| Surname | First name | Email | Title | Abstract Talks |
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| Barry | Nichole | nbarry@uw.edu | Sky-Based Calibration and the EoR Power Spectrum: Contamination, Mitigation, and Implications | Observations of the Epoch of Reionization promise to transform our understanding of the early universe, but these observations are impossible without unprecedented levels of instrument calibration. We present end-to-end simulations of a full EoR power spectrum analysis including all of the major components of a real data processing pipeline: models of astrophysical foregrounds and EoR signal, frequency-dependent instrument effects, sky-based antenna calibration, and the full PS analysis. This study reveals that a traditional sky-based calibration with independent parameters for each frequency and antenna can only be implemented if the calibration model is unrealistically accurate. We explore the origin of this contamination and potential mitigation techniques for sky-based calibration. We show that there is a strong joint constraint on the precision of the calibration catalog and the inherent spectral smoothness of antennas, resulting in a recommendation that EoR instruments aim to have no spectral features larger than 1 part in ~10^5 on scales faster than ~8 MHz (125 ns). This has significant implications for the instrumental design of the SKA-Low and other future EoR observatories. |
| Bassa | Cees | bassa@astron.nl | Searching for millisecond pulsars towards Fermi gamma-ray sources with LOFAR | Surveys for radio pulsars at the low frequencies of LOFAR are limited in sensitivity for the fastest spinning pulsars when using traditional incoherent dedispersion methods. We have implemented a novel coherent dedispersion method and use it in a targeted LOFAR survey for radio millisecond pulsars towards Fermi gamma-ray sources. In this talk I will present the coherent dedispersion method and outline the survey that we are performing. The results include the discovery of three new millisecond pulsars, one of which is the fastest spinning pulsar in the Galactic field. Our findings confirm the emergent picture that the fastest spinning millisecond pulsars have the steepest radio spectra. |
| Bernardi | Gianni | giannibernardi75@gmail.com | The Epoch of Reionization Array (HERA) | Measurements of the red-shifted 21-cm line from neutral Hydrogen is a major undertaking on modern observational cosmology. In this talk I will review the motivations, objectives and current status of HERA, a low frequency (50-240 MHz) experiment dedicated to measure the 21-cm line throughout cosmic dawn and reionization and currently under construction at the Karoo site in South Africa. |
| Bhat | Ramesh | ramesh.bhat@curtin.edu.au | Pulsar Astronomy with the Murchison Widefield Array | The Murchison Widefield Array (MWA), a low-frequency array comprising 128 elements (tiles) operating in the 80 to 300 MHz frequency band, was originally conceived as an imaging telescope intended for science applications such as all-sky surveys and the detection of the epoch of reionization. With the advent of a voltage capture system capable of recording raw voltage time series from each and every element at 100-us, 10-kHz native resolutions, the infrastructure to efficiently transport and archive these data on to the Pawsey supercomputing facility located in Perth, and a suite of processing pipelines for calibration and beam-forming, new science avenues have been opened up in the areas of time domain astronomy, including observations of pulsars and searches for Fast Radio Bursts (FRBs).Â These new capabilities are being exploited for a wide range of pulsar science, including high-time resolution investigations aimed at understanding the pulsar emission mechanism, a low-frequency census of pulsars in the southern hemisphere, and regular monitoring of millisecond pulsars that are important for high-profile pulsar timing-array experiments. The high-resolution imaging mode of MWA is also being utilized for extensive co-observing campaigns to augment the Parkes SUPERB (SUrvey for Pulsars and Extragalactic Radio Bursts) project. I will present an overview of current and planned scientific capabilities of the MWA in the areas of pulsar astronomy, as well as science highlights from a number of programs currently underway. Alongside opening up new science avenues in the areas of pulsars and fast transients, the associated technical developments are also providing useful insights into the beamforming and processing considerations that are important in the context of SKA-LOW. |
| Bhattacharyya | Bhaswati | bhaswati@ncra.tifr.res.in | Pulsars and Transients with the GMRT | Giant Metrewave Radio Telescope (GMRT) is currently the largest telescope in the metre-wavelength regime and is the prototype for the SKA in many ways. I will outline our research on time-domain studies of pulsars and transients with GMRT. The discovery of 20 pulsars from targeted (Fermi directed search) and blind surveys (GMRT High Resolution Southern Sky - GHRSS) and results from the follow up studies will be presented. We discovered seven MSPs in the Fermi directed searches, which were the first Galactic MSPs discovered with the GMRT. The GHRSS survey is an off-Galactic-plane survey at 322 MHz with complementary target sky to other ongoing low-frequency surveys by GBT and LOFAR. With 50% of the survey completed (i.e. 1500 deg^2), we have discovered 13 pulsars, one of which is a millisecond pulsar and two are mildly recycled pulsars. This is one of the highest pulsar per square degree discovery rate for any off-Galactic plane survey. In addition to periodicity searches, the single pulse searches of the GHRSS survey can reveal sources like Rotating Radio Transients (RRATs) and Fast Radio Bursts (FRBs). The simultaneous time-domain and imaging study for localising pulsars and transients (within ± 10″) and efficient candidate investigation with machine learning are some of the features of the GHRSS survey, which are also finding application in the SKA design methodology. Benefited by the quantum leap in the available instantaneous band-width with the upgraded GMRT in phase-2 of the GHRSS survey we expect to have even better pulsar per square degree discovery rate. The survey sensitivity in phase-2 will reach 1/4th of sensitivity of the SKA1, while providing a nice transition from GHRSS phase-1 pulsar survey to SKA1 pulsar and fast transient search program. |
| Bonafede | Annalisa | abonafede@ira.inaf.it | New radio emission from the cluster MACSJ0717+3745 - LOFAR observations | I will present new LOFAR observations of the cluster MACSJ0717, belonging to the "frontier -field" sample, located at high redshift (z~0.55), and known to host complex radio emission. X-ray and optical observations show a complex merger involving at least four sub-clusters. The new LOFAR observations reveal presence of additional emission, that is not easy to classify within the usual categories (radio halo, radio relic, mini halo). Even more puzzling, the radio emission does not follow the emission from the gas. A joint analysis of deep X-ray Chandra observations and LOFAR observations provide unique insights of the non-thermal processes taking place in this cluster. |
| Braun | Robert | r.braun@skatelescope.org | Low Frequency Science with the Square Kilometre Array | A fundamental enhancement of capability for realising “Low Frequency Science” will be provided by the SKA. The “Low” component of the SKA Observatory will span the 50 to 350 MHz band with a substantial improvement in sensitivity and image quality over current generation facilities. A flexible station definition of the array will provide options for between 100’s and 1000’s of virtual stations to be correlated, enabling exceptional visibility sampling on baselines between <10m and 65km for a wide range of imaging applications. A substantial dedicated pulsar search capability will enable sensitive, wide area surveys of both pulsars and single burst transient phenomena. The current project status will be outlined and an overview of the foreseen capabilities will be reviewed. |
| Broderick | Jess | broderick@astron.nl | LOFAR MSSS: A low-frequency counterpart to NVSS | The Multifrequency Snapshot Sky Survey (MSSS), covering the entire northern hemisphere, is the first major observing programme to be carried out with LOFAR. After several internal releases of intermediate data products to the MSSS team, the final stage of mosaicking and cataloguing is currently well underway, as we move towards the public release of the high band (HBA) part of the survey later this year (Heald et al., in prep.). MSSS-HBA, with its competitive combination of resolution (45 arcsec, equivalent to the 1400 MHz NVSS), frequency coverage (16 MHz bandwidth over the range 119-158 MHz), and sensitivity (~5 mJy/beam RMS, as well as excellent low surface brightness sensitivity), will have a niche in the scientific literature, as well as significant legacy value. In this talk, I will provide an overview of the MSSS-HBA data products, as well as the associated quality control and verification efforts, particularly in relation to the absolute flux density scale. I will also discuss current science highlights across a range of topics, and future prospects. Lastly, I will describe plans for the public data release, including flexible access options within the Virtual Observatory (VO) framework. |
| Brunetti | Gianfranco | brunetti@ira.inaf.it | Non thermal phenomena in galaxy clusters at low radio frequencies | Observations of galaxy clusters in the radio band prove the existence of non-thermal components, cosmic rays and magnetic fields. The origin of these components is most likely related to the process of formation of galaxy clusters suggesting that a fraction of the energy that is injected in the form of large scale motions and shocks in the intra-cluster-medium during clusters mergers is transported at smaller scales and channelled into magnetic fields and relativistic particles. This has fundamental implications also for the microphysics of the intra-cluster-medium. After briefly reviewing the most relevant observational facts, I will discuss our theoretical understanding of cluster-scale synchrotron radio sources, the most important open questions and the implications for observations at low radio frequencies. In particular I will focus on the potential breakthrough in the field that can be made by the ongoing LOFAR observations and –in the future- by the synergies between SKA and the Athena X-ray observatory. |
| Buitink | Stijn | Stijn.Buitink@vub.ac.be | Radio detection of neutrinos with LOFAR and ARIANNA | Cosmic neutrinos are valuable messenger particles carrying information of the most powerful sources in the Universe. They are created in interaction of cosmic rays with photons or dust and can help to identify the sources of cosmic rays and their acceleration process. Since a few years the IceCube observatory detects cosmic neutrinos in the TeV-PeV energy range, by measuring the optical Cherenkov light emitted by the leptons that are created when neutrinos interact inside the detector.<br><br>At even higher energies the neutrino flux becomes smaller and alternative techniques are required. ARIANNA consists of radio antennas buried just beneath the surface of the Ross ice shelf on Antarctica. It searches for the short radio pulses emitted by neutrino-induced particle cascades. The radio waves have a longer attenuation length than optical light and reflect on the ice-water boundary layer, allowing for a large detector volume of the order of 100 km^3. ARIANNA will search for cosmogenic neutrinos, that are created in the interactions of cosmic rays with the cosmic microwave background.<br><br>The visible side of the Moon represents an even larger detection volume. Neutrinos with energies above 10^22 eV can create radio pulses that are strong enough to escape from the lunar surface and are detectable with low frequency radio telescopes like LOFAR and SKA. LOFAR will search for these pulses by forming tied-array beams on the Moon. The detection strategy is somewhat similar to pulsar searches but at shorter timescales.<br><br>In this talk I will discuss the progress that is made with the ARIANNA prototype array and the LOFAR lunar detection pipeline. |
| Callingham | Joseph | callingham@astron.nl | Dying young and frustrated? A low radio frequency view of a young radio galaxies | Many active galactic nuclei (AGN) show a peak or turnover in their radio spectrum. Peaked-spectrum radio sources (including gigahertz-peaked spectrum and compact steep spectrum sources) are all radio galaxies with small angular extents, suggesting that they are either very young AGN or are confined by a dense surrounding medium. We here present a spectacular sample of 1484 low-frequency peaked-spectrum sources derived from the Murchison Widefield Array's GLEAM survey; for 95% of this sample, the peaked spectral behavior is newly identified. This very large sample allows us to perform a comprehensive study of the properties of peaked-spectrum sources as a function of luminosity and redshift. We also identify six sources that have optically thick spectral indices that are near or above the synchrotron self-absorption (SSA) limit, which could represent the first peaked-spectrum sources in violation of SSA theory. This talk will concluded with what the LOFAR Multifrequency Snapshot Survey (MSSS) can achieve in this area. |
| Chapman | Emma | e.chapman@imperial.ac.uk | Foreground Removal in the Epoch of Reionisation | The Epoch of Reionization (EoR) is enjoying a flood of data from current generation telescopes which hope to make the first statistical detection. While the SKA will provide much improved sensitivity and allow the exciting possibility of imaging the EoR, an extremely precise understanding of the instrument and the astrophysical foregrounds is still required. I will explain the various foreground removal techniques in use by LOFAR and other current generation telescopes and discuss what we can take from the current generation in order to optimise the SKA EoR pipeline. I will present results using the visibility generator OSKAR to consider the different configurations for SKA-LOW and consider the effect of calibration errors on the success of foreground removal. |
| Chhetri | Rajan | rzn.chhetri@gmail.com | Subarcsecond compact source properties using wide field interplanetary scintillation with the MWA | Recently, low radio frequency wide field-of-view instruments have opened up new opportunities to investigate radio galaxies and their evolution. However, their sub arcsecond compact cores still elude investigations in large numbers owing to the limitations of angular resolutions of these instruments. With our recently developed technique combining interplanetary scintillation with the wide field-of-view of the Murchison Widefield Array, we overcome this challenge to identify sub arcsecond compact components in large numbers from low radio frequencies. In this presentation, I will outline the technique and present radio properties of compact active galactic nuclei selected from 162 MHz. I will also present results on the differences in gamma ray properties of these low radio frequency compact objects compared against their counterparts from high radio frequencies. I also aim to outline the implications of this work for future instrument the SKA-Low. |
| Chrysaphi | Nicolina | n.chrysaphi.1@research.gla.ac.uk | Imaging Spectroscopy of a Type II solar radio burst observed by LOFAR | Nicolina Chrysaphi and Eduard P. Kontar School of Physics & Astronomy, University of Glasgow, G12 8QQ, UK Solar radio bursts provide a unique window into the plasma processes occurring in the solar corona that cannot be otherwise detected. One of the main types of solar radio bursts are Type II bursts which are characterised by a slow drift rate from high to low frequencies. It is believed that Type II bursts are the signatures of accelerated electrons that have been excited by MHD shock waves and have produced radiation through the plasma emission mechanism. A Type II radio burst with band-splitting was observed between 30-90 MHz by the Low Frequency Array (LOFAR) after a Coronal Mass Ejection (CME). Tied-array imaging was utilised producing images of high temporal, spatial, and spectral resolution, crucial for an accurate depiction of the rapidly variable solar activities. An estimation of the local coronal parameters like the AlfvÃ©n speed, the sound speed, and the magnetic field strength was obtained from this event. Approximations of the centroid locations in time and frequency were also acquired in order to allow for the examination of the emissions source motion, for the first time, within the band. The models of band-splitting in Type II bursts are discussed. |
| Chyzy | Krzysztof | krzysztof.chyzy@uj.edu.pl | Flattening of low-frequency spectra of nearby galaxies | We explore low-frequency spectra of galaxies in a large sample of objects of the Local Universe. From estimated 150 MHz fluxes from the LOFAR MSSS survey and fluxes at various frequencies obtained from the literature search we construct the integrated radio spectra of the sample galaxies. We measure the spectra curvature, look for their flattenings and turnovers, and analyze their statistical dependencies on galaxy inclination, morphology and luminosity. Interpretation of the results and discussion of processes shaping the low-frequency spectra are performed with a simple general model of galaxy radio emission and radiation transfer dependent on the galaxy viewing angle and absorption processes. The constructed model images at various frequencies, and the obtained local and integrated spectra of model galaxies are then confronted with our observational results. We model how thermal (free-free) absorption and departure from a simple power-low energy distribution of nonthermal electrons influence the shape of the spectra, and look for evidences of cool ionized gas in galaxies. We also discuss how incoming much deeper LOFAR surveys will enable investigation of more distant Universe and expected changes in radio spectra of high-redshift galaxies. |

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| Ciardi | Benedetta | ciardi@mpa-garching.mpg.de | EoR Simulations and 21cm Absorption | In this talk I will discuss theoretical models of cosmic reionization and associated predictions for detection of 21cm absorption lines in the spectra of high redshift radio loud sources. |
| Corstanje | Arthur | a.corstanje@astro.ru.nl | Improving the accuracy of cosmic-ray composition measurements with LOFAR | The radio signal of air showers from cosmic rays as we measure it with LOFAR, is sensitive to the atmospheric depth where the radio emission is maximal: X_max. The various types of primary particles each have a different distribution of X_max, also with a different average each. Measuring this X_max-distribution at LOFAR is at the base of our cosmic-ray composition measurements. For this, we use detailed simulations of the air shower process with the Corsika and CoREAS simulation software. For inferring X_max from the radio measurements of individual air showers, an important systematic uncertainty arises from varying atmospheric conditions due to the local weather at the time of the air shower. While this was already part of the systematic error budget before, accounting for the atmospheric variations will further improve the accuracy of the composition measurements. We will review the composition results obtained earlier, and the ongoing efforts to reduce the atmospheric uncertainty. |
| Croft | Steve | scroft@astro.berkeley.edu | Breakthrough Listen | The US$100M, 10-year philanthropic "Breakthrough Listen" project is driving an unprecedented expansion of the search for extraterrestrial intelligence (SETI). Modern instruments allow ever larger regions of parameter space (luminosity, duty cycle, frequency coverage) to be explored, which will enable us to place meaningful physical limits on the prevalence of transmitting civilizations. Data volumes are huge, and preclude long-term storage of the raw data products, so real-time processing and machine learning techniques must be employed to identify candidate signals as well as simultaneously classifying interfering sources. Breakthrough Listen is already underway in the GHz and optical bands. However, the low frequency sky is currently poorly explored from a SETI perspective. Breakthrough Listen plans to soon begin a pilot study using, and expanding the capabilities of, the Voltage Capture System on the Murchison Widefield Array. The characteristics of the MWA (large field of view, frequency coverage, capabilities for commensal observations, and location in a very radio quiet site) make it a superb instrument for SETI, and provide a pathway towards a search using SKA1-LOW. In addition, the tools developed for SETI are useful for RFI rejection, fast transient searches, and other areas of radio astronomy. |
| Cuciti | Virginia | vcuciti@ira.inaf.it | New detections of radio halos in galaxy clusters with low frequency GMRT observations | Giant radio halos are diffuse Mpc-scale synchrotron sources typically detected in massive and merging galaxy clusters. In the current view, radio halos (RH) originate through the acceleration of relativistic electrons by turbulence injected in the ICM during merging events. This scenario predicts a tight connection between the properties of RHs and the mass and dynamics of the hosting clusters. We are carrying out the analysis of deep radio observations of a sample of 75 mass-selected galaxy clusters (first results have been published in Cuciti et al. 2015) that is also leading to the discovery of new RHs and relics. In this talk, I will show deep GMRT 330 MHz observations of three clusters of the sample: Abell 3888, Zwcl0634.1+4750 and Abell 1451. We confirmed the presence of a giant RH in Abell 3888 (Shakouri et al. 2016) and we studied its spectral properties. We discovered two new RHs in Abell 1451 and Zwcl0634.1+4750. These two clusters also host other interesting sources, such as a radio relic at large distance from the cluster center and a peculiar head tail radio galaxy which might be interacting with a shock front. The RHs in Abell 1451 and Zwcl0634.1+4750 are underluminous with respect to the current radio-mass correlation as in the case of a few other cases recently discovered. This may suggest that, thanks to the improved sensitivities and statistics, we are now discovering "off-state" (faint) radio halos, a class of halos that is expected by models but it is still poorly studied. Deep low frequency radio observations are essential to discover this kind of objects and unveil their origin. |
| de Bruyn | Ger | ger@astron.nl | EoR with LOFAR (by André Offringa) | The LOFAR EoR project has recently published their first EoR upper limits from a single-night LOFAR observation of the North Celestial Pole field. In this talk I will describe our approach for calibrating the data, performing foreground subtraction and making the power spectrum, which includes a combination of direction dependent calibration using Consensus Sagecal and foreground removal with GMCA and GPR. I will summarize the progress being made on both of the LOFAR EoR fields being observed (NCP and 3c196), and discuss new insights into the effects of calibration. Finally, I will describe the steps that we will take next. |
| de Gasperin | Francesco | fdg@strw.leidenuniv.nl | Imaging at 50 MHz: the LOFAR LBA survey | One of the most attractive but challenging observing mode of LOFAR is interferometry at frequency of 50 MHz using the LBA dipoles. In this talk I will show the last results in term of calibration and imaging techniques for these very low frequencies and I will provide an update on the LOFAR LBA survey. I will present the first LBA mosaics obtained as part of the survey and show the first example of direction dependent calibration at 50 MHz. |
| Di Gennaro | Gabriella | gabriella.di.gennaro@cfa.harvard.edu | Deep in the (un)known: the Sausage Cluster | Radio halos and relics are diffuse extended sources found in merging galaxy clusters. They are characterized by their large Mpc physical sizes, low radio surface brightness, and steep spectra. Despite recent progress in our understanding of these sources, there are still many open questions regarding the underlying particle acceleration mechanisms and magnetic field properties. New low-frequency radio telescopes, such as LOFAR, in combination with deep imaging at GHz frequencies can provide important constraints on models for the formation of relics and halos. Here we present the ongoing study of one of the best examples of double radio relics, CIZA J2242.8+5301 (known as the “Sausage” Cluster), in the frequency range between 150 MHz and 4 GHz, with LOFAR and JVLA respectively. These JVLA observations are among the deepest ever obtained for a galaxy cluster. We use the LOFAR and ultra-deep JVLA images to construct high-resolution spectral index and curvature maps of the diffuse cluster emission and numerous head-tail radio galaxies. Our continuum and spectral studies hint that shock and turbulent re-acceleration play an important role in formation of halos and relics. In addition, we will present the first detailed high-resolution polarization study of the cluster to constrain the cluster magnetic field properties. |
| Emig | Kimberly | emig@strw.leidenuniv.nl | The first detections of radio recombination lines at cosmological distances | In particular, I will concentrate on AGN remnants and restarted radio sources. I will then dedicate part of the talk on the results recently obtained using LOFAR observations of famous fields, which represent the starting point of the LOFAR surveys. The combination of these statistical studies and the detailed studies of single objects has allow us to start making interesting progress in the lifecycle of radio AGN. |
| Fallows | Richard | fallows@astron.nl | From the Sun to the Earth: Observing Space Weather with LOFAR | As one of the world’s most flexible radio astronomy instruments, LOFAR enables studies of several aspects of space weather to be advanced beyond the current state-of-the-art. Observations of interplanetary scintillation (IPS) enable the determination of solar speed and estimates of solar wind density to be made which, when combined via 3-D tomographic techniques, build a global picture of the solar wind throughout the inner heliosphere. A major campaign undertaken through October 2016 involving LOFAR, MWA, and dedicated IPS observatories worldwide, sought to demonstrate the improvements which can be made by the extra detail that LOFAR can provide and the combination of worldwide data. Coronal Mass Ejections (CMEs) represent the most powerful space weather events. Trial observations with LOFAR have observed the full passage of a CME, demonstrating the variation which can be seen in speed as it passes over a line of sight. Determination of the interplanetary magnetic field associated with these events and the solar wind in general remains a “holy grail” in space weather forecasting efforts. One of the only methods by which this can be achieved throughout the inner heliosphere is via the observation of heliospheric Faraday rotation in the polarised signal from either a polarised radio source or a Galactic polarised background. With LOFAR, progress is being made in assessing this, as well as demonstrating the challenge that this measurement represents. Finally, the ionosphere acts as the footprint of any space weather event in the Earth’s space environment, with scintillation posing a particular challenge in the forecasting arena. LOFAR observations of ionospheric scintillation demonstrate the wide range in conditions across the LOFAR band and the small-scale variations and flows in the ionosphere giving rise to them. |
| Giacintucci | Simona | simona.giacintucci@nrl.navy.mil | Tracing multiple AGN outbursts at low frequency in cool-core clusters | We present results of a joint radio and X-ray analysis of the central radio sources in the cool-core clusters A496 and 2A0335+096. Combined low-frequency GMRT and high-frequency VLA radio data indicate that multiple AGN outbursts have occurred at different epochs in the cores of these relaxed clusters. Chandra images reveal X-ray cavities associated with the different episodes of radio activity, as well as X-ray cold fronts created by sloshing of the core gas. In A496, which does not have a radio minihalo, the bent outer radio lobes trace the cold front, suggesting that aged radio plasma is spread across the cool core by gas sloshing. In 2A0335, the steep spectrum lobes are immersed in a flatter-spectrum minihalo, which in turn is confined by the cold front. In this cluster, aged electrons are not only spread by sloshing but also reaccelerated, giving rise to the minihalo. These systems illustrate a possible sequence of how a minihalo emerges from seed electrons provided by aged AGN bubbles. |
| Griessmeier | Jean-Mathias | jean-mathias.griessmeier@cnrs-orleans.fr | Observation of extrasolar planets a low radio frequencies | The magnetized planets of the Solar System, especially Jupiter, are sources of strong, non-thermal radio emission reaching up to approximately 40 MHz in frequency. With the discovery of extrasolar planets, the question quickly arose whether exoplanets can host a similar emission, and if so, whether this emission could be detectable on Earth. Due to their distance, exoplanetary radio emission would have to be at least 1000 times more intense than Jupiter's emission to be detectable with current radio telescopes. Theoretical models suggest that, in certain cases, the radio emission of giant exoplanets may indeed reach the required intensity. At the same time, in order to generate such an emission, an exoplanet would have to have a sufficiently strong intrinsic planetary magnetic field. The detection of such an emission would thus constitute the first unambiguous detection of an exoplanetary magnetic field. We will present an ongoing observation program with the Low Frequency Array (LOFAR), which has the potential to detect exoplanetary radio emission, discuss the target selection based on theoretical arguments, and present results from the first pass of our data analysis. |
| Gurkan Uygun | Gulay | gulay.gurkanuygun@csiro.au | LOFAR/H-ATLAS: The low-frequency radio luminosity -- star-formation rate relation | Radio emission is potentially a key indicator of star-formation activity in galaxies, but the relationship between star formation and radio luminosity has to date been studied almost exclusively at 1.4 GHz and above. At lower radio frequencies thermal emission becomes increasingly negligible in comparison to high frequencies, and so we would expect it to be completely dominated by the radiation of supernova-generated cosmic rays. As part of the LOFAR Surveys Key Science project, the Herschel-ATLAS North Galactic Pole field has been surveyed with LOFAR at an effective frequency of 150 MHz. We select a sample of galaxies from the MPA-JHU value-added catalogue of SDSS galaxies in this area: the combination of Herschel, optical data and available mid-infrared data enable us to use sophisticated modelling techniques in order to derive star-formation rates (SFRs) of sample sources, allowing a detailed study of the low-frequency radio--star-formation relation in the nearby Universe. We find that many objects which were not classified as star-forming galaxies using optical emission-line diagnostics have significantly higher 150 MHz radio luminosity than would be expected given their SFR, possibly implying an important role for low-level AGN activity. For star-forming objects, we show that a single power-law relationship between radio luminosity and SFR is not a good description of all star-forming galaxies (SFGs) in the local Universe (0<z<0.3). If the L_{150}-SFR relation can be explained na\'ively by electron calorimetry, we conclude that low luminosity sources are not ideal calorimeters and differ from the main locus of SFGs at low redshifts. |
| Hancock | Paul | paul.hancock@curtin.edu.au | The GLEAM survey: Imaging and Calibration challenges | The GLEAM survey covers the extragalactic sky south of +30 degrees declination at frequencies from 72-231MHz and resulted in the detection of 307 thousand sources. The low frequency observing bands, large fractional bandwidth, and very large field of view of the MWA telescope made the observing easy to complete, but brought about many data processing challenges. In this talk I will discuss the issues that we encountered during the production of the GLEAM survey images and resulting catalouge, as well as our solutions to these problems. I will highlight the lessons that we learned that should inform future low frequency and/or large field-of-view radio surveys. |
| Hare | Brian | b.h.hare@rug.nl | LOFAR for Lightning Interferometry and Mapping | We will report on an on-going analysis of data recorded by the LOFAR LBAs during a thunderstorm 50 km north of the superterp in 2013. We have successfully located the source region of a number of lightning RF pulses using a time-of-arrival technique (TOA), similar to that used in standard lightning mapping arrays. We will show that these lightning pulses have a complex sub-structure that is similar between LBAs separated by large distances, and we will show that the lightning RF pulses are linearly polarized. Both of these results are new, due to the fact that lightning electric fields are not well studied in the frequency range of LOFAR LBAs. We will continue to develop our analysis by automating lightning pulse location finding so that full lightning flashes can be mapped, and by investigating the significance of the linear polarization and complex sub-structure of the lightning pulses. |
| Harwood | Jeremy | harwood@astron.nl | The low-frequency perspective of FR II radio galaxies | Due to their steep spectra, low-frequency observations of FR II radio galaxies potentially provide key insights in to the morphology, energetics and underlying physics of these powerful radio sources. However, limitations imposed by the previous generation of radio interferometers at metre wavelengths have meant that this region of parameter space remains largely unexplored. In this talk, we present the latest results from the nearby-AGN KSP using LOFAR and the VLA at frequencies between 50 and 460 MHz to investigate the dynamics, energetics and particle acceleration in FR II radio galaxies. For the first time, this allows us to undertake well resolved, detailed studies of FR IIs at low frequencies and place tight constraints on the low-energy electron distribution, magnetic field strength, and total energy content of the lobes. We discuss the impact this has on our understanding of nearby FR II radio galaxies and how an improved knowledge of their spectral structure on small spatial scales advances our understanding of the mechanisms which drive these powerful radio sources. |

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| Haverkorn | Maraijke | m.haverkorn@astro.ru.nl | The Milky Way at low frequencies | The Milky Way reveals new secrets at low frequencies. Bends and turnovers in power spectra of both thermal and non-thermal emission at these frequencies give us information about a wide variety of objects and processes in the interstellar medium such as properties of (cold) gas, HII regions and supernova remnants, or acceleration and distribution of Galactic cosmic rays. Otherwise invisible magnetic structures can be probed uniquely by spectro-polarimetry at these frequencies. I will attempt to review what has been learnt the past few years from the low-frequency radio telescopes LOFAR and MWA. |
| Heald | George | george.heald@csiro.au | Low-frequency observations of nearby galaxies | Low radio frequencies provide a unique view into the structure and evolution of star-forming galaxies. We are now able to develop new insights thanks to the modern suite of low-frequency observatories, as they continue to push the boundaries of our capability for high angular resolution imaging with exquisite image fidelity and surface brightness sensitivity. With these new observations we are building up a clearer picture of large-scale galactic magnetic fields, the propagation of cosmic rays, and their connection to the star formation process. I will summarise some exciting new insights developed from the careful study of selected edge-on and face-on spiral galaxies in the local Universe. I will also describe ongoing efforts for new understanding with large-scale surveys such as MSSS, GLEAM, and LoTSS. I will conclude with longer-term prospects made possible with the advent of substantial new observational capability from the expanded MWA and, of course, the low-frequency component of the SKA. |
| Heesen | Volker | volker@heesens.de | The low-frequency radio continuing star formation rate relation in nearby galaxies with LOFAR | We present first results of our survey of nearby galaxies with 140-MHz data from pointed observations and from the LOFAR 2-m Sky Survey (LoTSS). With the facet calibration technique we are now able to reach an rms noise level close to the thermal noise of ~150 μJy/beam at 7—10 arcsec spatial resolution. These maps are sensitivity matched with medium-deep (1 hr) observations of other state-of-the-art radio interferometers such as the Jansky VLA. We have selected our galaxies from the SINGS and KINGFISH infrared surveys, which provide us with ample of ancillary data. The infrared maps from HERSCHEL and Spitzer can be combined with GALEX far-ultraviolet maps in order to construct reliable star-formation rate surface density maps, corrected for internal absorption by dust. Balmer Halpha maps can be used to separate the thermal radio continuum emission, although at 140 MHz we expect the thermal fraction to be small (< 10 per cent). We also have ancillary radio maps, both 1.4-GHz continuum maps from the WSRT SINGS survey, as well as HI line emission maps from the VLA THINGS survey. We also have selected some highly inclined (>80 degree) galaxies from the CHANG-ES survey with complementary Jansky VLA data at 1.5 and 6 GHz. These data can be used to study the spatially resolved radio continuum—star formation rate (RC—SFR) relation on a 1-kpc scale in a statically meaningful sample. As part of this study, we will explore the effects of cosmic-ray transport by diffusion in galactic discs, the relation between the magnetic field and gas density as well as gas kinematics and the vertical cosmic ray transport by advection in galactic winds. |
| Hessels | Jason | hessels@astron.nl | LOFAR 2.0: : a premier low-frequency facility for the next decade | On the timescale of 2025, The International LOFAR Telescope will have been significantly upgraded: LOFAR2.0 will be a major and unique international radio telescope – even in the era of the Square Kilometre Array. LOFAR2.0's strengths lie in its<br>ability to make the sharpest possible images of the sky using a pan-European array of stations operating at the lowest radio frequencies we can see from Earth. We will discuss the upgrade plans and the major science drivers, including detection of<br>the first generation of stars, mapping of the evolution of galaxies, and elucidation of the pivotal role of magnetic fields in shaping the Universe. |
| Hessels | Jason | hessels@astron.nl | The low-frequency pulsar renaissance | Though pulsars were originally discovered with an aperture array operating at 82MHz, observers soon moved to higher radio frequencies in order to avoid the high sky background temperatures and the pernicious effects of the interstellar medium. With the advent of LOFAR and other digital aperture arrays, however, we have again returned to observing pulsars below 200MHz. With the much higher data rates and more precise signal processing that is now available, many of the previous challenges and disadvantages to high-time-resolution, low-frequency pulsar observing can now be overcome. The low-frequency window allows us to discover a previously missed sub-population of pulsars, which may be vital for understanding the underlying emission mechanism, and which can serve as important probes of extreme physics. Pulsar monitoring and timing is also allowing us to see pulsar magnetospheres and the interstellar medium in a new light. I will highlight some of the main accomplishments from the first 5 years of modern low-frequency pulsar observing, and give a look towards what will be possible with the SKA. |
| Hofer | Carolin | cahofer@phas.ubc.ca | Canadian Hydrogen Intensity Mapping Experiment | Hydrogen Intensity Mapping is a technique that uses the 21 cm line of neutral hydrogen to map the large-scale structure in the Universe. Without needing to resolve individual galaxies, it can survey unprecedented volumes, which makes it an ideal method to measure the Baryon Acoustic Oscillations as a function of redshift and thus place constraints on the dark energy equation of state. However, foreground removal is quite challenging, since the cosmic signal is several orders of magnitude below the bright galactic signal. The Canadian Hydrogen Intensity Experiment (CHIME) is a novel digital radio telescope built in Canada and consists of four cylindrical reflectors oriented North-South each of size 20 x 100m with 256 dual-polarization antennae. It will observe the 21cm line in a wide radio frequency band of 400 – 800 MHz which translates to a redshift range of $0.8 < z < 2.5$, the cosmic time epoch where dark energy became dynamically important. CHIME has no moving parts, and as such the sky transits through its field of view, making an image of the northern sky every day. In this talk I will introduce CHIME, its science goals, and its data analysis challenges. Analyzing CHIME data is a complex task, so we employ end-to-end simulations of the experiment, with known inputs, to develop and validate our data reduction and foreground filtering techniques. I will introduce the software developed to simulate visibilities from the CHIME telescope. I will focus on some of the more challenging instrumental properties we have encountered in the CHIME Pathfinder and show how they affect the sky maps. |
| Huege | Tim | tim.huege@kit.edu | Precision measurements of cosmic-ray air showers with SKA-low | With minor engineering changes, SKA-low can be adapted for the detection of extensive air showers initiated by cosmic rays in the Earth's atmosphere. Cosmic-ray detection profits from the very dense and uniform antenna spacing in a fiducial area of one km^2 and the large bandwidth of 50-350 MHz. While existing techniques can measure the depth of the air-shower maximum, an indicator for the particle mass, with a precision of ~20 g/cm^2, SKA-low is expected to provide a resolution of 10 g/cm^2 or better. These precision measurements will allow detailed studies of the mass composition of cosmic rays in the energy range of transition from a Galactic to an extragalactic origin. Furthermore, SKA-low will facilitate three-dimensional "tomography" of the electromagnetic cascades of air showers, allowing the study of particle interactions at energies beyond the reach of the LHC. Finally, studies of possible connections between air showers and lightning initiation can be taken to a new level with the SKA. I give an overview of the science potential of air shower detection with the SKA and report on the technical requirements and project status. |
| Intema | Huib | intema@strw.leidenuniv.nl | SPAM - 10 years of ionospheric calibration | In this talk I will reflect on the development, applications, and future of the SPAM ionospheric calibration approach. Many of its proven concepts have found their way into the processing pipelines of new aperture arrays like LOFAR. And many of its results from archival and new GMRT observations are providing crucial complementary and reference images to those same new arrays. |
| Jackson | Neal | jackson@astron.nl | Long baselines at low frequencies | In recent years, high-resolution radio observations which are routine at GHz frequencies have been extended to lower frequencies, in particular using the international baselines of LOFAR. I outline the current capabilities of LOFAR international baselines and review some of the science highlights. Such observations have great potential in the field of strong gravitational lensing, both in surveying for new lenses and study of existing ones. The particular contribution of low frequencies is to explore propagation effects by using multiple sight lines to a single background source. |
| Johnston-Hollitt | Melanie | Melanie.Johnston-Hollitt@vuw.ac.nz | A Catalogue of Relics and Halos from the MWA GLEAM Survey | The Murchison Widefield Array (MWA) GLEAM Survey covers the sky south of +30 in 20 frequency bands spanning 72-231 MHz. Due to the MWA's superb diffuse source sensitivity, GLEAM is the ideal survey to search for relics and halos in galaxy clusters. Here we present a new catalogue of relics and halos across the MWA accessible sky. In particular we present ~200 detections more than doubling the number of previously known diffuse cluster sources. In several cases we find evidence for halos filling the entire cluster volume, examples of systems with more than 2 relics, evidence for AGN as the source of the seed electrons in diffuse sources and glimpses of the cosmic web in the radio. We will discuss how this new sample affects the present cluster halo scaling relations in the literature and speculate on what will come in the MWA II and SKA_Low surveys. |
| Jordan | Christopher | christopher.jordan@curtin.edu.au | Ionospheric characterisation above the Murchison Radio Observatory with EoR datasets | Low-frequency radio astronomy instruments are severely impacted by our Earth's ionosphere; depending on the conditions, one may observe bulk displacements in source positions, or even scintillation. Moving into the SKA-Low era, it is important to use our current capabilities to understand the ionosphere, as things become more complicated with very long baselines. Fortunately, modern instruments, such as LOFAR and the MWA, are well-suited to further our understanding of the Earth's ionosphere. A prominent example of our being able to identify ionospheric activity are the tubular structures reported by Cleo Loi. The Real-Time System (RTS) is one of a few existing calibration pipelines designed for processing MWA data. One aspect of this calibration is to determine ionospheric effects; using this calibration scheme, we are able to observe the ionosphere at a high-resolution (spatial and temporal). Following on from these results, we have developed software to analyse ionospheric activity. In this talk, I will discuss our characterisation of the ionosphere derived from datasets collected for the Epoch of Reionization (EoR) project. With our large sample of data, we observe a wide range of ionospheric activities, and present a metric describing the quality of radio data due to the ionosphere. We also detail a novel method to reconstruct a scalar field representing the total electron content of the ionosphere, temporal correlations, and a possible connection to $K_p$ indices recorded from geomagnetic observatories around the world. |
| Kirsten | Franz | franz.kirsten@curtin.edu.au | Low Frequency VLBI -- Fringes between MWA and GMRT | The Murchison Widefield Array (MWA) is the SKA-low precursor built in the radio-quiet environment of the Murchison Radio-Astronomy Observatory in Western Australia. Besides the more common use of the MWA as a connected interferometer delivering usual visibilities, we can also capture the raw voltages from each individual tile via the so-called voltage capture system (VCS). In the post-processing these voltages can either be correlated, added incoherently, or summed up coherently to obtain maximal sensitivity. In the latter use case the MWA can be thought of a single dish that can be used as an element of a standard radio interferometer. In this talk I will present the results of our recent VLBI experiment aimed at finding fringes between the MWA and the Giant Meterwave Radio Telescope (GMRT) in India. We conducted observations of the Crab pulsar at about 160 MHz at both the MWA and the GMRT in phased-array mode. The Crab pulsar regularly emits giant pulses which we use to align the data streams. After careful frequency alignment we managed to find fringes across the entire overlapping band of about 30 MHz. |
| Kaplan | David | kaplan@uwm.edu | Faint, Highly-Polarized Flares from UV Ceti with the MWA | We will describe our program targeting known flare stars for low-frequency radio observations with the MWA. Specifically, we will discuss the discovery of several faint, highly-polarized flares from the prototypical dMe star UV Ceti. The properties of the flares differ from those received in the past, and allow us to place significant constraints on the flaring mechanism. We will also discuss more recent multi-wavelength efforts to measure the flare properties across radio and optical wavelengths. |
| Kontar | Eduard | eduard@astro.gla.ac.uk | The First Imaging Spectroscopy of the Solar Radio Burst Fine Structures | Solar radio observations provide a unique diagnostic of non-thermal processes in the outer solar atmosphere where the plasma is too dilute to produce significant X-ray or ultraviolet radiation. However, solar radio sources are also embedded in the turbulent plasma of the solar atmosphere, a medium which strongly affects the propagation of the emitted radio waves and hence the observed radiation field; decoupling the intrinsic properties of the source from the effects of radio-wave propagation presents a considerable challenge. Here we report imaging spectroscopy data of solar radio bursts structures observed with the Low Frequency Array (LOFAR), an instrument with unprecedented time resolution that permits direct capture of the radio-wave propagation effects. The observations show systematic increases in the size of both sources of fundamental (plasma frequency) and harmonic (double plasma frequency) radiation that are consistent with simulations of wave propagation effects in the turbulent solar atmosphere. Analysis of these propagation effects provides values for the size of density fluctuations in the corona, and decoupling their effects provides values for the minimum sizes of the intrinsic sources. The analysis further suggests that radio wave propagation effects are the likely cause of the well-known paradoxical co-spatiality of the sources of fundamental and harmonic radiation. |
| Mann | Gottfried | gmann@aip.de | Tracking of an electron beam through the solar corona with LOFAR | The Sun's activity occurs by various phenomena such as bursts of radio emission. Solar type III radio bursts are signatures of beams of energetic electrons propagating along magnetic field lines in the corona. Here we present novel interferometric LOFAR (LOw Frequency ARray) observations of a solar type III radio burst with unprecedented spectral, spatial, and temporal resolution. With LOFAR' spectroscopic and imaging capabilities the propagation of the type III radio burst can be studied. It provides evidences for the propagation of the radio source along the coronal magnetic field lines. The evolution of the type III burst shows a nonuniform movement of the radio burst source in the corona. That can be expained, that the type III radio burst is not generated by a monoenergetic electron beam, but by an ensemble of energetic electrons with a spread distribution in velocity and energy. The study was performed by a close collaboration with the LOFAR team at ASTRON and the team of LOFAR's solar key science project. |
| Mesinger | Andrei | andrei.mesinger@sns.it | Learning about astrophysics with the cosmic 21-cm signal | The next few years will see a rapid evolution in our understanding of the first billion years of our Universe, driven by the redshifted 21-cm line. Statistical measurements, and eventually tomography with the SKA, will finally shed light on the final frontier of astrophysical cosmology: the Epoch of Reionization (EoR). I will briefly review our current state of knowledge, including the first detection (2 sigma) of ongoing EoR from the spectra of a z=7.1 quasar. I will then quantify the upcoming breakthroughs in our understanding, enabled by the Bayesian parameter estimation framework we have been developing. |
| Mevius | Maaijke | mevius@astron.nl | Probing ionospheric structures using LOFAR | Ionospheric disturbances of the interferometric phases pose a challenge for LOFAR data calibration. On the other hand, as a side product of this calibration, valuable information about the ionospheric structure can be gained, probing ionospheric scales from several tens of meters up to 100 km. We used the information of all Dutch stations of several nights to collect statistical information on these structures. A different technique uses the position shifts of sources due to ionospheric TEC gradients over the LOFAR core. With this technique it is possible to directly image moving ionospheric structures. We will discuss these different techniques with which ionospheric information can be obtained from LOFAR data and show results thererof. These techniques not only gain information about ionospheric physics, but, as will be shown, can also be used to assess an ionospheric quality to a radio-astronomical observation and to adopt the calibration strategy accordingly. |

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| Morganti | Raffaella | morganti@astron.nl | The physics and lifecycle of local radio AGN | Galaxy formation models indicate that active galactic nuclei (AGN) likely play a prominent role in the formation and evolution of galaxies. However, quantifying their effect requires a good knowledge of their energetics and of how their nuclear activity proceeds throughout the life of the host galaxy, i.e. whether it alternates to periods of quiescence and, if so, on which timescales these cycles occur.<br>Observations at low frequencies are important for all these aspects. I will start by reviewing recent results obtained in quantifying the energetics of radio sources thanks to better constraining their low frequencies properties and radio spectrum.<br>I will then discuss the progress made in understanding their recurrent periods of activity. For this, the emission at low radio frequencies can be used as fossil record to trace and date the phases in their life. I will review the results obtained in the last years on this topic using low frequencies observations from different radio telescopes.<br>In particular, I will concentrate on AGN remnants and restarted radio sources. I will then dedicate part of the talk on the results recently obtained using LOFAR observations of famous fields, which represent the starting point of the LOFAR surveys. The combination of these statistical studies and the detailed studies of single objects has allow us to start making interesting progress in the lifecycle of radio AGN. |
| Morosan | Diana | morosand@tcd.ie | LOFAR Tied-array Imaging and Spectroscopy of Solar Radio Bursts | LOFAR is a new-generation radio interferometric array operating at frequencies of 10–240 MHz. LOFAR is capable of both interferometric and beam formed modes, with unprecedented sensitivity compared to previous radio telescopes due to the large number of LOFAR antennas. With the recent commissioning of LOFAR, the low frequency Sun can now be studied with unprecedented spectral, spatial and temporal resolution. In this talk, I will review recent progress of LOFAR observations of the Sun using beam-formed modes, in particular tied-array beams. Due to the nature of some solar radio bursts (short timescales and fine frequency structures), high cadence (<50 ms), tied-array imaging has been developed with LOFAR to be used instead of standard interferometric imaging which is currently limited to just a few images per second. This new imaging method already produced substantial results on the spatial characteristics of a multitude of Type III radio bursts and solar S bursts and continues to be applied to solar observations. Solar S bursts, in particular, have been imaged for the first time using this observational mode. |
| Mulcahy | David | david.mulcahy@manchester.ac.uk | Exploring the low frequency nature of nearby galaxies with observations and modelling | Observing nearby galaxies at low frequencies enables the study of weak magnetic fields in the extended disk and halo as Cosmic Ray electrons suffer less from synchrotron losses and thus are able to travel further. Until the advent of LOFAR, no such detailed studies could be performed due to the lack of resolution and calibration strategies for correcting for the ionosphere. With the aid of numerical models together with observations, we can further extract more accurate information on the cosmic ray electron propagation in determining what propagation process dominate in each galaxy in addition to the magnitude of this process. In this talk I will present recent LOFAR observations and modelling of the face-on galaxy M51 and the edge-on galaxy NGC891. We observe a significant extension in the disk of M51 compared to higher frequencies and are able to determine the main propagation process in this galaxy. We observe significant signs of absorption in the disk of NGC891, the first time observed in a normal star forming galaxy and finally we explore the Cosmic Ray propagation in the halo. |
| Murphy | Tara | tara.murphy@sydney.edu.au | Exploring the dynamic radio sky with SKA pathfinders | The last five years has seen a boom in transients surveys with SKA pathfinders including MWA, ASKAP and LOFAR. The aim of these surveys is to explore a diverse range of transient phenomena, including explosive events such as supernova and GRBs through to the possibility of making radio detections of extrasolar planets. I will review the current status of this research, and the latest results from radio transients surveys (including the first detections). I will also discuss the challenges and plans for the next wave of surveys. |
| Muxlow | Tom | tom.muxlow@manchester.ac.uk | Star-formation Across Cosmic Time:<br>Initial Results from the e-MERGE Study of the µJy Radio Source Population | The e-MERGE survey is a multi-tiered legacy survey to exploit the unique combination of very high sensitivity and spatial resolution to study the formation and evolution of star-forming galaxies and AGN out to redshifts of z~5. These low frequency 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. e-MERGE Tier 1 will study AGN and star-formation in the µJy radio source population in GOODS-N. Initial results from e-MERLIN, in combination with the JVLA, and the EVN from the central 10 arcminutes of the e-MERGE Tier 1 region are presented here, demonstrating how high resolution images can disentangle and separate regions of star-formation and AGN activity in the differing µJy radio source populations, together with showing the angular size distributions for each source type for an interim sample of 248 sources within the central part of GOODS-N. In combination with matched resolution observations at even lower frequencies with LOFAR, extended star-formation can be imaged in detail to redshifts approaching 5. |
| Nisbet | David | dmn@roe.ac.uk | The Determination of the Luminosity Function of Jet-mode AGN out to a Redshift of z~2 | We present results from a deep LOFAR 150 MHz survey of the ELAIS-N1 field. 250 hours of LOFAR data have been taken in this field, with exceptional multi-wavelength data, making it the deepest tier of the LOFAR Surveys. We provide an update on the data processing, and present the scientific results arising from a direction-dependent calibrated image of a single 8-hr dataset, reaching around 100 microJy/bm rms. 1300 radio sources were detected within the 5 sq-deg area covered by the deep PanSTARRS, UKIDSS and SWIRE/SERVS surveys. A refinement to the maximum likelihood analysis, incorporating colour information, was developed and this, coupled with extensive visual checking, has allowed host galaxy identifications for 97% of the radio sources. After sifting out star-forming galaxies, the sample has allowed the determination of the luminosity function of jet-mode AGN out to a redshift of z ~ 2, in order to investigate the evolution of radio-AGN feedback back to the peak epoch of activity in the Universe. |
| Oberoi | Divya | div@ncra.tifr.res.in | The Sun and the Heliosphere at Low Radio Frequencies | Traditionally, radio imaging has relied on time and bandwidth synthesis to obtain images with high imaging dynamic range and fidelity. For sources like the Sun at low radio frequencies, which vary considerably over short temporal and spectral scales, this imposed a severe limitation. The recent advent of the new generation of large-N instruments has lead to large improvements in the ability of these instruments to gather sky information over short snapshots and narrow bandwidths. In addition, the wide fields-of-view of these instruments allow them to observe large heliospheric volumes and study solar flares and using both, the emission from the plasma associated with flares as well as the propagation effects they impose on the radio emission from background radio sources. These instruments have, on the one hand, lead to very impressive improvements in the state-of-the-art for solar imaging and provided the ability to trace the evolution of solar emission simultaneously along the four dimensions of time, frequency and image plane in unprecedented detail. On the other hand, this increased information is accompanied by a corresponding increase in data volumes and computational load, making the conventional human effort intensive analysis impractical. The observations from these instruments hold great promise for making progress on problems ranging from coronal heating to predictions of geo-effectiveness of Coronal Mass Ejections. Here we review the recent progress which has been made in studies of the quiet Sun, characterisation of what are perhaps the weakest yet non-thermal radio emission features at these frequencies, and a few more conventional solar bursts using a mix of non-imaging and imaging techniques, with an emphasis on the work done using the Murchison Widefield Array. |
| Offringa | Andre' | offringa@astron.nl | Low frequency imaging | Imaging at low frequencies is more difficult due to various reasons: wider field of views, larger w-terms, and the relatively large effect of the ionospheric at low frequencies. In combination with large data volumes, larger bandwidths and requirements of high dynamic range, low-frequency imaging is challenging. I will present these challenges and discuss solutions to these problems.<br>The WSClean imaging software was specifically developed for (fast) imaging of low-frequency observations. It includes novel features such as fast multi-scale multi-frequency deconvolution that can handle large bandwidths, as well as automatic scale-dependent masking that produces more accurate models. Recently, the Image Domain Gridder (IDG) was integrated into WSClean, which allows fast imaging of large fields and the application of ionospheric corrections during the gridding. By combining WSClean IDG with a fast constrained multi-directional solver that is being developed at Astron, a fast multi-directional self-calibration pipeline is provided that can be used for both HBA and LBA high-resolution high-fidelity imaging. |
| Oonk | Raymond | oonk@strw.leidenuniv.nl | Uncovering the diffuse CO-dark gas in cold interstellar clouds | The interstellar medium (ISM) is a key factor in the evolution of galaxies over cosmic time. Cold, atomic clouds are a key component of the ISM, but so far this phase has been difficult to study, because its main tracer, the HI 21 cm line, does not constrain the basic physical information of the gas (e.g., temperature, density) well. New low-frequency telescopes open up the opportunity to study this component of the ISM through a complementary tracer in the form of low-frequency carbon radio recombination lines (CRRL). These CRRLs provide a sensitive probe of the physical conditions in cold, diffuse clouds (e.g. Oonk et al. 2017,2015; Salas et al. 2017; Salgado et al. 2017a,b; Morabito et al. 2014). In this talk I will focus on our recently published LOFAR studies of the CRRL emitting cold clouds towards Cassiopeia A (Oonk et al. 2017; Salas et al. 2017). Here we obtain the first self-consistent physical CRRL model fit for these clouds and show that they are best fit with a temperature 85 K and an electron density 300 cm-3. Both temperature and density are constrained to within 15%. I will argue that much of the CRRLs arise in the CO-dark surface layers of cold clouds where most of the carbon is ionized but hydrogen has made the transition from atomic to molecular. Low-frequency CRRLs thus have the potential to become a powerful probe of this important and difficult to observe gas phase. I will also discuss how these CRRLs can be used to derive the magnetic field strength and cosmic ray ionization rate in these clouds. Finally I will highlight the latest results from our ongoing LOFAR Galactic plane CRRL survey and relate these larger-scale measurements to our detailed Cassiopeia A study. |
| Petroff | Emily | petroff@astron.nl | Fast Radio Bursts: Recent Discoveries and Future Prospects | Fast radio bursts (FRBs) are quickly becoming a subject of intense interest in time-domain astronomy. FRBs have the exciting potential to be used as cosmological probes of both matter and fundamental parameters, but such studies require large populations. Advances in FRB detection using current and next-generation radio telescopes will enable the growth of the population in the next few years. Real-time discovery of FRBs is now possible with a significant number of FRBs now detected in real-time. I will discuss the developing strategies for maximising real-time science with FRBs as well as the properties of the growing FRB population. I will also discuss upcoming efforts to detect FRBs across the radio spectrum using a wide range of new and refurbished radio telescopes around the world and how these discoveries can inform next generation surveys and pave the way for the enormous number of FRB discoveries expected in the SKA era. |
| Polzin | Elliott | elliott.polzin@manchester.ac.uk | LOFAR study of the eclipses of black widow pulsar J1810+1744 | Black widows and redbacks are two classes of binary pulsar system that can be identified by characteristic irradiation, and possibly subsequent ablation, of the companion, which in many cases results in the eclipsing of the pulsed radio emission for a portion of the orbits. These systems provide the unique opportunity to investigate a variety of key processes that are yet to be fully understood, such as the ablation of the binary companion and subsequent evolution of the binary, the eclipse mechanism, and possible intra-binary shock regions between the pulsar and companion. Here I will present a study of the eclipses of the black widow pulsar J1810+1744 at low frequencies, where the eclipse mechanism is most pronounced. Utilising the simultaneous dual beamforming and interferometric mode of LOFAR HBA, pulsar flux variations throughout the orbit are compared for the two observing techniques to test for the presence of scattering and absorption at eclipse orbital phases. Dispersion measure variations are used as a sensitive probe into outermost edges of the eclipsing material surrounding the companion star. |
| Pritchard | Jonathan | j.pritchard@imperial.ac.uk | Epoch of Reionisation and Cosmology at low frequencies | Low frequency observations of the redshifted 21cm line promise to open a new window onto the first billion years of the cosmic history. Over the last few years, telescopes such as LOFAR, MWA, and PAPER have begun to place meaningful upper limits on this 21cm signal. Despite the challenges to measuring this weak signal there is a real possibility of a first detection in the not too distant future. In this review, I will describe the background physics of the 21cm signal and it's connection to cosmology, the first galaxies and the epochs of reionisation and heating of the IGM. I will also sketch some of the path ahead towards next generation experiments such as SKA and HERA. |
| Rajpurohit | Kamlesh | kamlesh@tls-tautenburg.de | A spectacular view of the Toothbrush: filaments and inhomogeneous magnetic fields | Radio relics are extended diffuse emission sources located in the outskirts of galaxy clusters. There is substantial evidence that relics trace shock fronts, induced into the intra-cluster medium (ICM) by cluster mergers, leading eventually to the acceleration of particles. We present 1-2 GHz JVLA images of 1RXS J0603.3+4214, a cluster that host one of the brightest relics (known as Toothbrush). Our JVLA images provide an unprecedented detailed view of the Toothbrush, revealing enigmatic filamentary structures. The high resolution spectral index map between 150 MHz to 1.5 GHz reveal flat spectrum at the northern shock, namely $\alpha=-0.70$ to $-0.75$. These JVLA observations in combination with GMRT and LOFAR data, allowed us to study the spectral index and curvature with 2 and 4 arcsec resolution, respectively. Considering a shock plus downstream aging scenario, we find that there are significant variations of the magnetic field strength along the line of sight. The downstream spectral profile, between 150 MHz to 1.5 GHz, can be explained by an inhomogeneous magnetic field and high Mach number shock (${\hfil \mathcal{M}}=3.7$). The spectral profiles rules out field strength above 5 $\mu $G. We provide evidence that the filamentary structures associated with the Toothbrush are not just filaments of enhanced emission. Our result highlights that the actual injection spectrum is flatter than the one obtained from the spectral index maps. The radio halos shows a spectral index distributions which remains uniform, ($\alpha \sim-1.20$), with small intrinsic scatter of $\lesssim0.02$. The southern edge of the radio halo, that coincides with a shock, is somewhat steeper and characterized by hot ICM. In our sensitive JVLA high resolution radio maps, we discovered several head-tail cluster galaxies and found that at low resolution one-fourth of the halo emission may come from these head tail galaxies and from smaller sources. |

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| Rioja | Maria J. | maria.rioja@icrar.org | IONOSPHERIC STUDIES AND CALIBRATION USING MWA AND LOFAR OBSERVATIONS | The next generation of low frequency radio interferometers are designed to have high sensitivities and wide fields of view. However, to achieve the ambitious goals of the SKA and the pathfinders requires, in addition, a precise calibration of all the sources of error. The ionospheric propagation effects dominate at low frequency; therefore this is the most crucial challenge in calibration. Ionospheric effects are characterized by spatial (i.e. direction-dependent) and temporal fluctuations, which degrade the image quality and ultimately will limit the science achievable by the SKA. Therefore an empirical characterization and understanding of the ionospheric diffraction and refraction properties is fundamental to developing optimum strategies to mitigate them. We present an approach that measures the ionospheric phase screen above the array, along multiple directions across the field-of-view, independently and in parallel. This is achieved by selecting out the sky signal from each line-of-sight to be solved for, by suppressing the contributions from all other directions. We demonstrate the method using both MWA and LOFAR observations. The result is an improved image quality and astrometry after applying the calibration in the visibility domain. We find that the most common distribution of the ionospheric phase screens across the MWA can be approximated as a planar surface, which is the lowest order of ionospheric spatial structure and results in a position shift in the image domain. However higher order structures (i.e. curvatures) can be found at the lower frequencies and in bad weather conditions. Such a screen results in a defocusing of the array, and therefore cannot be corrected in the image domain. Our method corrects for the phase errors in the visibility domain, allowing for more robust imaging solutions. Finally, we discuss the implications of these findings for the baseline lengths and sensitivity planned for SKA-Low. |
| Riseley | Christopher | chris.riseley@csiro.au | Magnetic Fields in High-z Clusters: A Full-Polarization Study of MACS J0025.4-1222 with the GMRT | Mergers between clusters of galaxies are some of the most violent events since the Big Bang, releasing tremendous amounts of energy into the intra-cluster medium (ICM). This energy is deposited in the form of shocks, heating and bulk motion of the ICM; only a fraction of which could be used to amplify and distort the magnetic field and/or (re-)accelerate the electron population. Smoking-gun evidence of relativistic electrons and magnetic fields in the ICM is provided by diffuse synchrotron emission associated with the ICM of merging systems. These sources are known variously as radio haloes and radio relics - although examples of the same emission mechanism, relics and haloes have different underlying physical origins and characteristics. Only a fraction of clusters host these objects, the vast majority of which lie below redshift z = 0.2. At high redshift, few clusters are known to host diffuse radio emission, although this is largely due to the limited sensitivity of historic radio observations. With the improved sensitivity of next-generation radio telescopes, investigating the strength and structure of magnetic fields in galaxy clusters across a broad redshift range is becoming possible. Understanding the evolution of magnetic fields with cosmic time is one means by which to probe the origins of cosmic magnetism, one of the key objectives for the Square Kilometre Array (SKA). In this talk, I will present a deep multifrequency study of the high-redshift (z = 0.5857) cluster MACS J0025.4-1222 with the Giant Metrewave Radio Telescope (GMRT), where I have recently detected diffuse radio emission for the first time. I will discuss what we can infer about the magnetic field strength and structure based on full-polarization data from the GMRT below 1 GHz and how this fits into the evolving picture of large-scale magnetic fields in the Universe. |
| Rottgering | Huub | rottgering@strw.leidenuniv.nl | Deep and sharp imaging at low radio frequencies with LOFAR Studies of clusters, AGN and starburst galaxies | The pan-European LOFAR telescope is now producing the deepest and sharpest images ever of the low frequency Universe. In this talk I will first briefly review how the LOFAR Survey Key Science Project has dealt with the many technical challenges that needed to be overcome to achieve this.<br>In the second part I will briefly present the status of the survey project and give an overview of the first results related to clusters of galaxies, AGN and starburst galaxies. |
| Sadler | Elaine | elaine.sadler@sydney.edu.au | Radio AGN populations and their evolution | Until recently, most large studies of local and distant radio-source populations combined optical spectroscopy with radio data at a single frequency near 1.4 GHz. A new generation of radio surveys now allows us to construct accurate radio spectra of large galaxy samples across a wide range in frequency. By separating the frequency-dependent contributions of older, extended lobe emission and younger, compact core emission, we can start to map out the radio AGN life cycle as well as identifying interesting sub-classes like peaked-spectrum radio galaxies. I will review some recent work on in this area, including both low-frequency radio continuum studies and searches for redshifted 21cm HI absorption in and around distant radio galaxies. |
| Scholten | Olaf | Scholten@kvi.nl | Status and perspectives of the radio detection technique of cosmic ray air showers | Energetic cosmic rays impinging on the atmosphere create a particle avalanche called an extensive air shower that emits a radio pulse through which we can measure their properties. At LOFAR we have measure the footprint (position dependence) of the four Stokes parameters that uniquely determine the linear and/or circular polarization of the radio signal. We show that some of the finer details of the signal, its circular polarization, can be measured accurately and agrees with model predictions for fair weather circumstances. It can be explained as due to the interfering contributions from the two different radiation mechanisms, a main contribution due to a geomagnetically-induced transverse current and a secondary component due to the Askaryan effect. Having established the precise understanding of radio emission from EAS, the emitted radio signal can be used to determine the magnitude and direction of the induced currents in an EAS in the presence of atmospheric electric fields such as are present during thunderstorm conditions. We will show that the linear as well as the circular polarization of the radio waves carry clear information on the magnitude and orientation of the electric fields at different heights in the thunderstorm clouds. |
| Seymour | Nick | nick.seymour@curtin.edu.au | The Surprising Complexity of the Radio Emission from Star Forming Galaxies | In the absence of a radio-loud active galactic nuclei, radio emission from galaxies is a superb tracers of the current star formation rate (SFR). This is due to the fact that radio photons are unimpeded by dust unlike common tracers of SFR in the optical and UV. At the radio regime both free-free emission from star forming regions and the large-scale galactic synchrotron emission are directly related to the on-going SFR. I will present the broad radio-band (~100MHz to ~100GHz) studies of 19 low redshift (z~0.1) star forming galaxies. From 70-230 MHz we have photometric measurements from the Galactic and Extra-galactic MWA (GLEAM) survey complemented by higher frequency photometry (1-100GHz) from the Australian Telescope Compact Array. In addition to distinguishing the free-free and synchrotron components, we can observe low frequency turn-overs due to free-free absorption. Furthermore, we find multiple synchrotron components with different free-free turn-overs. These turn-overs are likely related to regions with different Emission Measures. I will discuss how this complexity in the radio spectral energy distributions is related to the geometry of the galaxy, as well as implications for deep surveys at 1.4GHz, ultra-deep low frequency source counts and Epoch of Reionisation foreground. |
| Shimwell | Timothy | shimwell@strw.leidenuniv.nl | Galaxy Clusters in the LOFAR Two-metre Sky Survey | The LOFAR Two-metre Sky Survey (LoTSS) is a deep 120–168 MHz imaging survey that will eventually cover the entire Northern sky. Each of the 3170 pointings will be observed for 8 hrs, which, at most declinations, is sufficient to produce ∼5″ resolution images with a sensitivity of ∼100 micro-Jy/beam and accomplish the main scientific aims of the survey which includes studying magnetic fields and particle acceleration mechanisms in clusters of galaxies. In this talk I will overview the present status of the survey with a specific focus on galaxy cluster science. |
| Smolcic | Vernesa | vs@phy.hr | VLA-COSMOS 3 GHz Large Project: Cosmic evolution of radio AGN and star forming galaxies since z~5 | Understanding how galaxies form in the early universe and their subsequent evolution through cosmic time is a major goal of modern astrophysics. Panchromatic look-back sky surveys significantly advanced the field in the past decade, and we have entered an even more fruitful period - a 'golden age' of radio astronomy - with new facilities delivering an order of magnitude increase in sensitivity. The VLA-COSMOS 3 GHz Large Project is based on 384 hours of observations with the Karl G. Jansky Very Large Array (VLA) at 3 GHz (10 cm) toward the two square degree COSMOS field. It simultaneously provides the largest and deepest radio continuum survey at high (0.75 arcsec) angular resolution to-date, bridging the gap between last-generation and next-generation surveys. The final mosaic reaches an rms of 2.3 uJy/beam, and delivers 10,830 radio sources (down to 5sigma), 93% of which were associated with multi-wavelength counterparts, reaching out to z~5. This allowed us to gain an unprecedented view toward the cosmic evolution of radio AGN and star forming galaxies since z~5, the results of which will be presented in this talk. |
| Spinelli | Marta | mspinelli@uwc.ac.za | Polarised synchrotron simulations for EoR experiments | Unveiling the neutral Hydrogen distribution during the Era of Reionization is one of the main goals of upcoming radio surveys. Detection of the redshifted 21 cm line emission is complicated by the contamination from foreground sources that are stronger by several orders of magnitude. Proper foreground subtraction relies on the foreground emission being spectrally smooth. These foregrounds include point sources and free-free emission. The dominant foreground is, however, galactic synchrotron emission caused by cosmic ray electrons interacting with the galactic magnetic field. Synchrotron emission can also be polarised. In every EoR experiment with an instrumentally polarised response, an improper calibration can induce a leakage of polarization into intensity. This is potentially a problem because the Faraday rotation affecting the foreground signal creates a complex frequency dependent structure that will be more difficult to separate from the authentic EoR signal. Polarised synchrotron is particularly challenging at the low frequencies of interest for EoR since there is clearly a lack of correlation with total intensity. In this talk, I will present the status of the simulations we are constructing based on a full sky extrapolation of the statistical properties of MWA data at 189 MHz. |
| Tabatabaei | Fatemeh | fatemeht@gmail.com | Cloud-Scale GMRT Survey of M33: Unveiling the Low-Frequency Properties of the ISM | Investigating the low-frequency properties of the star forming regions and interstellar medium, we have performed a GMRT survey of M33 at 240 and 320 MHz at cloud-scale resolutions (~50pc). At frequencies below 1 GHz, it is expected that the thermal emission from HII regions becomes opaque generally, but the M33's giant HII regions are still the brightest features at 240 MHz and 320 MHz. Through a SED analysis, I will discuss the nature and origin of this emission and further present the spectral variation of the synchroton emission from other locations within the galaxy. The low-frequency radio continuum emission is also compared with the Herschel FIR data as well as the IRAM-30m CO(2-1) data at comparable resolutions. The 320 MHz emission shows a tighter correlation with the colder than with the warmer dust with a correlation slope deviating from the linearity. |
| Tan | Chia Min | chiamin.tan@postgrad.manchester.ac.uk | LOTAAS Periodicity Search for Pulsars | LOFAR Tied Array All-Sky Survey (LOTAAS) is an ongoing all northern sky survey for pulsars and transients. It is one of the first large scale pulsar survey conducted at an observing frequency of less than 200 MHz. As of 14 March 2017, the survey has completed 1187 pointings, almost two-thirds of the total amount of planned survey pointings. The survey has discovered 50 new pulsars via periodicity searches. In this talk, I will present the periodicity search for pulsars discussing the survey approach and distinctive features. This will include a discussion of an improved machine learning classifier used to identify the best candidates produced by the pipeline for further investigation. This is the first such approach for pulsar searches which uses a three-class classifier to enable the separation of pulsars, noise and radio-frequency interference. I will present a summary of the search findings so far and a more detailed description of the first binary pulsar discovered in the blind search which has a spin period of 33 ms and an orbital period of 3 days. This will be a part of a joint talk with Daniele Michilli on LOTAAS where he will cover the general description of the survey, as well as the process and results from the single pulse searches for pulsars and transients. |
| Tasse | Cyril | cyril.tasse@obspm.fr | Direction dependent imaging and Wirtinger calibration for low frequency radio surveys | The new generation of radio interferometers is characterized by high sensitivity, wide fields of view<br>and large fractional bandwidth. To synthesize the deepest images enabled by the high dynamic range of these<br>instruments requires to take into account the direction dependent Jones matrices, while estimating the spectral properties of the sky in the imaging and deconvolution algorithms. |
| Tiburzi | Catarina | ctiburzi@mpifr-bonn.mpg.de | Pulsar Timing with LOFAR | LOFAR does not only discover new pulsars but it also a versatile pulsar timing experiment telescope. Whether it is observations with the LOFAR core, or observations with single stations, LOFAR demonstrates unique opportunities for sensitive high-cadence observations. These timing observations allow to address a number of science questions, ranging from studying pulsars as radio sources to using them as probes for the interstellar medium. |
| Trott | Cathryn | cathryn.trott@curtin.edu.au | Progress towards the EoR with the Murchison Widefield Array | I will review progress in the Murchison Widefield Array (MWA) Epoch of Reionisation experiment, including current best limits and the systematics that are constraining us. Despite observing over 1000 hours on three fields, the MWA team has processed <30% of the data, due to the need to refine and improve data calibration and processing. Over the past 12 months, the international MWA team has made significant progress toward understanding the effects of calibration, incomplete sky models, polarisation, and the ionosphere, on EoR detection and estimation, and early application of these lessons has enabled deeper recent limits to be obtained with fewer data. |
| Turner | Jake | jt6an@virginia.edu | The search for radio emission from exoplanets using LOFAR low-frequency beam-formed observations | Detection of radio emission from exoplanets can provide information on the star-planet system that is very difficult or impossible to study otherwise, such as the planetâ€™s magnetic field, magnetosphere, rotation period, orbit inclination, and star-planet interactions. Such a detection in the radio domain would open up a whole new field in the study of exoplanets, however, currently there are no confirmed detections of an exoplanet at radio frequencies. In this study, we discuss our ongoing observational campaign searching for exoplanetary radio emissions using beam-formed observations within the Low Band of the Low-Frequency Array (LOFAR). To date we have observed three exoplanets: 55 Cnc, Upsilon Andromedae, and Tau BoÃ¶tis. These planets were selected according to theoretical predictions, which indicated them as among the best candidates for an observation. During the observations we usually recorded three beams simultaneously, one on the exoplanet and two on patches of nearby â€œemptyâ€ sky. An automatic pipeline was created to automatically find RFI, calibrate the data due to instrumental effects, and to search for emission in the exoplanet beam. Additionally, we observed Jupiter with LOFAR with the same exact observational setup as the exoplanet observations. The main goals of the Jupiter observations are to train the detection algorithm and to calculate upper limits in the case of a non-detection. Data analysis is currently ongoing. Conclusions reached at the time of the meeting, about detection of or upper limit to the planetary signal, will be presented. |
| Vazza | Franco | vazza@ira.inaf.it | The low-frequency view on the complex life of galaxy cluster outskirts | I will present the state of the art in simulating the complex gas flows in the peripheral regions of galaxy clusters, which are connected to cosmic filaments on largest scales and often feature non-thermal emission triggered by strong shock waves. I will discuss the present and future possibilities of studying the origin of cosmic magnetism and plasma conditions by combining future low-frequency observations with advanced theoretical models |

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| White | Sarah | sarah.white@icrar.org | The MWA GLEAM 4-Jy Sample | The GaLactic and Extragalactic All-sky MWA (GLEAM) Survey is a continuum survey conducted using the Murchison Widefield Array (MWA). The first catalogue from this survey contains around 300,000 extragalactic sources, each with 20 radio flux-densities spanning a frequency range of 72-231 MHz. In this talk I will present the MWA GLEAM 4-Jy Sample, which consists of around 1,850 sources brighter than 4 Jy at 151 MHz. The sample is a factor 10 times larger than the most prominent low-frequency radio-source sample that is optically complete: the revised Third Cambridge Catalogue of Radio Sources (3CRR). As a result, the properties of powerful active galactic nuclei (AGN) and strongly-starbursting systems can be studied more robustly. Several of the sources have extended radio emission, and follow-up data from the Australia Telescope Compact Array (ATCA) enables us to extend our radio spectra to higher frequencies than those of the MWA. As a result, we can investigate whether there is evidence of spectral turnover, indicative of synchrotron self-absorption or free-free absorption due to the presence of neutral gas. Furthermore, we use multi-wavelength data over the Southern hemisphere - such as existing optical spectra from the 6-degree Field Galaxy Survey (6dFGS) and mid-infrared images from the Widefield Infrared Survey Explorer (WISE) - to identify the host galaxies of the low-frequency radio emission. Those with 6dFGS spectra are then used to provide first insights into the local sources with optically-bright hosts (median z = 0.088). |
| Wijers | Ralph | R.A.M.J.Wijers@uva.nl | Finding transients in the image plane at low radio frequencies | Good reasons have been advanced for why bright radio transients should always be slow transients at low radio frequencies. These reasons, however, are not good enough for Mother Nature to obey. In this talk I explore the question why we should nonetheless expect bright, fast radio transients, and give an update on what types of radio transient we have already found. I will focus on image plane transients, as beam-formed searches for transients and pulsars are disucssed by others at this meeting. |
| Williams | Wendy | w.williams5@herts.ac.uk | Deep LOFAR imaging and AGN evolution | I will discuss some of the challenges of high resolution and deep imaging at low frequencies with LOFAR. I will present a recent LOFAR image of the Bootes field at 150 MHz, made using new direction-dependent calibration techniques. This new image has allowed us to build statistically large samples of high power radio-loud AGN between 0.5 <= z < 2 and study the evolution of their different accretion modes (high versus low excitation radio galaxies). We use the excellent multiwavelength coverage in this field to explore this evolution as a function of various properties of their host galaxies, including stellar masses and rest-frame colours. This direction-dependent calibration and imaging has been applied on a number of other fields. Using the combined Bootes and H-ATLAS data we have compiled a sample of bright nearby radio galaxies with which we study the relation source size and shape, power and radio spectral index. |
| Xue | Mengyao | mengyao.xue@postgrad.curtin.edu.au | A Low Frequency Census of Southern Pulsars with the MWA | Operating in the range 80-300 MHz, the Murchison Widefield Array (MWA) provides an excellent opportunity to extend the frequency range of pulsar observations in the Southern Hemisphere. We carried out a census of known (cataloged) pulsars at 185 MHz using the MWA Voltage Capture System (VCS) which records voltage data from all 128 MWA tiles at high time and frequency resolutions (100 us, 10 KHz). In this census, the detected powers from 128 MWA tiles are incoherently summed. This gives us a huge field of view (~700 deg2). A significant number of pulsars could be covered in a single pointing. We've developed a new, automatic pipeline that has successfully detected 51 pulsars in 37 hours of observations, including 6 millisecond pulsars (MSPs). Based on this census result, we ran 15,000 PsrPopPy simulations to estimate the number of prospective pulsar detections by SKA1-low. From the simulation results, SKA1-low is expected to find ~7700 pulsars. |
| Varenius | Eskil | varenius@chalmers.se | Subsecond international LOFAR observations of nearby starburst galaxies at 150 MHz | We present new subarcsecond images of the galaxies Arp 299 and NGC4194 made with the International LOFAR telescope at 150MHz. The main aim is to study in detail the structure of the low frequency radio emission from both AGN and star forming regions in these galaxies. The high spatial resolution allows us to separate compact emission from e.g AGN core and SNe from extended halos and outflows, and to study the structure of free-free absorption in the galaxy nuclei. We compare these new preliminary images with previously published subarcsecond LOFAR images of the nearby star forming galaxies M82 and Arp 220 |