomisches Institut der Ruhr-University Bochum)

Radio-loud LLAGN probed with the EVN (14:40-14:55)

- Dr. PARAGI, Zsolt (Joint Institute for VLBI in Europe)

AGN Jet Kinetic Power and the Energy Budget of Radio Galaxy Lobes (14:55-15:10)

- Dr. GODFREY, Leith (ICRAR/Curtin University)

Searching for jet radio emission from intermediate-mass black holes (15:10-15:25)

- Dr. MEZCUA, Mar (Instituto de Astrofísica de Canarias)

The MOJAVE Survey and the role of a long term VLBA monitoring in AGN jet studies (16:00-16:15)

- Dr. SAVOLAINEN, Tuomas (Max-Planck-Institut f. Radioastronomie)

A LOFAR view of the hotspots of Cygnus A (16:15-16:30)

- Dr. MCKEAN, John (ASTRON)

LOFAR Observations of Hercules A (16:30-16:45)

- BIRZAN, Laura (Leiden Observatory)

The radio/gamma-ray connection: cm to sub-mm band radio and gamma-ray correlated variability in Fermi bright blazars (16:45-17:00)

- Dr. FUHRMANN, Lars (Max-Planck-Institut für Radioastronomie Bonn)

Effect of interactions and environment on radio and optical nuclear activity. (17:00-17:15)

- Dr. SABATER, Jose (IfA, University of Edinburgh)

AGN feedback works both ways (17:15-17:30)

- ZINN, Peter-Christian (Ruhr-University Bochum)

The Beginnings of German Radio Astronomy and the Road to the Effelsberg 100 meter Telescope (20:00-20:30)

- Prof. MENTEN, Karl (MPIfR)

Radio Astronomy: from Karl Jansky to the SKA (20:30-21:00)

- KELLERMAN, Ken (National Radio Astronomy Observatory)

Tuesday 23 April 2013**Black holes (09:00-09:25)**

- Presenters: REZZOLLA, Luciano

The Distance, Mass, and Spin of the Black Hole in Cyg X-1 (09:25-09:40)

- Dr. REID, Mark (Harvard-Smithsonian CfA)

Observing super massive black holes with Schwarzschild radius resolution using very high frequency VLBI (09:40-09:55)

- Dr. WEINTROUB, Jonathan (Harvard-Smithsonian CfA)

Microarcsecond Scale Imaging of Black Holes and Jets (09:55-10:10)

- Dr. KRICHBAUM, Thomas (MPIfR)

Radio Detections of the Intermediate-Mass Black Hole ESO243-49 HLX-1 (10:10-10:25)

- Dr. CSEH, David (Radboud University Nijmegen)

On the formation and destruction of self-absorbed compact jets in accreting binary black holes (11:00-11:15)

- Prof. CORBEL, Stephane (Univ. Paris Diderot & CEA Saclay)

Fundamental gravitational physics with the SKA (11:15-11:30)

- Prof. LAEMMERZAHN, Claus (ZARM, University Bremen)

Relativistic radio transients (11:30-11:55)

- SODERBERG, Alicia

The High Time Resolution Universe survey for pulsars and transients (11:55-12:10)

- Dr. JOHNSTON, Simon (CSIRO)

Constraining the rates of bright, nearby, millisecond transients (12:10-12:25)

- Dr. KARASTERGIOU, Aris (University of Oxford)

Results from a Transient Survey of the Stripe 82 region with the JVLA (12:25-12:40)

- Dr. BOURKE, Stephen (Caltech)

Variability measurements of Sgr A* at ALMA bands 3, 6 and 7 (13:45-14:00)

- BRINKERINK, Christiaan (Dept. of Astrophysics, Radboud University Nijmegen)

FRATs: Real-time detection of Fast Radio Transients with LOFAR (14:00-14:15)

- TER VEEN, Sander (Radboud Universiteit Nijmegen)

LWA1, Crab Giant Pulses, and a Commensal Search for other Short Dispersed Pulses (14:15-14:30)

- ELLINGSON, Steven (Virginia Tech)

"An X-Raydio Switcheroo" -- synchronous X-ray and radio mode changes in a pulsar (14:30-14:45)

- Dr. VAN LEEUWEN, Joeri (ASTRON)

LOFAR's View of Millisecond Pulsars (14:45-15:00)

- Dr. KONDRATIEV, Vladislav (ASTRON)

Can we see pulsars around Sgr A*? - The latest searches with the Effelsberg telescope (15:00-15:15)

- Dr. EATOUGH, Ralph (Max-Planck-Institut für Radioastronomie)

Pulsars: Rapidly Spinning Towards the SKA (15:15-15:40)

- Dr. HESSELS, Jason (ASTRON / University of Amsterdam)

Wednesday 24 April 2013**The polarised sky (09:00-09:25)**

- Presenters: SCAIFE, Anna

Large-scale magnetic field structure and its evolution in spiral galaxies (09:25-09:40)

- KRAUSE, Marita (MPIfR)

Low-frequency Polarisation Studies of Pulsars with LOFAR (09:40-09:55)

- Dr. NOUTSOS, Aristeidis (MPIfR)

Exploring the Polarised Sky with the Global Magneto-Ionic Medium Survey (09:55-10:10)

- Dr. DOUGLAS, Kevin (University of Calgary/Dominion Radio Astrophysical Observatory)

Studying the Galactic Magnetic Field with the CGPS (10:10-10:25)

- GEISBUESCH, Joern (NRC-DRAO)

The LOFAR view of Cosmic Magnetism (10:25-10:40)

- Dr. BECK, Rainer (MPIfR)

MAGMO: Mapping the Galactic Magnetic field through OH masers (11:00-11:15)

- Dr. GREEN, James (CSIRO Astronomy and Space Science)

Exploring magnetic fields with LOFAR (11:15-11:30)

- SOBEY, Charlotte (MPIfR)

INVITED TALK - Cluster (11:30-11:55)

- BRUNETTI, Gianfranco

Spectral and morphological signatures of cluster merger shocks: CIZA J2242.8+5301 (11:55-12:10)

- STROE, Andra (Leiden Observatory)

Radio observations of cosmic rays and magnetic fields in galaxy clusters. (12:10-12:25)

- Dr. BONAFEDE, Annalisa (Hamburger Sternwarte - Hamburg University)

Thursday 25 April 2013**High z star formation (09:00-09:25)**

SMOLCIC, Vernesa

The e-MERGE Star-formation Survey (09:25-09:40)

Dr. MUXLOW, Tom (Jodrell Bank Centre for Astrophysics, University of Manchester, UK)

Resolving the Nuclear Outburst in NGC 660 (09:40-09:55)

- Dr. MOMJIAN, Emmanuel (NRAO)

Wide-field global VLBI observations of the globular cluster M15 (09:55-10:10)

- KIRSTEN, Franz (Max Planck Institut für Radioastronomie)

Unveiling details of the radio continuum emission in M51 (10:10-10:25)

- Dr. DUMAS, Gaelle (IRAM)

Interplay between the star formation and ISM as probed by the radio-FIR correlation in galaxies (11:00-11:15)

- Dr. TABATABAEI, Fatemeh (Max-Planck-Institut für Astronomie)

Reionization and the Cosmic Dawn (11:15-11:40)

- Prof. KOOPMANS, Leon (Kapteyn Astronomical Institute)

The LOFAR EoR Key Science Project: first results (11:40-11:55)

- Prof. DE BRUYN, Ger (ASTRON / Kapteyn Institute)

Observability of the Dark Ages and the Epoch of Reionization: What do large-scale simulations tell us? (11:55-12:10)

- Dr. ILIEV, Ilian (University of Sussex)

The 21cm view of the Epoch of Reionization (12:10-12:25)

- Prof. MELLEMA, Garrelt (Dept. of Astronomy, Stockholm University)

Intergalactic Gas in Groups of Galaxies: Implications for Dwarf Spheroidal Formation and the Missing Baryons Problem (12:25-12:40)

- Dr. FREELAND, Emily (Stockholm University)

Large-scale HI streams (13:45-14:00)

- WONG, Ivy (CSIRO)

INVITED TALK - Gas in Galaxies (14:00-14:25)

- Dr. KORIBALSKI, Baerbel (CSIRO ATNF)

The Effelsberg-Bonn HI Survey first data release: The Local Universe (14:25-14:40)

- Presenters: Mr. FLOER, Lars (AlfA)

Complete Ionisation of the Neutral Gas in High Redshift Active Galaxies (14:40-14:55)

- Dr. CURRAN, Stephen (Sydney Institute for Astronomy)

Evolution in the H I Distribution of Galaxies in Groups as Evidence for Pre-processing and Mass Assembly at the Current Epoch (14:55-15:10)

- Prof. WILCOTS, Eric (University of Wisconsin)

Stacking and Intensity Mapping in Radio Astronomy (15:10-15:25)

- Prof. STAVELEY-SMITH, Lister (ICRAR/UWA)

A Pilot for a VLA HI Deep Field (16:00-16:15)

- FERNANDEZ, Ximena (Columbia University)

INVITED TALK - HI cosmology (16:15-16:40)

- MEYER, Martin

The evolution of the cosmic atomic and molecular gas mass density (16:40-16:55)

- Dr. ZWAAN, Martin (ESO)

Importance of atomic hydrogen in H2 and star formation (16:55-17:10)

- Prof. STANIMIROVIC, Snezana (University of Wisconsin, Madison)

PdBI observations of far infra-red emission lines in high redshift quasars (17:10-17:25)

- SIMONA, Gallerani (Scuola Normale Superiore di Pisa)

Probing changes in the fundamental constants with cosmological time (17:25-17:50)

- Dr. KANEKAR, Nissim (National Centre for Radio Astrophysics)

Friday 26 April 2013**Structures of the Milky Way and local group (09:00-09:25)**

- BRUNTHALER, Andreas

Redetermination of Galactic Spiral Density Wave Parameters Based on Analysis of Masers VLBI Observations (09:25-09:40)

- Prof. BOBYLEV, Vadim (Central (Pulkovo) Astronomical Observatory of Russian Academy of Sciences)

Spectral ageing: New results and methods of spectral analysis using JVLA broadband radio data (09:40-09:55)

- HARWOOD, Jeremy (University of Hertfordshire)

Line Spectroscopy with LOFAR (09:55-10:10)

- Dr. OONK, Raymond (ASTRON (Netherlands Institute for Radio Astronomy))

The SKA baseline design and an update on recent progress (10:10-10:25)

- Dr. DIAMOND, Phil (SKA Organisation)

Compact Atomic Hydrogen Clouds in an Outflow from the Milky Way's Centre (11:00-11:15)

- Dr. MCCLURE-GRIFFITHS, Naomi (CASS)

The Effelsberg-Bonn HI Survey first data release: The Milky Way galaxy (11:15-11:30)

- Dr. WINKEL, Benjamin (MPIfR)

The four leading arms of the Magellanic Cloud system (11:30-11:45)

- Dr. KERP, Juergen (Argelander-Institut für Astronomie, Universität Bonn)

How do cool stars lose mass? (11:45-12:00)

- Dr. RICHARDS, Anita (University of Manchester)

SETI (12:00-12:25)

- SIEMION, Andrew

Current Status and New Capabilities of the Jansky Very Large Array (12:25-12:40)

- Dr. VAN MOORSEL, Gustaaf (NRAO)

ALMA: current status and future prospects (13:45-14:00)

- LAING, Robert (ESO)

e-MERLIN (14:00-14:15)

- BESWICK, Rob

The Giant Metre-wave Radio Telescope: Current Status, Some Recent Science Highlights and Upgrade Plans for the Future (14:15-14:30)

- Prof. GUPTA, Yashwant (National Centre for Radio Astrophysics)

KAT-7 and MeerKAT update (14:30-14:45)

- DEANE, Roger

Update on The Australian SKA Pathfinder (14:45-15:00)

- Dr. LISA, Harvey-Smith (CSIRO)

VLBI at low frequencies (15:00-15:15)

- Dr. WUCKNITZ, Olaf (MPIfR)

RadioAstron Space VLBI mission: current status and early results (15:15-15:30)

- Dr. KOVALEV, Yuri (Astro Space Center of Lebedev Physical Institute)

Cluster Science with ASKAP and the Murchison Wide Field Array and the Australian SKA Pathfinder (15:30-15:45)

- JOHNSTON-HOLLITT, Melanie (Victoria Univ. of Wellington)

New instruments at the IRAM 30m telescope (15:45-16:00)

- Dr. KRAMER, Carsten (IRAM)

2.2 Scientific report

80 years ago, in spring 1933, Karl Jansky published his discovery of cosmic radio emission. This paved the way not only for a new discipline, radio astronomy, but also for an exploration of the universe that now encompasses almost the entire electromagnetic window. Today, radio astronomy is about to enter into yet another new era with a number of new or upgraded radio facilities coming online and major new initiatives, like ALMA or the Square Kilometre Array (SKA).

The initial goal of the - Modern Radio Universe 2013 - was to highlight the original and exciting science currently being produced by radio astronomical telescopes, such as the GBT, Effelsberg, LOFAR, ALMA, JVLA, GMRT, e-MERLIN, EVN, VLBA, as well as pathfinder experiments of the SKA, and others. This goal has been archived with a very dense scientific programme of almost 100 oral contributions and 100 posters, covering cosmology, galaxy evolution, AGN & compact objects, star formation, the interstellar medium, Galactic science, radio transients, fundamental, extreme physics and associated theory. Furthermore, the conference provided an update on the newest technical developments at various facilities.

In general, the conference programme covered a large range of various and diverse topics. In fact, some of the presented scientific discoveries are that new and of a high impact and are at present in the publications stage by ranked journals such Nature, Science, etc. Also due to the selection criteria of the scientific programme most of the presentations are of such quality that no specific judgement can be given on highlights and therefore the description of the scientific programme will cover a random selection of contributions and scientific results.

Apart from the scientific programme, the SOC invited 16 people to provide overview talks on specific topics. The range of the covered topics of the overview talks can be seen as the scientific layout of the conference. The individual topics of the invited presentations are:

<p>Monday – 22 April 2013</p> <ul style="list-style-type: none"> - Radio AGN populations in the nearby Universe and their evolution - Unification
<p>Tuesday – 23 April 2013</p> <ul style="list-style-type: none"> - Black holes - Relativistic radio transient - Pulsars: Rapidly spinning towards the SKA
<p>Wednesday – 24 April 2013</p> <ul style="list-style-type: none"> - The polarised sky - Clusters
<p>Thursday – 25 April 2013</p> <ul style="list-style-type: none"> - High z star formation - Reionisation and the cosmic dawn - Gas in Galaxies - HI cosmology - Probing changes in the fundamental constants with cosmological time
<p>Friday – 26 April 2013</p> <ul style="list-style-type: none"> - Structures of the Milky Way and local group - SETI

In the following, a short summary of the individual days of the scientific programme is given and some presentations are discussed.

- Monday – 24 April 2013

The first session on Monday covered new results from recent radio surveys obtained by the JVLA, LOFAR, and ALMA.

As an example, **PADOVANI** presented recent results on the sub-mJy radio source populations at 1.4 GHz based on the Extended Chandra Deep Field South VLA survey. Based in the survey sensitivity of about 30 microJy, details on radio source evolution and luminosity functions have been discussed. One of their outcomes are that the sub-mJy radio sky turns out to be a complex mix of: star-forming galaxies and radio-quiet AGN evolving at a similar, strong rate; non-evolving low-luminosity radio galaxies; and declining radio powerful ($P > 10^{24}$ W/Hz) AGN. One of their results suggests that radio emission from $z \sim 2$ radio-quiet AGN is closely related to star formation.

Further, observational constraints on radio source counts have been discussed based on large scale simulations. In particular, the observed values of the faint source counts at 1.4 GHz do not agree to within their stated uncertainties, and there are many plausible factors that could cause this. **HEYWOOD** showed how the sampling variance imposed on the observed counts is due to a combination of Poisson statistics and intrinsic cosmological source clustering is a major contributor to the scatter in the source counts, and may even be the sole cause at flux densities below 50 micro-Jy.

Additional survey science has been discussed by using a novel application of linear estimators to determine the magnitude and direction of the cosmic radio dipole. **RUBART** finds that the NVSS and WENSS estimates of the cosmic radio dipole are consistent with each other and with the direction of the cosmic microwave background (CMB) dipole. However they find inconsistencies in the NVSS dipole amplitude of $(1.6 \pm 0.6) \times 10^{-2}$ in direction (RA, DEC = $(154^\circ \pm 21^\circ, -2^\circ \pm 21^\circ)$) with the CMB. In particular, the estimated amplitude exceeds the one expected from the CMB by a factor of about 3 and is inconsistent with the assumption of a pure kinetic origin of the radio dipole at 99.5 % CL.

The second and third session on Monday covered topics such as: the morphology of radio source & their substructures, nuclear activity, active galactic nuclei, and observational techniques to discriminate various source populations and source components.

MCKEAN presented LOFAR imaging, at the highest ever angular resolution obtained at the lowest observable radio frequencies, of the nearby active galaxy Cygnus A (3C 405; $z = 0.056$). Furthermore, they confirmed that the overall spectral index distribution of the source steepens towards the centre, consistent with previous imaging at higher radio frequencies. Using the few arcsecond-scale resolution provided by LOFAR, they are able to determine the radio spectral index of individual components of the source for the first time. Finally they found that the spectra for both hotspots turnover around 160 MHz, and are highly inverted below this frequency, ruling out a low energy-cut off model for the electron distribution in this region.

SAVOLAINEN presented results from the MOJAVE Survey (Monitoring of Jets in AGN with VLBA Experiments), which is a long-term program to monitor the structural evolution of the parsec-scale jets in blazars using the Very Long Baseline Array (VLBA). The current monitoring sample includes over 300 sources that are regularly observed at 2 cm wavelength

in both linear and circular polarisation. This allows also probing the magnetic field structure of the jets. Many of these jets have been monitored since the mid-1990s, which provides an opportunity to study their long-term behaviour including accelerations, bends, rotations of the jet nozzle, the filling factor of the flow channel, and development of instabilities. From the analysis of the long-term MOJAVE data several lines of evidence are emerging, which suggests that the jets are still becoming organised at distances of tens of parsecs from the central engine and that the flow channels may be wider than what is seen illuminated at any given epoch.

- Tuesday – 25 April 2013

All contributions of the first session on Tuesday show new results of measuring black holes properties.

REID presented a rock-solid and precise measurement of the distance to the high-mass X-ray binary Cyg X-1, which contains the first black hole candidate to be discovered. The distance was obtained by trigonometric parallax, using the VLBA, and has an uncertainty of only 6 %. This firm result allows accurate modelling of the system, which yields precision estimates of the masses of both stars of the binary system. The mass of the compact object is 15 ± 1 Msun, far above that possible for a neutron star. Based on the accurate distance and mass measurements, analysis of X-ray data in the thermal state, where disk emission dominates, yields the black hole spin.

WEINTROUB and **KRICHBAUM** presented independently observations of Sgr A* with high frequency Very Long Baseline Interferometry (VLBI), the technique whereby radio telescopes around the world are linked together in a Global array with extraordinary angular resolution. Very short wavelength VLBI observations have now confirmed structure on ~ 4 Schwarzschild radius scales within Sgr A*, and have revealed time variability in this source on the same spatial scales.

The 2nd and 3rd sessions on Tuesday covers transient, pulsar science, and the variable sky.

BOURKE presented results from multi epoch transient surveys with the JVLA. Using the new capabilities of the JVLA they have conducted a 3 epoch transient survey in the SDSS Stripe 82 region. The survey covers a field of 50 sq. deg. at 3 GHz to a rms noise level of 75 micro Jy per epoch with temporal baselines of 1 week and 1 month. Simultaneous optical monitoring (with the Palomar Transient Factory) was also performed. They developed a distributed calibration and imaging pipeline machinery that allows processing the data in near-real-time for rapid follow-up. First results show a dozen bona fide transients, including a tidal disruption event candidate and a magnetic flare from a RS CVn star.

BRINKERINK presented variability measurements of Sgr A* at ALMA bands. The authors have observed Sagittarius A* over an 8-hour time period with ALMA at bands 3 (100 GHz), 6 (250 GHz) and 7 (340 GHz) and present the measured lightcurves of Sagittarius A* at these frequencies. Jet models for Sagittarius A* predict a clear relation in time variability between emission at different radio frequencies. They presented time lags between the ALMA bands that have been measured up to now only in the 22-43 GHz range, but not at higher frequencies.

ELLINGSON presented LWA1 observations to monitor the giant pulses (GP) of the Crab Nebula pulsar (B0531+21) in the frequency range 20 - 84 MHz. In general, the LWA1

receives on average 3-5 GPs/hour which have pulse energy sufficiently large to be detected with high signal-to-noise ratio over the entire range 36-84 MHz simultaneously, with intermittent detections extending into the 20-34 MHz range. Such capability enables one to determine the pulse waveform as a function of frequency on a pulse-by-pulse basis. Their scientific goal is to establish rigorous rate-density limits for pulse emission over the widest possible range of DM, pulse width, and wavelength accessible to LWA1. The authors analysed statistics of pulse amplitude and waveform characteristics, including pulse broadening. The first 10 hours of data have been fully reduced, resulting in no significant detections (other than Crab GPs), implying a limit of less than 3.3×10^{-5} events $\text{yr}^{-1} \text{pc}^{-3}$ with pulse energy greater than 800 Jy s.

- Wednesday – 26 April 2013

On Wednesday the scientific programme took place only in the two morning sessions covering polarised radio emission and cluster science.

NOTSOS showed LOFAR polarisation observations of bright pulsars below 200 MHz; these comprise the highest-quality data of this kind available to date. In general, polarisation properties of pulsars has been extensively studied at frequencies of hundreds of MHz up to a few GHz, but little is known of the polarisation properties of pulsars below a few hundreds of MHz. LOFAR is the first radio telescope with high sensitivity below 200 MHz, that allows a detailed study of pulsar polarisation at the lowest radio frequencies accessible from the ground. A comparison of pulsar polarisation properties, like the fraction of linear polarisation and that of orthogonal-mode emission, between ~ 100 MHz and ~ 1 GHz can provide invaluable information about the little-understood coherent radio emission of pulsars. A comparison of the measured polarisation properties with those published in the literature showed how the high-precision rotation measures from LOFAR enables us to get a complete picture of the distribution of particles in pulsar magnetospheres that are responsible for the observed polarised emission.

STROE presented GMRT, WSRT, INT, and LOFAR observations to investigate the spectral and morphological signatures of the cluster merger shocks in CIZA J2242.8+5301. The authors uncovered a very steep spectrum compact radio emission and observed a bi-modality in the distribution and orientation of cluster radio galaxies, which confirmed the merging nature of the cluster itself. Their analysis combined WSRT HI and INT H α mapping of the cluster volume and outskirts and showed evidence of interaction between the intra-cluster gas and the radio galaxies travelling at high speeds and shaping their radio jets into a head-tail morphology. Furthermore, the authors showed a striking deficit of neutral and ionised gas in cluster galaxies as compared to the field. They find significant over-densities of H α emitters in the proximity of the northern relic and particularly near the southern relic. Most importantly, the vast majority of the H α galaxies near the relics exhibit disturbed and extended morphologies of up to 40 kpc, while field emitters are a factor of 2-3 smaller. Since H α traces star formation and HI cold gas, these studies provide the first direct test whether the shock drives or prohibits star formation and to decipher the role of the merger in shaping the HI and H α luminosity functions.

- Thursday – 27 April 2013

On Thursday each of the 4 sessions compromised different scientific topic. The contributions in the first session covered star formation, in the second session our current knowledge of the epoch of reionisation has been discussed, and in the third and fourth session line emission in galaxies (e.g. neutral hydrogen or from molecular species) and their cosmological applications presented.

MUXLOW discussed the star-formation survey e-MERGE and showed recent e-MERLIN commissioning observations. e-MERGE is an ambitious Legacy survey to exploit e-MERLIN's unique combination of sensitivity and spatial resolution to study the formation and evolution of star-forming galaxies and AGN out to redshifts of $z > 5$. These observations will provide a powerful, obscuration-independent tool for measuring the massive star formation and AGN activity in high-redshift galaxies, hence tracing the development of the stellar populations and the black hole growth in the first massive galaxies. With a resolution of 50-200 mas in C- and L-Bands, corresponding to < 0.5 -1.5kpc at $z > 1$, e-MERLIN gives us our first truly reliable view of the distribution of star-formation within typical galaxies at the epoch where the bulk of the stars in the present-day Universe were being formed. e-MERLIN will disentangle the relative contributions of AGN and star-formation, an essential step given the apparently simultaneous growth of the black holes and stellar populations in galaxies. e-MERGE will also statistically characterize the nature of the sub-micro Jy radio population, which are the target objects for the SKA.

DE BRUYN showed first results of the LOFAR EoR Key Science Project, which aims to study the redshifted 21cm signals from the Epoch of Reionization. LOFAR Cycle-0 observations started in December 2012 and more than two hundred hours of good quality data have now been accumulated on each of the two primary 'windows': the North Celestial Pole and the field around the bright compact radio source 3C196. The observations span the frequency range from 115-189 MHz, covering HI redshifts between $z=6.5$ and 11.3. The authors showed ultra-deep continuum images (< 50 microJy noise, 6" PSF) of these fields and describe the prospects of detecting signals from the EoR. The processing of the entire data is expected to last for at least another 6 months. The authors also discuss some of the challenges in the calibration and processing of this gigantic dataset (several 100 TB).

WONG showed first results of an automated search of large-scale HI streams in the HIPASSv2 dataset. Observations of diffuse gas external to galaxies are still somewhat limited even though one of the key unknowns (in our understanding of galaxy formation) is how galaxies accrete gas and build up its baryonic content. Using the new HIPASSv2 maps, the authors presented evidence for a large-scale diffused neutral intergalactic medium within the GH 58 galaxy group, which consist of several compact sub-groups of galaxies. Most notably, a large HI stream extending ~ 500 kpc between HCG44 and NGC 3162 has been presented. Compared to the currently published version of the HI Parkes All-Sky Survey (HIPASS), the newly-reprocessed version (HIPASSv2) presents an improvement in the noise RMS by a factor of 1.5. WONG also presented some early results from the search for large-scale diffused HI streams within the nearby Universe using HIPASSv2. They showed hundreds of new candidates of large-scale diffused emission that may otherwise remain undetected via interferometric observations.

ZWAAN discussed the evolution of the cosmic atomic and molecular gas mass density. The author presented new measurements of the atomic and molecular gas mass density at various redshifts using the spectral stacking technique. For this they used the JVLA to make an accurate measurement of the cosmic molecular mass density at redshift $z=1.6$. This redshift corresponds to a time when the star formation rate density of the Universe was peaking and the build-up of stellar mass was happening faster than ever. Since molecular gas is driving star formation, measuring the evolution of the molecular gas mass density, Ω_{mol} , is fundamental to our understanding of galaxy evolution. The authors showed a statistical measurement of the CO content of ~ 100 well-studied galaxies at $z \sim 1.6$ and use this to make a robust measurement of the molecular gas mass density. Their results put strong constraints on semi-analytical models of galaxy evolution that include the role of cold gas and predict that the molecular mass density grows an order of magnitude between $z=0$ and $z=2$. In addition, they presented WSRT results of HI stacking that result in an accurate

measurement of the atomic gas mass density at redshift $z=0.2$. Both results are the most reliable measurements made with the 21-cm emission stacking technique beyond the local universe, and the highest signal-to-noise measurements of Ω_{HI} at intermediate redshift, bridging the gap between high- z damped Ly-alpha observations and blind 21-cm surveys at $z=0$. Their measurements are also consistent with the fact that the neutral gas density increases by a factor of two between $z=0$ and $z=1$. Finally they discussed the implications of these measurements in the general context of galaxy evolution and discuss the ramifications for future gas evolution studies with ALMA and the SKA.

- Friday – 28 April 2013

The first and some parts of the second session on Friday covered Galactic science, whereas the rest of the programme provides overview talks of new observing modes and technical upgrades of current or new observatories like LOFAR, VLBI, JVLA, ALMA, e-MERLIN, GMRT, KAT-7 & MeerKAT, Australian SKA pathfinders, RADIOASTRON, and the IRAM 30m telescope.

WINKEL reported on the first data release of the Effelsberg-Bonn HI survey (EBHIS). **EBHIS** covers the whole northern sky above Dec > -5 deg in HI 21-cm line emission. EBHIS comprises information on the neutral hydrogen of the Milky Way as well as on the Local Volume Galaxies out to a redshift of 0.07. The data reduction software has been developed from scratch and includes novel calibration methods and RFI mitigation algorithms. Furthermore, EBHIS is fully corrected for stray-radiation, which is one of the most important aspects for quantitative studies of the gaseous phases of the Milky Way galaxy. Even prior to its completion, the EBHIS data have been already used by their collaborators for a broad range of scientific applications including correlation with Planck data, IVC/HVC research, and as resource for short-spacing corrections of Milky Way and nearby galaxy data. Some of these early results have been used to highlight the extraordinary quality of the EBHIS data products. In addition to the presentation by WINKEL the group also presented the extra-galactic part in the talk by FLÖR.

BOBYLEV showed how maser VLBI observations can be used to redetermine the Galactic Spiral Density Wave Parameters. The spatial velocities of all 58 currently known masers with trigonometric parallaxes, proper motion, and line-of-sight velocities are analysed to re-determine the Galactic kinematic parameters. The authors showed a new method of searching for periodicities in the residual velocities of Galactic objects to estimate the parameters describing the Galactic spiral density wave in accordance with the linear theory. In contrast to the standard method of periodogram analysis of series that the authors used previously, this new method, based on a modified Fourier analysis, takes into account the logarithmic pattern of the Galactic spiral structure and the position angles of Galactic objects. All this allows for an accurate analysis of the velocities for objects distributed in a wide range of Galactocentric distances. In order to increase the significance of the extraction of periodic signals from data series with large gaps the authors also developed a spectrum reconstruction method based on the generalized maximum entropy method. In summary, the authors demonstrated that they could redetermined the Galactic spiral density wave parameters (e.g. peak velocity of periodic perturbations, the wavelength including the pitch angle of the density wave, the phase of the Sun in the density wave, velocity of the perturbations near the location of the Sun). Taking also into account perturbations evoked by the spiral density wave, they have obtained non-perturbed components of the peculiar solar velocity with respect to the local standard of rest (LSR).

2.3 Meeting Photo

Modern Radio Universe 2013 - conference picture in front of the venue. Further pictures can be found via the web page of the conference.



2.4 Participant list

One of the highlights of this conference is that it showed how vibrant and young radio astronomy has become, that is shown by the fact that undergraduate students have delivered more than 10% of the oral contributions. The gender balance of the conference was 25% female to 75% male.

The 204 participants of the conference are from 23 countries distributed from all over the world.

Australia	12
Canada	3
Chile	1
China	1
Croatia	1
France	6
Germany	69
Greece	1
Hungary	1
India	4
Italy	6
Mexico	1
The Netherlands	30
New Zealand	1
Poland	2
Portugal	1
Republic of Korea	1
Russia	6
South Africa	5
Spain	4
Sweden	4
Ukraine	1
United Kingdom (UK)	27
United States of America (USA)	16
	204

The individual participants are listed in the following:

Last name	First name	Institution	City	Country
Afonso	Jose	Centre for Astronomy and Astrophysics of the University of Lisbon	Lisbon	PORTUGAL
Andernach	Heinz	Depto. de Astronomía, Univ. Guanajuato	Guanajuato	MEXICO
Argo	Megan	ASTRON	Dwingeloo	NETHERLANDS
Avison	Adam	Manchester University	Manchester	UNITED KINGDOM
Baars	Jaap	MPIfR	Rheinbach	GERMANY
Bach	Uwe	Max-Planck-Institut für Radioastronomie	Bonn	GERMANY
Bajkova	Anisa	Central (Pulkovo) Astronomical Observatory of RAS	Saint-Petersburg	RUSSIA
Beck	Rainer	MPIfR	Bonn	GERMANY
Ben Bekhti	Nadya	Argelander-Institut für Astronomie	Bonn	GERMANY
Bertoldi	Frank	AlfA	Bonn	GERMANY
Best	Philip	Institute for Astronomy, Edinburgh	Edinburgh	UNITED KINGDOM
Beswick	Rob	JBCA, University of Manchester	Manchester	UNITED KINGDOM
Biggs	Andy	ESO	München	GERMANY
Birzan	Laura	Leiden Observatory	Leiden	NETHERLANDS
Bobylev	Vadim	Central (Pulkovo) Astronomical Observatory	Saint-Petersburg	RUSSIA
Boccardi	Biagina	MPIfR	Bonn	GERMANY
Bonafede	Annalise	University of Hamburg	Hamburg	GERMANY
Bourke	Stephen	CALTECH	Pasadena	USA
Brinkerink	Christiaan	Radboud University Nijmegen	Nijmegen	NETHERLANDS
Brinks	Elias	University of Hertfordshire	Hatfield	UNITED KINGDOM
Britzen	Silke	MPIfR	Bonn	GERMANY
Brunetti	Gianfranco	IRA Bologna	Bologna	ITALY
Brunthaler	Andreas	MPIfR	Bonn	GERMANY
Chandola	Yogesh	NCRA-TIFR	Pune	INDIA
Chandra	Ishwara	NCRA	Pune	INDIA
Charlot	Patrick	Laboratoire d'Astrophysique de Bordeaux	Floirac	FRANCE
CORBEL	Stéphane	Univ. Paris Diderot & CEA Saclay	Gif sur Yvette cedex	FRANCE
Cseh	David	Radboud University Nijmegen	Nijmegen	NETHERLANDS
Curran	Stephen	ARC Centre of Excellence	Sydney	AUSTRALIA
de Bruyn	Ger	ASTRON & Kapteyn Institute	Dwingeloo	NETHERLANDS
de Graauw	Thijs	ALMA	Vitacura, Santiago	CHILE
Deane	Roger	University of Cape Town	Cape Town	SOUTH AFRICA
Deller	Adam	ASTRON	Dwingeloo	NETHERLANDS
Dembska	Marta	Kepler Institute of Astronomy, University of Zielona Góra	Zielona Góra	POLAND
Dettmar	Ralf-Jürgen	Ruhr-University Bochum	Bochum	GERMANY
Dewdney	Peter	SKA Organisation	Macclesfield	UNITED KINGDOM
Diamond	Philip	SKA Organisation	Macclesfield	UNITED KINGDOM
Douglas	Kevin	University of Calgary/DRAO	Penticton	CANADA
Dumas	Gaelle	IRAM	Grenoble	FRANCE
Eatough	Ralph	MPIfR	Bonn	GERMANY
Ellingson	Steven	Virginia Tech	Blacksburg	USA
Engels	Dieter	Hamburger Sternwarte	Hamburg	GERMANY
Etoka	Sandra	Hamburger Sternwarte	Hamburg	GERMANY
Falcke	Heino	Radboud University, Nijmegen	Nijmegen	NETHERLANDS
Fanaroff	Bernie	SKA SA	Cape Town	SOUTH AFRICA
Fender	Rob	University of Southampton	Southampton	UNITED KINGDOM
Fenech	Danielle	University College London	London	UNITED KINGDOM
Feretti	Luigina	Istituto di Radioastronomia INAF	Bologna	ITALY
Fernandez	Ximena	Columbia University	New York	USA

Last name	First name	Institution	City	Country
Flöer	Lars	Argelander-Institut für Astronomie	Bonn	GERMANY
Freeland	Emily	Stockholm University	Stockholm	SWEDEN
Frey	Sandor	Institute of Geodesy, Cartography and Remote Sensing	Budapest	HUNGARY
Fuhrmann	Lars	Max-Planck-Institut für Radioastronomie Bonn	Bonn	GERMANY
Gallerani	Simona	Scuola Normale Superiore (Pisa)	Pisa	ITALY
Geisbuesch	Joern	NRC-DRAO	Penticton	CANADA
Goddi	Ciriaco	JIVE	Dwingeloo	NETHERLANDS
Godfrey	Leith	ICRAR/Curtin University	Perth	AUSTRALIA
Green	James	CSIRO Astronomy & Space Science	Sydney	AUSTRALIA
Gupta	Yashwant	NCRA	Pune	INDIA
Hanson	Richard	MPIA	Mannheim	GERMANY
Harvey-Smith	Lisa	CSIRO Astronomy & Space Science	Sydney	AUSTRALIA
Harwood	Jeremy	University of Hertfordshire	Hatfield	UNITED KINGDOM
Heald	George	ASTRON	Dwingeloo	NETHERLANDS
Heesen	Volker	University of Southampton	Southampton	UNITED KINGDOM
Herzog	Andreas	Ruhr-University Bochum	Bochum	GERMANY
Hessels	Jason	Sterrenkundig Instituut Anton Pannekoek	Amsterdam	NETHERLANDS
Heywood	Ian	University of Oxford	Oxford	UNITED KINGDOM
Hodge	Jacqueline	MPIA	Heidelberg	GERMANY
Hoeft	Matthias	Thüringer Landessternwarte	Tautenburg	GERMANY
Hogan	Michael	Durham University	Durham	UNITED KINGDOM
Horneffer	Andreas	MPIfR	Bonn	GERMANY
Iliev	Ilian	University of Sussex	Falmer, Brighton	UNITED KINGDOM
Johnston-Hollitt	Melanie	Victoria University of Wellington	Wellington	NEW ZEALAND
Johnston	Simon	CASS	Sydney	AUSTRALIA
Juette	Eva	Astronomisches Institut der Ruhr-Universität Bochum	Bochum	GERMANY
Kanekar	Nissim	National Centre for Radio Astrophysics	Pune	INDIA
Kapinska	Anna	ICG, University of Portsmouth	Portsmouth	UNITED KINGDOM
Karastergiou	Aris	Oxford	Oxford	UNITED KINGDOM
Karim	Alexander	ICC Durham	Durham	UNITED KINGDOM
Kellermann	Ken	NRAO	Charlottesville	USA
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Koerdinö	Elmar	Radboud Universiteit Nijmegen	Nijmegen	NETHERLANDS
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Kondratiev	Vlad	ASTRON	Dwingeloo	NETHERLANDS
Koopmans	Leon	Kapteyn Astronomical Institute	Groningen	NETHERLANDS
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Kramer	Carsten	IRAM	Granada	SPAIN
Kramer	Michael	MPIfR	Bonn	GERMANY
Kraus	Alex	MPIfR	Bonn	GERMANY
Krause	Marita	MPIfR	Bonn	GERMANY
Krichbaum	Thomas	MPIfR	Bonn	GERMANY
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Lämmerzahl	Claus	ZARM, University Bremen	Bremen	GERMANY
Lüghausen	Verena	Argelander-Institut für Astronomie	Bonn	GERMANY
Maciel	Tamela	University of Cambridge	Cambridge	UNITED KINGDOM
Mack	Karl-Heinz	Istituto di Radioastronomia - INAF	Bologna	ITALY
Malofeev	Valery	PRAO ASC Lebedev	Pushchino	RUSSIA
Mantovani	Franco	RadioNet3 / MPIfR	Bonn	GERMANY
Mao	Sui Ann	NRAO/University of Wisconsin Madison	Wisconsin	USA
Marcote	Benito	University of Barcelona	Barcelona	SPAIN
Marecki	Andrzej	Centre for Astronomy, Copernicus Univ.	Torun	POLAND
McClure-Griffiths	Naomi	CSIRO Astronomy & Space Science	Epping	AUSTRALIA
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Menten	Karl	MPIfR	Bonn	GERMANY
Meyer	Martin	ICRAR/UWA	Crawley	AUSTRALIA
Mezcua	Mar	Instituto de Astrofísica de Canarias (iac)	La Laguna	SPAIN
Middelberg	Enno	Astronomisches Institut der Ruhr-Universität Bochum	Bochum	GERMANY
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Rubart	Matthias	Bielefeld University	Bielefeld	GERMANY
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Schilizzi	Richard	University of Manchester	Manchester	UNITED KINGDOM
Schinkel	Frank	University of New Mexico	Albuquerque	USA
Siemion	Andrew	SETI	Berkeley	USA
Sluse	Dominique	Argelander Institut für Astronomie	Bonn	GERMANY
Smirnov	Oleg	Rhodes University & SKA SA	Cape Town	SOUTH AFRICA
Smolic	Vernesa	University of Zagreb	ZAGREB	CROATIA
Sobey	Charlotte	MPIfR	BONN	GERMANY
Soderberg	Alicia	CfA Harvard	Cambridge	USA
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Tabatabaei	Fatemeh	MPIA	Heidelberg	GERMANY
ter Veen	Sander	Radboud University Nijmegen	Nijmegen	NETHERLANDS
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Trasatti	Monica	Argelander-Institut für Astronomie	Bonn	GERMANY
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Umana	Grazia	INAF-OACT	Catania	ITALY
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van Ardenne	Arnold	ASTRON	Dwingeloo	NETHERLANDS
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van Driel	Wim	Paris Observatory	Meudon	FRANCE
van Leeuwen	Joeri	ASTRON	Dwingeloo	NETHERLANDS
van Moorsel	Gustaaf	NRAO	Socorro	USA
van Velzen	Sjoert	Radboud University Nijmegen	Nijmegen	NETHERLANDS
Vardoulaki	Eleni	University of Crete	Heraklion	GREECE
Verdes-Montenegro	Lourdes	Instituto de Astrofísica de Andalucía (IAA-CSIC)	Granada	SPAIN
Vermeulen	Rene	ASTRON	Dwingeloo	NETHERLANDS
Vernstrom	Tessa	University of British Columbia	Vancouver	CANADA
Weintraub	Jonathan	Harvard-Smithsonian CfA	Cambridge	USA
Whittam	Imogen	Cavendish Laboratory, University of Cambridge	Cambridge	UNITED KINGDOM
Wiebeinski	Richard	MPIfR	Bonn	GERMANY
Wilcots	Eric	University of Wisconsin	Madison	USA
Williams	Wendy	Leiden Observatoy/ASTRON	Leiden	NETHERLANDS
Winkel	Benjamin	MPIfR, Effelsberg	Bad Münstereifel	GERMANY
Winnberg	Anders	Onsala Space Observatory	Onsala	SWEDEN
Wong	O. Ivy	CSIRO Astronomy & Space Science	Marsfield	AUSTRALIA
Wrigley	Nick	Jodrell Bank Centre for Astrophysics	Manchester	UNITED KINGDOM
Wucknitz	Olaf	MPIfR	Bonn	GERMANY
Xu	Ye	Purple Mountain Observatory	Nanjing	CHINA
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Zamaninasab	Mohammad	Max-Planck-Institut für Radioastronomie	Bonn	GERMANY
Zanichelli	Alessandra	Istituto di Radioastronomia - INAF	Bologna	ITALY
Zarb Adami	Kristian	Oxford / Astrophysics	Oxford	UNITED KINGDOM

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Zinchenko	Igor	Institute of Applied Physics, Russian Academy of Sciences	Nizhny Novgorod	RUSSIA
Zinn	Peter-Christian	Ruhr-University Bochum	Bochum	GERMANY
Zwaan	Martin	ESO	Garching bei München	GERMANY

I hereby confirm the participant list of the **Modern Radio Universe 2013** in Bonn.

Bonn 9 July 2013: _  _ (Hans-Rainer Klöckner, chair of the LOC)

2.5 Information of the EC financial contribution

The RadioNet3 contribution to the conference was approx. 10 000 Euro. This contribution was used to support individual participants (see below), and to cover some of the cost of the local organisation, like e.g. the cost of rent of the venue at the LVR in Bonn.

The following 6 participants received funding via RadioNet3:

- **Ken Kellerman** (NRAO Charlottesville, USA)
- **Vernesa Smolicic** (University of Zagreb, Croatia)
- **Megan Argo** (ASTRON, the Netherlands)
- **Alla Miroshnichenko** (Institute of Radio Astronomy of the NAS of Ukraine, Ukraine)
- **Mar Mezcua** (Instituto de Astrofísica de Canarias (IAC), Spain)
- **Mamta PANDEY-POMMIER** (Centre de Recherche Astrophysique de Lyon, France)