**COMMISSION J**

**J01 : New Telescopes (C. Ferrari, T. Bourke)**

**Conveners:**

Chiara Ferrari, chiara.ferrari@oca.eu

Tyler Bourke, tyler.bourke@skao.int

**Session Description:**

The grand vision of the SKA project over the last 30 years has stimulated the development of new radio astronomy facilities around the globe. These telescopes are paving the way from the scientific, technological, and methodological point of view for the two telescopes of the SKA Observatory, whose construction has officially started on July 1st, 2021. This session will highlight new and upgraded cm-to-m wavelength interferometers that are and will be operating before SKA science begins later this decade.

**J02 : VLBI (F. Colomer, T. Venturi)**

**Conveners:**

Francisco Colomer, colomer@jive.eu

Tiziana Venturi, tventuri@ira.inaf.it

**Session Description:**

Very Long Baseline radio Interferometry (VLBI) is a mature technique, whose applications in astronomy, geodesy and planetary sciences are unique now that the need for milliarcsecond angular resolution and for extremely accurate localisation are the ultimate frontiers for some of the hottest scientific areas. For this reason, VLBI is in the heart of some of the most advanced present and future instruments and developments (EHT, ngVLA, SKA, VGOS).This session will bring together experts in each field of application, to provide a view of the state-of-the-art and the desired developments, and to assess the central relevance of VLBI in the continuously evolving landscape of astrophysics, Earth and planetary sciences.

**J03 : Time-domain astronomy - observations and instrumentation (S. Bhandari, C. Law)**

**Conveners:**

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Casey Law : claw@astro.caltech.edu

**Session Description:**

**J04 : Cosmological HI - observations and instrumentation (N. Razavi-Ghods, D. Price)**

**Conveners:**

Nima Razavi-Ghods, nima@mrao.cam.ac.uk

Danny Price,danny.price@curtin.edu.au

**Session description:**

21-cm emission from atomic Hydrogen (HI) in the early Universe is expected to have produced a readily measurable signal at low radio frequencies (~10-200 MHz). This signal encodes cosmological information about the formation of the first stars and galaxies. However, due to foreground emission many magnitudes brighter than the anticipated HI signal, cosmological HI experiments have exquisite calibration requirements. The EDGES experiment has reported the detection of an absorption feature at 78 MHz; verification of this signal by other experiments is crucial. This session is focused on recent observations, observational techniques and novel instrumentation approaches toward detection of the Cosmic Dawn and Epoch of Reionization from measurement of highly-redshifted HI emission.

**J05 : Wide-field radio astronomy (G. Heald, D. Fenech, I. Prandoni)**

**Conveners:**

George Heald,george.heald@csiro.au

Danielle Fenech, dmfd2@cam.ac.uk

Isabella Prandoni,prandoni@ira.inaf.it

**Session Description:**

Radio astronomy is in the midst of a transformation. State-of-the-art receivers allowing larger fields-of-view alongside developments in high-speed digital signal processing and digital beam-forming techniques, as well as the availability of broad-band optical fibre links between antennas, have enabled a ten-fold boost in sensitivity and survey speed. Together these advances have prompted major upgrades to existing telescopes (e.g. JVLA, ATCA-CABB, eMERLIN, eEVN, WSRT-APERTIF, Parkes, etc.) and the emergence of a new generation of radio facilities (e.g. LOFAR, MeerKAT, ASKAP, MWA, FAST, etc.). These facilities, optimized for sensitive wide-field sky surveys and/or simultaneous observations of multiple regions of the sky, will yield transformational science in many research fields, from cosmology to astrophysics, and represent essential technological and scientific test-beds for the future SKA Observatory (SKAO).

We aim to bring together researchers bridging the engineering and astrophysics disciplines, to discuss the optimal scientific exploitation of this new generation of radio surveys, as well as future technological perspectives for wide-field radio facilities on the pathway to SKAO.

The key points that the session will address are:

* Scope, depth and design of ongoing or planned wide-area radio-continuum and spectral line surveys
* Scope, depth and design of ongoing or planned time-domain surveys, exploiting multi-beaming
* Observing/analysis modes/strategies which will allow us to most efficiently exploit these data, including wide-field VLBI
* New wide-field radio astronomy technology (Phased Array Feeds, Aperture Arrays, etc.)
* Digital processing advances enabling real-time beamforming and correlation in multiple directions

**J06 : Space-based radio astronomy (M. Bentum, M. Klein Wolt)**

**Conveners:**

Mark Bentum, bentum@astron.nl

Marc Klein Wolt, M.KleinWolt@astro.ru.nl

**Session Description:**

**J07 : Calibration and instrumentation (T. Carozzi, J. Gilmore)**

**Conveners:**

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**Session Description:**

The development of radio astronomy technology depends ultimately not only on innovations in instrumentation but also on their correct calibration. In this session we solicit new results on radio astronomical instrumentation such as novel antenna designs and new methods or aspects of instrumental calibration. This could be new insights or improvements on existing radio telescopes, such as ALMA, LWA, LOFAR, MWA, or new or planned ones such as NenuFAR, HERA, SKA or even space-based telescopes. The science cases are numerous and involve capabilities from wide-field imaging to precision spectroscopy. Thus we hope to invite interest from a very wide cross-section of research on calibration and instrumentation in radio astronomy.

**J08 : CEM methods for radio astronomy (P. Bolli, D.B. Davidson)**

**Conveners:**

Pietro Bolli, pbolli@arcetri.inaf.it

David B. Davidson, david.davidson@curtin.edu.au

**Session Description**

Contemporary radio telescopes and related instruments rely heavily on Computational Electromagnetic (CEM) techniques. A variety of software packages to numerically solve Maxwell’s equations, or to approximate their solutions via high-frequency techniques, are commercially available and widely used in radio observatories. Such software allows the design, optimization and high-fidelity characterization of antennas, arrays, and microwave components in very complex environments. This session aims to bring together RF and microwave engineers using CEM techniques to develop radio astronomy technology.

**J09 : Receiving systems and their components (E. De Lera Acedo, D. Prinsloo)**

**Conveners:**

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David Prinsloo, d.prinsloo@tue.nl, prinsloo@astron.nl

**Session Description**

**J10 : Big Data and AI in radio interferometry (S.J. Wijnholds, U. Rau, G. Hellbourg, N. Gupta)**

**Conveners:**

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**Session Description**

Given the ever increasing data volumes produced by current and future radio interferometers (e.g. LOFAR, MWA, EVLA, ALMA, MeerKAT, ASKAP, GMRT, SKA, ngVLA), radio astronomy has entered the Big Data era. New data processing methods need to be developed that effectively exploit the capabilities of new hardware technologies to keep up with the deluge of data. With very large-N interferometers with N>1000 being planned (e.g. DSA-2000 or Phase 2 SKA) comes the need to further develop highly optimized, automated, high-throughput end-to-end pipelines for real-time flagging, calibration and imaging.

This session aims to provide a forum to present and discuss the (co-)development of algorithms and computing platforms to deal with the Big Data challenges posed by current and future radio astronomical instruments. It intends to cover a broad range of astronomical applications, including but not limited to:

* Calibration and imaging at scale;
* Real-time analysis for transient science, RFI excision and SETI;
* Pipeline operations, algorithm automation and HTC;
* Software paradigms and compute frameworks;
* AI and ML approaches geared towards any of the aforementioned challenges.

**J11: Latest news and observatory reports (open session)**

**Conveners:**

Douglas Bock, douglas.bock@csiro.au

Stefan Wijnholds, wijnholds@astron.nl

**Session Description**

The primary aim of this session is to provide space in the program for updates from radio observatories around the globe and for latest results. As this is intended to be an informative session, prospective contributors are only requested to submit an abstract sketching what will likely be presented during the session. The secondary aim of this session is to provide a forum for contributions that do not fit in one of the other sessions.

**JE : EMC issues in integration of digital and analog electronics (C. Carobbi, K. Buch, A. Tzioumis)**

**Conveners:**

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**Session Description**

In relatively recent times, in several areas of radio frequency engineering, a process is taking place aimed at replacing analog conditioning circuits of receivers with digital counterparts. Advantages are in terms of storage and retrieval of detected signals, sophisticated and fast signal processing, overall stability and accuracy of receivers. A notable recent example of this process is in radio astronomy, where there is a trend to move digitization of the received analog signals, and even some processing, closer to the highly sensitive receivers in the front-end electronics. The price to pay is in terms of the issues inherent to coexistence, in close proximity, of sensitive analog radio-frequency circuits with high-speed and relatively high signal level, digital circuits. The session is open to contributions, from any field of application, devoted to the mitigation of interference arising from the integration of analog and digital electronics. Session topics include appropriate layout of circuits and interconnections, grounding, shielding, filtering, coupling and cross-talk performance, processing and other EMC techniques aimed at minimizing interference effects.

**JG : Mutual Benefit between radio astronomy and ionospheric science (M. Mevius, C. Cesaroni)**

**Conveners:**

Maajke Mevius, mevius@astron.nl

Claudio Cesaroni, claudio.cesaroni@ingv.it

**Session Description**

The ionized atmosphere significantly affects radio wave propagation and this can lead to misinterpretation of data of radio astronomical observations. Astronomical science  using radio waves acquired at ground, especially at the lowest frequencies (e.g. LOFAR/MWA/LWA, and in the future the SKA), should therefore definitely take up-to-date atmospheric parameters into account. On the other hand, those ionospheric disturbances observed in radio signals can be used to retrieve information about the morphology and dynamics of the ionosphere. Typically, radio astronomical observations are sensitive to small scale disturbances in the ionosphere, with spatial scales from hundreds of meters to hundreds of kilometers and from seconds to minute timescales.

To pose a solid bridge between the ionospheric and radio astronomical scientific communities, this session solicits contributions to facilitate exchange of information on their respective states of the art as well as on their future needs.

Contributions are welcome from both communities:

* Scientists studying the ionosphere presenting climatology studies, small scale disturbances like TIDs and scintillation and abnormal behaviors of the ionosphere during extreme events.
* Scientists dealing with radio astronomy that need to remove or mitigate the ionospheric contribution from their measurements or that can contribute to the understanding the ionospheric physics with their studies.

**JH : Solar, heliospheric and planetary physics (P. Zucca, P. Galopeau)**

**Conveners:**

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Patrick Galopeau, patrick.galopeau@latmos.ipsl.fr

**Session Description**

The Sun, the heliosphere, the magnetized planets in the solar system, are sources of intense radio emission. The session solicits contributions that report on recent observations of solar, heliospheric and planetary radio emissions. Coordinated multi-point observations from ground radio telescopes (e.g., LOFAR, MWA, LWA, NenuFar, URAN-2, UTR-2) and spacecraft plasma/wave experiments (e.g., BepiColombo, Juice, Solar Orbiter, Parker Solar Probe, Galileo, Juno) are especially encouraged. Presentations may focus on radiophysics observations, radio bursts, statistical or case studies, techniques used and developed to investigate the remote magnetic field and the electron density in solar system regions, like the solar corona, the interplanetary medium and the magnetized auroral regions. Interest also extends to laboratory and experimental studies devoted to the comprehension of the generation mechanisms (e.g., cyclotron maser instability) and the acceleration processes (e.g., Alfven waves).