

**Commission A**

Monday 18-08-14 08:00 - 09:20

**A01****Universal Coordinated Time: The International Reference Time Scale and Possible Redefinition**

*Session Conveners: Felicitas Arias, BIPM; Ron Beard*

As the Earth rotation slows, additional seconds are required more frequently. Over several centuries, the rate of correction will become problematic. It is expected that two leap seconds will be required every year by the 22nd century. The actual number of leap seconds to keep track of time would become unwieldy by current standards in the future. Thus a new method of using UTC may become necessary to cope better than current systems do. There are proposal being offered to redefine UTC and abolish leap seconds. The result would be a major change in civil timekeeping. This sessions focuses on the time-scale issues of UTC and possible redefinition of the time standards.

Monday 18-08-14 09:40 - 10:40

**A02****Open Session (1)**

*Session Conveners: Dr. W.A. Davis (USA), Prof. Yasuhiro Koyama (Japan)*

General Topics - open sessions and posters: Antennas, Bioeffects and medical applications, EMC and EM metrology/pollution, Interconnect and Packaging Evaluation, Material Measurement and Charaterization, Microwave to submillimeter measurements/standards, Noise Measurements and Standards, Quantum metrology and fundamental concepts, Time and frequency, Time domain metrology, Techniques for Remote Sensing, Measurements and Calibration in Propagation, RFID, Signal Enhancement for EM Metrology, Scattering calibration, references (bi-static)

Monday 18-08-14 13:40 - 15:40

**A03****Time Scale**

*Session Conveners: Yasuhiro Koyama; Parameswar Banerjee*

Time scale is one of the fundamental frameworks for scientific and engineering measurements. The current time scale is defined and maintained from the ensemble of a numerous numbers of atomic clocks and the quality of the time scale is continuously evolving. The key elements of the time scale are the algorithm of ensemble calculation, developments of better comparison techniques, developments of primary frequency standards, and so on. Papers describing various activities related with these elements are solicited.

Monday 18-08-14 16:00 - 17:40

**A04****Time and Frequency Transfer**

*Session Conveners: Wlodek Lewandowski; Pascale Defraigne*

The time and frequency transfer session focuses on the mechanisms for comparing measurements of time and frequency from one location to another. The techniques are used for creating and distributing standard time scales such as the International Atomic Time. Topics may include simultaneous observation methods (GPS, TV, and radio astronomy), two-way transfer methods, and network methods (network-time and precision-time protocols).

Tuesday 19-08-14 08:00 - 09:20

**AD01**

**Metrology of Optical Frequencies and Optical-Dimensional Measuring Techniques (1)**

*Session Conveners: Josef Lazar; Otakar Wilfert; Juraj Poliak; Jose Luis Arce Diego; Dr. Felix Fanjul-Velez*

Dimensional metrology which is now domain of laser optics represents nowadays the most dynamic branch of measurement science. Primary etalons of lengths – highly stable lasers are able to operate with relative uncertainties very close to the primary etalon of time which is at present the most precise instrument ever made. A great breakthrough into the optical metrology came with the introduction of femtosecond mode-locked lasers generating a comb of equidistantly spaced discrete optical frequencies. These frequencies are a multiplied product of the fundamental repetition frequency. Thus a bidirectional bridge between the sphere of radiofrequency and optical frequencies became possible and the idea of uniting the definition and standard of time and length came true. Measurement of geometrical quantities relies primarily on optical techniques with a highly coherent laser source. The dominant family of methods is derived from interference phenomena. This means that a highly precise wavelength generated by a laser standard is used as a scale for distance evaluation. Interferometer can be seen as an analog to the rf counter counting elements of time – it counts elements of length, single waves of spatial frequencies. A host of related techniques broaden the scope of optical metrology to other quantities, up from fundamental metrology to industrial measurements.

Tuesday 19-08-14 09:40 - 12:00

**AD02**

**Metrology of Optical Frequencies and Optical-Dimensional Measuring Techniques (2)**

*Session Conveners: Josef Lazar; Otakar Wilfert; Juraj Poliak; Jose Luis Arce Diego; Dr. Felix Fanjul-Velez*

Dimensional metrology which is now domain of laser optics represents nowadays the most dynamic branch of measurement science. Primary etalons of lengths – highly stable lasers are able to operate with relative uncertainties very close to the primary etalon of time which is at present the most precise instrument ever made. A great breakthrough into the optical metrology came with the introduction of femtosecond mode-locked lasers generating a comb of equidistantly spaced discrete optical frequencies. These frequencies are a multiplied product of the fundamental repetition frequency. Thus a bidirectional bridge between the sphere of radiofrequency and optical frequencies became possible and the idea of uniting the definition and standard of time and length came true. Measurement of geometrical quantities relies primarily on optical techniques with a highly coherent laser source. The dominant family of methods is derived from interference phenomena. This means that a highly precise wavelength generated by a laser standard is used as a scale for distance evaluation. Interferometer can be seen as an analog to the rf counter counting elements of time – it counts elements of length, single waves of spatial frequencies. A host of related techniques broaden the scope of optical metrology to other quantities, up from fundamental metrology to industrial measurements.

Tuesday 19-08-14 13:40 - 15:40

**A05**

**Quantum-Based Metrology**

*Session Conveners: Christopher L. Holloway; Steven Jefferts*

In recently years there has been a great interest to relating as many types of measurements as possible to the atom. While for decades the atom been used for time and frequency standards, recently, various research groups have been investigating other types of atom based measurements, for example, electric-field and magnetic-field sensors (as well as others type of measurements). If and when possible, such measurements are fundamental and have the advantage that calibration are not needed, as such, possible providing the most accurate measurements available. This special session will introduce and overview various types of measurements based on the atom.

Wednesday 20-08-14 08:00 - 09:20

**A06**

**Education and Training in Metrology (1)**

*Session Conveners: Bruce Warrington*

The electromagnetic metrology community focuses on unifying measurements of radio waves, temperature, humidity, radioactivity, DC frequency, fiber optics, photometry, and ionizing radiation. Those who participate in electromagnetic metrology work toward creating The goal is generally a unified form of electrical voltage and currents that describe or characterize an electromagnetic system. Without electromagnetic metrology and related standards, different standards of measurement would be used throughout the world for electrical measurements. Products would no longer have standards for evaluation or repair, leading to a failure of systems. Understanding the basics of such measurements is fundamental to electromagnetic education. Students need to understand the processes, the standard, the calibration process, and the variances of such measurements to effectively evaluate systems and the related performance.

Wednesday 20-08-14 09:40 - 10:40

**A07**

**Education and Training in Metrology (2)**

*Session Conveners: Bruce Warrington*

The electromagnetic metrology community focuses on unifying measurements of radio waves, temperature, humidity, radioactivity, DC frequency, fiber optics, photometry, and ionizing radiation. Those who participate in electromagnetic metrology work toward creating The goal is generally a unified form of electrical voltage and currents that describe or characterize an electromagnetic system. Without electromagnetic metrology and related standards, different standards of measurement would be used throughout the world for electrical measurements. Products would no longer have standards for evaluation or repair, leading to a failure of systems. Understanding the basics of such measurements is fundamental to electromagnetic education. Students need to understand the processes, the standard, the calibration process, and the variances of such measurements to effectively evaluate systems and the related performance.

Wednesday 20-08-14 13:40 - 15:40

**AB01**

**Recent Advances in Antenna Measurement Techniques (1)**

*Session Conveners: William A. Davis; Olav Breinbjerg*

Recent advances in practical and theoretical aspects of near as well as far-field antenna measurements. The session spans from small body-area-network antennas where interaction with the measurement system is challenging, over adaptive antennas for which measurement of all states becomes too time-consuming, to large satellite antennas where size and space-functionality may prevent direct measurements. The session also encompasses processing of measurement data, e.g. antenna diagnostics and measurement facility validation.

Wednesday 20-08-14 16:00 - 17:40

**AB02**

**Recent Advances in Antenna Measurement Techniques (2)**

*Session Conveners: William A. Davis; Olav Breinbjerg*

Recent advances in practical and theoretical aspects of near as well as far-field antenna measurements. The session spans from small body-area-network antennas where interaction with the measurement system is challenging, over adaptive antennas for which measurement of all states becomes too time-consuming, to large satellite antennas where size and space-functionality may prevent direct measurements. The session also encompasses processing of measurement data, e.g. antenna diagnostics and measurement facility validation.

Thursday 21-08-14 08:00 - 09:20

**A08**

**Advances in sensor development and applications (1)**

*Session Conveners: Chouki Zerrouki*

Sensors' developments have become particularly challenging in various applications fields. Are mainly concerned, environmental and food analyses, biomedical applications, pathogens' detection and diagnosis. It is then important to elaborate accurate and sensitive systems which enable a rapid and selective identification of analytes of interest. This session will focus on, but is not limited to, development and use of chemical and biosensors, biocompatible nanomaterials and/or nanoparticle based sensors, surfaces and interfaces functionalization and engineering for diagnostic devices, and any novel materials and structures or other novel applications. Works dealing with more fundamental aspects, which contribute to a better understanding of electrical interactions and transfers between systems, biomaterials and molecules, are equally appreciated.

Thursday 21-08-14 09:40 - 12:00

**A09**

**Advances in sensor development and applications (2)**

*Session Conveners: Chouki Zerrouki*

Sensors' developments have become particularly challenging in various applications fields. Are mainly concerned, environmental and food analyses, biomedical applications, pathogens' detection and diagnosis. It is then important to elaborate accurate and sensitive systems which enable a rapid and selective identification of analytes of interest. This session will focus on, but is not limited to, development and use of chemical and biosensors, biocompatible nanomaterials and/or nanoparticle based sensors, surfaces and interfaces functionalization and engineering for diagnostic devices, and any novel materials and structures or other novel applications. Works dealing with more fundamental aspects, which contribute to a better understanding of electrical interactions and transfers between systems, biomaterials and molecules, are equally appreciated.

Thursday 21-08-14 13:40 - 14:40

**AT**

**Tutorial A: The BeiDou Navigation Satellite System**

*Session Conveners: Dr. W.A. Davis (USA)*

Tutorial Presenter: Prof Chunhao Han, Beijing Satellite Navigation Center

The BeiDou Navigation Satellite System is now in operation. This tutorial provides an overview of this new regional navigation system. The talk will consider the BeiDou Navigation Satellite System: timing and positioning. The BeiDou Navigation Satellite System is a Chinese satellite navigation system, currently consisting of two separate satellite constellations. The application of the BeiDou Navigation Satellite System (BDS) includes overseas and domestic clients, heightening expectations. The BeiDou system is to be used for transport, weather forecast, fishing, forestry, telecommunications, hydrological monitoring and mapping.

Thursday 21-08-14 14:40 - 15:40

**A10**

**Global Navigation Systems (Overview of the timing techniques in the various satellite systems)**

*Session Conveners: Jörg Hahn; Gao Xiaoxun*

Satellite navigation provide autonomous geo-spatial positioning with global coverage. Receivers determine location (longitude, latitude, and altitude) to within a few metres using time signals transmitted along a line-of-sight by radio from satellites. Some systems are localized to a region of the world at present, while other offer world-wide coverage. This session focuses on the additional systems that include NAVSTAR (GPS) and GLONASS as global systems. The Chinese regional Beidou navigation system was presented in the tutorial. The European Union's Galileo positioning system is a GNSS in, scheduled to be fully operational by 2020. India, France, and Japan are also in the process of developing regional navigation systems

Friday 22-08-14 08:00 - 09:20

**A11**

**Nonlinear Measurements and Characterization (1)**

*Session Conveners: William A. Davis; Nuno Borges Carvalho*

Nonlinear measurements and characteristics of devices and circuits has long been a challenge. Various attempts to define a parameter set have been suggested, but most are limited to either theoretical models or single frequency measurements. New network analyzer techniques have lead to the introduction of X-parameters that offer the basic fundamental frequency information as well as harmonic information, providing a more complete characterization of a device. For power devices, temperature dependence becomes an additional challenge. This session will focus on new developments and some classic views of nonlinear measurements.

Friday 22-08-14 09:40 - 10:40

**A12**

**Nonlinear Measurements and Characterization (2)**

*Session Conveners: William A. Davis; Nuno Borges Carvalho*

Nonlinear measurements and characteristics of devices and circuits has long been a challenge. Various attempts to define a parameter set have been suggested, but most are limited to either theoretical models or single frequency measurements. New network analyzer techniques have lead to the introduction of X-parameters that offer the basic fundamental frequency information as well as harmonic information, providing a more complete characterization of a device. For power devices, temperature dependence becomes an additional challenge. This session will focus on new developments and some classic views of nonlinear measurements.

Friday 22-08-14 13:40 - 15:40

**A13**

**Mode-Stir Chambers**

*Session Conveners: Dr. Charles Bunting; Per-Simon Kildal*

Electromagnetic reverberation chamber or mode-stir chambers were originally used as an environment for EMC testing, but during the last 13 year they have s also been developed into an environment for accurate testing of wireless devices for digital communication systems. The session will be open for different contributions related to testing in reverberation chambers, and in particular the emulation of rich isotropic multipath and accurate testing of wireless devices.

Friday 22-08-14 16:00 - 17:40

**AJ01**

**Pulsars and the Application to Time Scales**

*Session Conveners: Matsakis Demetrios; G  rard Petit*

Precision timekeeping and astronomy are considering a new time scale based on observations of pulsars. The new pulsar-based time scale provides an independent means of determining terrestrial time and may provide insights for the retrospective evaluation of atomic time scales and a new view on time scales. This session focuses on all such applications of the long term stability of the rotation of pulsars.


Saturday 23-08-14 08:00 - 09:20

**A14**

**Open Session (2)**

*Session Conveners: Dr. W.A. Davis (USA), Prof. Yasuhiro Koyama (Japan)*

General Topics - open sessions and posters: Antennas, Bioeffects and medical applications, EMC and EM metrology/pollution, Interconnect and Packaging Evaluation, Material Measurement and Charaterization, Microwave to submillimeter measurements/standards, Noise Measurements and Standards, Quantum metrology and fundamental concepts, Time and frequency, Time domain metrology, Techniques for Remote Sensing, Measurements and Calibration in Propagation, RFID, Signal Enhancement for EM Metrology, Scattering calibration, references (bi-static)




Saturday 23-08-14 09:40 - 10:40

**A15**

**Open Session (3)**

*Session Conveners: Dr. W.A. Davis (USA), Prof. Yasuhiro Koyama (Japan)*

General Topics - open sessions and posters: Antennas, Bioeffects and medical applications, EMC and EM metrology/pollution, Interconnect and Packaging Evaluation, Material Measurement and Characterization, Microwave to submillimeter measurements/standards, Noise Measurements and Standards, Quantum metrology and fundamental concepts, Time and frequency, Time domain metrology, Techniques for Remote Sensing, Measurements and Calibration in Propagation, RFID, Signal Enhancement for EM Metrology, Scattering calibration, references (bi-static)



**Commission B**

Monday 18-08-14 08:00 - 09:20

**B01****Inverse Scattering and Imaging (1)***Session Conveners: Karl Langenberg (Germany); Matteo Pastorino (Italy); Ehud Heyman (Israel)*

Electromagnetic wave techniques, both active and passive, are gathering strong attention in sensing and imaging related to security applications. They include landmine detection, identification of intruders, finding human bodies in disaster events, vehicle collision avoidance, security checking at airports, etc. Used wavelength now ranges from radio to X-ray waves. One of recent driving forces is the use of UWB (Ultra Wideband) signals, which dramatically improves the range resolution, and thus extends the applicability of radar technique to targets with very short ranges, such as indoor and medical imaging. Many of these applications require super resolution and/or very fast computation in order to provide real time images with high quality and reliability. Advanced inverse scattering algorithms and imaging techniques are the key issues of the session. Theoretical investigations and studies aiming to other type of applications are of course welcome.

Monday 18-08-14 09:40 - 10:40

**B02****Inverse Scattering and Imaging (2)***Session Conveners: Karl Langenberg (Germany); Matteo Pastorino (Italy); Ehud Heyman (Israel)*

Electromagnetic wave techniques, both active and passive, are gathering strong attention in sensing and imaging related to security applications. They include landmine detection, identification of intruders, finding human bodies in disaster events, vehicle collision avoidance, security checking at airports, etc. Used wavelength now ranges from radio to X-ray waves. One of recent driving forces is the use of UWB (Ultra Wideband) signals, which dramatically improves the range resolution, and thus extends the applicability of radar technique to targets with very short ranges, such as indoor and medical imaging. Many of these applications require super resolution and/or very fast computation in order to provide real time images with high quality and reliability. Advanced inverse scattering algorithms and imaging techniques are the key issues of the session. Theoretical investigations and studies aiming to other type of applications are of course welcome.

Monday 18-08-14 13:40 - 14:40

**BT****Tutorial B: Controlling Waves on Metasurfaces***Session Conveners: Prof. Guiliano Manara**Tutorial Speaker: Stefano Maci (Italy)*

Metasurfaces constitute a class of thin metamaterials, which can be used from microwave to optical frequencies to create new electromagnetic engineering devices. They are obtained by a dense periodic texture of small elements printed on a grounded slab without or with shorting vias. These have been used in the past for realizing electromagnetic bandgaps (EBG) or equivalent magnetic-walls. Changing the dimension of the elements, being the sub-wavelength 2D-periodicity equal, gives the visual effect of a pixelated image and the electromagnetic effect of a modulation of the equivalent local reactance. The modulated metasurface reactance (MMR) so obtained is able to transform surface or guided waves into different wavefield configurations with required properties. The MMR allows in fact a local modification of the dispersion equation and, at constant operating frequency, of the local wavevector. Therefore, the general effects of metasurface modulation are similar to those obtained in solid (volumetric) inhomogeneous metamaterial as predicted by the Transformation Optics; namely, re-addressing the propagation path of an incident wave. However, significant technological simplicity is gained. In this lecture, after illustration of the design method of metasurfing-wave antennas, various examples are presented and discussed, including Luneburg lenses, Maxwell's Fish-eyes, isoflux antennas, Doppler-guide antennas and new types of transmission lines.



*Stefano MACI is a Full Professor of Antennas at the University of Siena, and Director of the PhD School of Information Engineering and Science (which presently includes about 60 PhD students). His present research interests are focused on high-frequency and beam representation methods, computational electromagnetics, large phased arrays, planar antennas, reflector antennas and feeds, metamaterials and metasurfaces.*

*Since 2000 he was member the Technical Advisory Board of 11 international conferences, member of the Review Board of 6 International Journals. He organized 23 special sessions in international conferences, and he held 10 short courses in the IEEE Antennas and Propagation Society (AP-S) Symposia about metamaterials, antennas and computational electromagnetics.*

*He was responsible of 5 projects funded by the European Union (EU). In 2004-2007 he was WP leader of the Antenna Center of Excellence (ACE, FP6-EU) and in 2007-2010 he was International Coordinator of a 24-institution consortium of a Marie Curie Action (FP6).*

*He was the founder of the European School of Antennas (ESoA), a post graduate school that presently comprises 30 courses on Antennas, Propagation, Electromagnetic Theory, and Computational Electromagnetics and 150 teachers coming from 15 countries. He was a member of the AdCom of IEEE Antennas and Propagation Society (AP-S) and former associate editor of AP-Transaction.*

*Stefano Maci is presently Director of ESoA, a member of the Board of Directors of the European Association on Antennas and Propagation (EuRAAP), a member of the Technical Advisory Board of the URSI Commission B, a member of the Governing Board of the European Science Foundation (ESF) Project "NewFocus", a member of the National Enabling Committee, a Distinguished Lecturer of the IEEE Antennas and Propagation Society (AP-S), a member of the Antennas and Propagation Executive Board of the Institution of Engineering and Technology (IET, UK), Chair of the Award Committee of IEEE AP-S.*

*His research activity is documented in 10 book chapters, 110 papers published in international journals, (among which 76 on IEEE journals), and about 300 papers in proceedings of international conferences.*

Monday 18-08-14 14:40 - 15:40

### **B03**

#### **Scattering and Diffraction (1)**

*Session Conveners: Ludger Klinkenbusch (Germany); Paul D. Smith (Australia)*

The Session will review topics covering a wide range of scattering and diffraction problems, including edge diffraction, high-frequency methods, hybridization with high-frequency methods, use of artificial structures for optimal control of wave propagation, scattering from disordered media, and potential applications. Study of scattering from non-linear/anisotropic media as well as mathematical problems will also be emphasized. In addition, scattering and diffraction by canonical structures will be considered. Of interest might be different types of illuminating fields, such as plane waves, rays, and beams.



Monday 18-08-14 16:00 - 17:40

**B04**

**Electromagnetic Theory**

*Session Conveners: Gerhard Kristensson (Sweden); Ari Sihvola (Finland)*

This session addresses the most recent advances in electromagnetic theory. It includes all aspects of electromagnetics, and all frequency ranges from statics to optics, including both time and frequency formulations. Of special interest are advances in mathematical and material modeling, solutions of canonical problems, analytic identities, guided wave, mathematical aspects of numerical methods, random media, asymptotic methods, and antenna theory.

Tuesday 19-08-14 08:00 - 09:20

**B05**

**Scattering and Diffraction (2)**

*Session Conveners: Ludger Klinkenbusch (Germany); Paul D. Smith (Australia)*

The Session will review topics covering a wide range of scattering and diffraction problems, including edge diffraction, high-frequency methods, hybridization with high-frequency methods, use of artificial structures for optimal control of wave propagation, scattering from disordered media, and potential applications. Study of scattering from non-linear/anisotropic media as well as mathematical problems will also be emphasized. In addition, scattering and diffraction by canonical structures will be considered. Of interest might be different types of illuminating fields, such as plane waves, rays, and beams.

Tuesday 19-08-14 09:40 - 12:00

**BD01**

**Recent Advances in Metamaterials**

*Session Conveners: Christophe Caloz (Canada); Richard Ziolkowski (USA); Nader Engheta (USA)*

In the last decade, there has been a renewed interest in using fabricated structures at various length scales to develop composite materials that mimic known material responses or that qualitatively have new, physically realizable response functions that do not occur, or may not be readily available, in nature. Researchers have studied the exotic physics associated with these metamaterials and the potential use of their properties for interesting engineering applications, including lenses, cloaking, antennas, small waveguides and cavities, and other devices at microwave, millimeter-terahertz and optical frequencies.

Tuesday 19-08-14 13:40 - 15:40

**B06**

**Analytical, Numerical and Hybrid Methods in Electromagnetics**

*Session Conveners: Prabhakar H. Pathak (USA); Donald R. Wilton (USA); Giuliano Manara (Italy)*

This session will focus primarily on ray optical ( UTD/GTD), or wave optical (PO/PTD), or beam Optical (Gaussian beams and complex source beams) or numerical methods (MoM, FEM, FE-BI). These methods may also be used in some systematic form of an appropriately paired hybrid combination to solve a variety of electrically large, and also possibly complex, EM antenna and scattering problems that otherwise cannot be solved efficiently and in a tractable fashion by any of these methods when just used alone. Basically, each method will generally exhibit domains of applicability and domains where they fail or maybe even become intractable; thus, the main purpose of any hybridization is to overcome the limitations of any one approach by systematically combining it with one or more of the other appropriate methods, so that the resulting hybrid solution can remain valid over the entire domain of interest while being also relatively efficient for applications.

Wednesday 20-08-14 08:00 - 09:20

**B07**

**Beam & High-Frequency Methods (1)**

*Session Conveners: Timor Melamed (Israel), Andrey Osipov (Germany), Stefano Maci (Italy)*

The session will address the theory and topical applications of the whole range of high-frequency methods with a special focus on beam methods. By using the wavelength as a small parameter, the methods should lead to simpler approximate solutions of electromagnetic problems, thus allowing a physical insight into the solution and numerically efficient simulations of problems hardly treatable with direct numerical methods- The beam part of the sessions will focus on EM and scalar beam propagation and scattering as well as on application of beam (phase-space) expansions. Further methods of interest include the geometrical optics (GO), the geometrical theory of diffraction (GTD), the uniform theory of diffraction (UTD), the physical optics (PO) and the physical theory of diffraction (PTD). Papers on solutions of canonical problems to be used as building blocks in the high-frequency solutions and on topical applications like electromagnetic radiation, scattering and propagation in structures involving engineered materials (metamaterials, metasurfaces, etc) are particularly welcome.

Wednesday 20-08-14 09:40 - 10:40

**B08**

**Beam & High-Frequency Methods (2)**

*Session Conveners: Timor Melamed (Israel), Andrey Osipov (Germany), Stefano Maci (Italy)*

The session will address the theory and topical applications of the whole range of high-frequency methods with a special focus on beam methods. By using the wavelength as a small parameter, the methods should lead to simpler approximate solutions of electromagnetic problems, thus allowing a physical insight into the solution and numerically efficient simulations of problems hardly treatable with direct numerical methods- The beam part of the sessions will focus on EM and scalar beam propagation and scattering as well as on application of beam (phase-space) expansions. Further methods of interest include the geometrical optics (GO), the geometrical theory of diffraction (GTD), the uniform theory of diffraction (UTD), the physical optics (PO) and the physical theory of diffraction (PTD). Papers on solutions of canonical problems to be used as building blocks in the high-frequency solutions and on topical applications like electromagnetic radiation, scattering and propagation in structures involving engineered materials (metamaterials, metasurfaces, etc) are particularly welcome.

Wednesday 20-08-14 13:40 - 15:40

**B09**

**Ultrawideband Antennas and Arrays**

*Session Conveners: Jiro Hirokawa (Japan), John Volakis (USA), Zhi Ning Chen (Singapore)*

Ultra-wideband (UWB) wireless technology is attractive for upcoming commercial applications, including next-generation short-range high data rate wireless connectivity, high resolution imaging, detection and identification, localization, and high accuracy radars, to mentions a few. Antennas are key front-end components in UWB wireless systems, with each application having its own requirements. Besides the conventional parameters such as impedance matching bandwidth, 3D radiation patterns, radiation efficiency, UWB systems have additional design constrains. Among them are polarization orthogonality, MIMO capability, low cost beam steering for mm and sub-mm wave applications, interference rejection, low dispersion and stable gain across large bandwidths.

Wednesday 20-08-14 16:00 - 17:40

**BD02**

**Advanced Computational Techniques for Multi-Scale and Multi-Physics Electromagnetics**

*Session Conveners: Jin-Fa Lee (USA); Weng Cho Chew (USA)*

Real life engineering applications are often multi-disciplinary and multi-scale in nature. Examples include: antennas placements on large platforms, phased array with thermal consideration, signal integrity in integrated circuits and packages, nano-electronic modeling, modeling of organic light emitting diodes, to name just a few. However, existing numerical methods and commercial software have been shown inadequate for solving these new emerging engineering problems. It is, therefore, of paramount importance to research and develop new novel computational techniques to address these interesting and challenging applications effectively.

Thursday 21-08-14 08:00 - 09:20

**BD03**

**Nano-Electromagnetics**

*Session Conveners: Andrea Al  (USA); Filippo Capolino (USA)*

The development of nanostructures and advances in nanofabrication techniques has motivated interest in understanding and exploiting new interactions between matter and electromagnetic waves, especially exploiting strong near-field interaction and enhancements. As an increasing part of modern technology and science involves electromagnetics in nanostructures, this session focuses on novel wave physics related to nano-electromagnetics in semiconductors, graphene, carbon nanotubes, plasmonic nanostructures, and metamaterials.

Thursday 21-08-14 09:40 - 12:00

**B10**

**Antennas: Recent Advances and Future Outlook**

*Session Conveners: Yahya Rahmat-Samii (USA), Sembiam Rengarajan (USA), Paolo Nepa (Italy)*

High performance communication and radar systems are constantly pushing the envelop for novel antenna developments. Modern antennas are required to be reconfigurable, and exhibit multifunction and multiband performance. They look more like a composite device and very different from classic antennas. Antennas optimized for near field radiation, wearable unobtrusive textile antennas, transparent antennas, compact arrays for MIMO systems and diversity schemes, high efficiency antennas for device-to-device communications, low-cost phased arrays for high-data-rate mobile-to-satellite communications, compact antennas for miniaturized biomedical devices, multi-beam airborne and satellite antennas, and large spacecraft antennas at millimeter wave frequencies and beyond. These are just a few examples of what the system developers are asking for the next generation antennas. These performance demands are stimulating an intense research activity on novel artificial materials and advances in antenna/material characterization as well. This session intends to address recent advances in antenna developments and applications including future outlook.

Thursday 21-08-14 13:40 - 15:40

**B11**

**Electromagnetic Field Transformations for Measurements and Numerical Methods**

*Session Conveners: Thomas Eibert (Germany); Yang Hao (UK); Raj Mittra (USA)*

"Historically field transformation methods for measurements and numerical modeling techniques have been developed independent from each other. In both fields, enormous progress has been achieved during the past years and very powerful algorithms are available for various applications. Further progress can however be expected, if future research is stimulated by joint synergetic effects from both disciplines. The session focuses on field transformation methods for measurements and numerical modeling. Particular contributions are invited from the field of near-field far-field transformations and from the field of near-field near-field transformations including diagnostics of antennas and scatterers. Novel algorithms with good numerical efficiency and wide applicability are of interest."

Friday 22-08-14 08:00 - 09:20

**B12**

**Time-Domain Electromagnetics and Transient Phenomena (1)**

*Session Conveners: A. Yarovoy (The Netherlands); Arthur D. Yaghjian (USA)*

Transient phenomena are becoming extremely important for many application domains. CMOS and Bi-CMOS technology allows signals with a few ps leading edge, and a frequency domain analysis of such signals is out of discussion. Radars routinely use bandwidths exceeding 1GHz, and narrow-band EM modelling is not anymore welcome at radar conferences. (Ultra)High-resolution imaging at microwave, sub-mm and THz can be much better understood in time domain rather than in frequency one. Multi-scale analysis is very much applicable, but it should be done over a large frequency band.

Friday 22-08-14 09:40 - 10:40

**B13**

**Time-Domain Electromagnetics and Transient Phenomena (2)**

*Session Conveners: A. Yarovoy (The Netherlands); Arthur D. Yaghjian (USA)*

Transient phenomena are becoming extremely important for many application domains. CMOS and Bi-CMOS technology allows signals with a few ps leading edge, and a frequency domain analysis of such signals is out of discussion. Radars routinely use bandwidths exceeding 1GHz, and narrow-band EM modelling is not anymore welcome at radar conferences. (Ultra)High-resolution imaging at microwave, sub-mm and THz can be much better understood in time domain rather than in frequency one. Multi-scale analysis is very much applicable, but it should be done over a large frequency band.

Friday 22-08-14 13:40 - 15:40

**B14**

**Novel Mathematical Methods in Electromagnetics**

*Session Conveners: Kazuya Kobayashi (Japan); Youri Shestopalov (Sweden)*

This session will cover recent achievements in the field of advanced mathematical techniques as applied to mathematical problems arising in all branches of electromagnetics. Topics of interest include, but are not limited to the following areas: electromagnetic theory; novel mathematical techniques; analytical regularization methods; canonical problems; numerical methods; scattering and diffraction; high-frequency techniques; guided waves; inverse problems; random media and rough surfaces; waves in complex media; time-domain techniques; nonlinear phenomena; computational electromagnetics.

Friday 22-08-14 16:00 - 17:40

**BCD01**

**Reconfigurable Antennas for Cognitive Radio**

*Session Conveners: Karu Esselle (Australia); A. Monorchio (Italy)*

"Software radio, software defined radio (SDR) and cognitive radio (CR) system paradigms pose special challenges for antenna designers and researchers. Innovative designs are needed to achieve the broad band or multiband performance required by the adaptive nature of the transponders. Switched band antennas with integral solid state or MEMS switching devices are emerging as a possible solution, but significant challenges remain. Designers of integrated receivers may need to incorporate switchable filtering inside the antenna structure. Designers of broadband and multiband antennas for SDR in the mm-wave bands will face many fabrication and integration challenges. The session is intended to provide an update on the state-of-the-art in a class of promising techniques including miniaturization and software matching control, to derive novel and unconventional antennas operating over large bandwidths for SDR and CR."

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Saturday 23-08-14 08:00 - 09:20

**BCD02****Emerging Wireless Technologies (1)**

*Session Conveners: M. Ando (Japan); Marco Luise (Italy); Smail Tedjini (France)*

Wireless systems are spreading not only in communications but also in varieties of applications, such as sensing and power transferring. To support these trends, novel demands are emerging for each level of wireless technologies in devices, circuits, systems and networking. The session will present the emerging wireless technologies in general aspects. Some examples are, but are not limited to: "Near field and short range communications", "Wireless Sensor networks", "RFID", "Radio Climatology", "Wireless power transfer", "Battery less devices" and "Energy harvesting". As is always the case with the wireless systems, the management of radio spectrum and power efficiency are indispensable. Then, "RF direct sampling", "Cognitive devices and networking" and "Wireless and photonic devices for mobile cloud networking" are also the keywords for sustainable popularization of these applications. Novel concepts, principles and approaches for the utilization of radio are highly solicited.

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Saturday 23-08-14 09:40 - 10:40

**BCD03****Emerging Wireless Technologies (2)**

*Session Conveners: M. Ando (Japan); Marco Luise (Italy); Smail Tedjini (France)*

Wireless systems are spreading not only in communications but also in varieties of applications, such as sensing and power transferring. To support these trends, novel demands are emerging for each level of wireless technologies in devices, circuits, systems and networking. The session will present the emerging wireless technologies in general aspects. Some examples are, but are not limited to: "Near field and short range communications", "Wireless Sensor networks", "RFID", "Radio Climatology", "Wireless power transfer", "Battery less devices" and "Energy harvesting". As is always the case with the wireless systems, the management of radio spectrum and power efficiency are indispensable. Then, "RF direct sampling", "Cognitive devices and networking" and "Wireless and photonic devices for mobile cloud networking" are also the keywords for sustainable popularization of these applications. Novel concepts, principles and approaches for the utilization of radio are highly solicited.

**Commission C**

Monday 18-08-14 08:00 - 09:20

**C01****Advances in signal processing for cognitive radio (1)***Session Conveners: Yves LouËt, SUPELEC, France; Rodrigo De Lamare; University of York, UK*

Cognitive radio has emerged as one of the most promising paradigms for efficient utilization of the radio spectrum. Still, a number of functions that any cognitive radio terminal has to accomplish are the subject of intense research. We think of spectrum sensing, of signal feature recognition, of the different criteria to authorize the use of the available bandwidth, and of the (dynamic) signal design criteria to optimize the exploitation of the spectrum resources. The session will also discuss particular criteria to design cognitive terminals, like software-defined or flexible radio.

Monday 18-08-14 09:40 - 10:40

**C02****Advances in signal processing for cognitive radio (2)***Session Conveners: Yves LouËt, SUPELEC, France; Rodrigo De Lamare; University of York, UK*

Cognitive radio has emerged as one of the most promising paradigms for efficient utilization of the radio spectrum. Still, a number of functions that any cognitive radio terminal has to accomplish are the subject of intense research. We think of spectrum sensing, of signal feature recognition, of the different criteria to authorize the use of the available bandwidth, and of the (dynamic) signal design criteria to optimize the exploitation of the spectrum resources. The session will also discuss particular criteria to design cognitive terminals, like software-defined or flexible radio.

Monday 18-08-14 13:40 - 15:40

**CA01****Radio Localization Techniques: satellite, indoor, in tunnels, autonomous***Session Conveners: Carles Fernandez-Prades, CTTC, Spain, ; Massimo Crisci, European Space Agency, The Netherlands*

In the last years, the different techniques to obtain information about the location of a radio terminal have really boomed. The workhorse in this respect is GPS, now augmented and integrated by other Global Satellite Navigation Systems like Russia's GLONASS and Europe GALILEO. The reliability and availability of such systems will benefit from their mutual integration in new-generation receivers, nonetheless they still cannot give any indication when the terminal is indoor due to the low power of the received signal. Other "terrestrial" systems come to the aid in this respect, based on cellular networks, Wi-Fi signals, or even opportunity wideband radio signals like those emitted by television repeaters. The session will examine the latest results about such topics, and in particular about the integration of GNSS with "local" positioning elements.

Monday 18-08-14 16:00 - 17:40

**CD01****Circuit Technologies for Mobile Communications***Session Conveners: Shoichi Narahashi, NTT DOCOMO, Japan; Ke Wu, Ecole Polytechnique of Montreal*

Mobile, and in particular, cellular communications is ever evolving towards new generation of networks and equipment. In this respect, the technologies for RF and baseband components to be used in terminals and radio based stations has to keep up with the pace. The session will present advances in the field of (superconducting) filters and transmission lines for such applications.

Tuesday 19-08-14 08:00 - 09:20

**C03**

**Advances in Channel Coding for Reliable Communications**

*Session Conveners: Alberto Tarable, CNR Torino; Joseph Jean Boutros, Texas A&M University @ Qatar*

The field of channel coding is one of the most mature in wireless communications, especially after the recent invention and application of iterative decoding. Still, many areas are benefiting from innovations that promise to push further reliability of communications, including polar coding, and the generalization of previously known schemes like convolutional LDPC codes, and new high-dimensional lattice codes. In addition to this, channel codes are being applied also in new domains like physical-layer network coding and physical security.

Tuesday 19-08-14 09:40 - 12:00

**C04**

**Emerging technologies for 5G cellular communications**

*Session Conveners: Marco Luise, University of Pisa, Italy; Gerhard Fettweis, Technical Univ. of Dresden, Germany*

The commercial advent of 4th-Generation (4G) cellular radio communication systems has already started, so that we can say that research on 4G is close to an end. In this field, the focus is nowadays on the so-called "Beyond-4G" (B4G) or directly 5th-Generation (5G) systems. The quest is manifold: on one hand the accent is on "Green" technologies both from the standpoint of the network (to decrease power consumption and electromagnetic pollution) and from that of the terminal (to increase battery life). In addition, more capacity in terms of bandwidth efficiency (bit/s/Hz) and of spatial density of capacity (bit/s/km<sup>2</sup>) is requested. The session investigates a number of technologies to achieve such objectives like small-cells, cell-to-cell cooperation, cooperative and massive MIMO, interference management.

Tuesday 19-08-14 13:40 - 15:40

**CB01**

**Radio Channel measurements and modeling: MIMO, indoor, outdoor**

*Session Conveners: Sana Salous, Durham University, UK; Claude Oestges, Catholic University of Louvain, Belgium*

The development of new technologies for wideband wireless communications ask for more research and more accurate radio channel measurements and models. This happens in the field of (indoor) positioning with UWB signals, of Gbit/s communications, of massive MIMO systems with a large number of radiating elements, of cooperative and relaying systems and of heterogeneous networks in small metrocells. The complexity of such scenarios demands advanced measurement techniques and simple yet accurate models based on sparsity or on different parametric techniques that will be the subject of the session.

Wednesday 20-08-14 08:00 - 09:20

**C05**

**Cooperative Communications and Network Coding (1)**

*Session Conveners: Alister Burr, University of York, UK; Giacomo Bacci, University of Pisa, Italy*

A very promising approach for improving efficiency of wireless networks is cooperation between multiple devices. This includes the use of one or more relays to forward the messages, cooperation between terminals or base stations to serve users, and network coding for collaborative routing of multiple flows over a network. Many approaches are being researched, including amplify-and forward, decode-and-forward, and compress and forward relaying, physical layer network coding, and other network coding approaches operating at higher layers. The proposed session will deal with the most advanced techniques in this area.

Wednesday 20-08-14 09:40 - 10:40

**C06**

**Cooperative Communications and Network Coding (2)**

*Session Conveners: Alister Burr, University of York, UK; Giacomo Bacci, University of Pisa, Italy*

A very promising approach for improving efficiency of wireless networks is cooperation between multiple devices. This includes the use of one or more relays to forward the messages, cooperation between terminals or base stations to serve users, and network coding for collaborative routing of multiple flows over a network. Many approaches are being researched, including amplify-and forward, decode-and-forward, and compress and forward relaying, physical layer network coding, and other network coding approaches operating at higher layers. The proposed session will deal with the most advanced techniques in this area.

Wednesday 20-08-14 13:40 - 14:40

**CT**

**Tutorial C:**

*Session Conveners: Prof. Marco Luise (Italy)*

Abstract not available yet

Wednesday 20-08-14 14:40 - 15:40

**CF 01**

**URSI-ISPRS Session on Communications and Remote Sensing in Disaster Scenarios (1)**

*Session Conveners: Simonetta Paloscia, IFAC-CNR, Italy; Chao Wang, Center for Earth Observation and Digital Earth, China, Tullio Tanzi, ISPRS, Institut Mines-Telecom - Telecom Paris Tech., France*

When a disaster strikes, communication facilities can be totally destroyed. A critical early requirement is the setting up of emergency communication systems to support rescue teams and disseminate information and instructions to the survivors. Access to ground-based and space based observational data are facilitated by the international charter "Space and Major Disasters" signed by various space agencies. The session is concerned with research and technological developments which may help to improve prediction and monitoring of potential hazards, and which may be involved in the main phases of disaster (preparedness, response and recovery). More specifically, the session will focus on emergency communication, fast deployment of communication networks, disaster relief services, recent advances in Synthetic Aperture Radar (SAR, InSAR, DinSAR) and Ground Penetrating Radars.

Wednesday 20-08-14 16:00 - 17:40

**CF 02**

**URSI-ISPRS Session on Communications and Remote Sensing in Disaster Scenarios (2)**

*Session Conveners: Simonetta Paloscia, IFAC-CNR, Italy; Chao Wang, Center for Earth Observation and Digital Earth, China, Tullio Tanzi, ISPRS, Institut Mines-Telecom - Telecom Paris Tech., France*

When a disaster strikes, communication facilities can be totally destroyed. A critical early requirement is the setting up of emergency communication systems to support rescue teams and disseminate information and instructions to the survivors. Access to ground-based and space based observational data are facilitated by the international charter "Space and Major Disasters" signed by various space agencies. The session is concerned with research and technological developments which may help to improve prediction and monitoring of potential hazards, and which may be involved in the main phases of disaster (preparedness, response and recovery). More specifically, the session will focus on emergency communication, fast deployment of communication networks, disaster relief services, recent advances in Synthetic Aperture Radar (SAR, InSAR, DinSAR) and Ground Penetrating Radars.



Thursday 21-08-14 08:00 - 09:20

**CBDK01**

**Body-Area Networks**

*Session Conveners: Raffaele D'Errico, CEA-LETI, France; Kamyaz Yazdandoost, NICT, Japan*

Wireless body area network (WBAN) is a small-scale communications network that operates inside, on, or in the peripheral proximity of a human body. In recent years WBANs are gaining more and more attentions due to the great number of possible applications. Medical, sport, fitness, and entertainment are just few examples of areas where WBANs could find useful employments. The basic concept of WBAN is to transfer the vital signs of a patient, sports man, fireman, and so on to the respectful unit for further action. In particular, the medical motivation is to increase survival rates and improvement of health outcomes with easy and fast diagnosis and treatment. The goal for homecare services is to improve quality of life and independence for patients by supporting care at home. The wireless body area networks promise to revolutionize health monitoring. However, designers of such systems face a number of challenging tasks. The session will focus on the main technological challenges such as radio propagation and channel modeling in, on and around the body, antennas, low-power and energy-harvesting sensors and transmission nodes, in a word, all the key technologies that are crucial for the implementation of a WBAN.

Thursday 21-08-14 09:40 - 12:00

**C07**

**Wireless Physical Layer Security**

*Session Conveners: Alain Sibille, Telecom ParisTech, France; Michael A. Jensen, Brigham Young University, USA*

A number of fundamental results in the field of physical security are being found nowadays. The area is still in its infancy and many different topics are collected under this title, ranging from the computation of the secrecy capacity of wireless fading channels, to the design of cryptographic systems using the terminal noise as the encryption waveform, to directional modulation techniques that intentionally scramble the data constellation so as to make it undetectable off a certain privileged line of sight. The session will touch upon the many facets of these techniques trying to give a unified view of the field.

Thursday 21-08-14 13:40 - 15:40

**C08**

**Urban scenarios: small cells, indoor to outdoor, vegetation**

*Session Conveners: Lorenzo Vangelista, University of Padova, Italy; Dennis Rose, TU Braunschweig, Germany*

The cellular networks operated by mobile providers are getting more complex every day. In order to ensure a good performance across multiple layers or multiple RATs and to cope with the increasing user demand, realistic modelling of these networks for system simulations is crucial. Simple models that rely on regular network layouts or simple geo-data enable fast computation of system simulation but cannot reflect the dynamic behaviour of modern communication networks. More realistic models reflect the real environment, with buildings, streets, user and traffic simulations and realistic network deployments. In particular, since 80% of the traffic originates from the inside of buildings, the simulation of Pico- and Femto-Cells becomes more and more relevant. This session addresses propagation models for realistic Outdoor-to-Indoor and Indoor-to-Outdoor environments as well as the effect of vegetation.

Friday 22-08-14 08:00 - 09:20

**CD02**

**Ultra-high bit rate radio communications (TeraHertz and 60 GHz) (1)**

*Session Conveners: Thomas Keurner, Technical University of Braunschweig, Germany; Cyril Renaud, University College London; Tadao Nagatsuma, Osaka University, Japan*

With the ever-growing demand of modern applications in terms of communications bit-rate, wireless networks are facing a bottleneck in the access segments, especially when confronted with their wired counterparts, that are more and more exploiting fiber optics connections up to the end-user link. A number of technologies are emerging in the field of radio communications to bridge this gap. The aim is to provide Gbit/s-rate wireless connections with simple technologies in millimeter-wave band (from 60 GHz to 600 GHz and higher). The session aims to present the latest results in terms of technologies (signal generation and detection) and systems (modems) in the field.

Friday 22-08-14 09:40 - 10:40

**CD03**

**Ultra-high bit rate radio communications (TeraHertz and 60 GHz) (2)**

*Session Conveners: Thomas Keurner, Technical University of Braunschweig, Germany; Cyril Renaud, University College London; Tadao Nagatsuma Osaka University, Japan*

With the ever-growing demand of modern applications in term of communications bit-rate, wireless networks are facing a bottleneck in the access segments, especially when confronted with their wired counterparts, that are more and more exploiting fiber optics connections up to the end-user link. A number of technologies are emerging in the field of radio communications to bridge this gap. The aim to provide Gbit/s-rate wireless connections with simple technologies in millimeter-wave band (from 60 GHz to 600 GHz and higher). The sessions aims to presents the latest results in terms of technologies (signal generation and detection) and systems (modems) in the field.

Friday 22-08-14 13:40 - 15:40

**C09**

**Resource allocation in wireless networks**

*Session Conveners: Silvia Ruiz, UPC, Spain; Luca Sanguinetti, SUPELEC, France*

Differently from the algorithms for scheduling studied and implemented in the past, the advent of 4G heterogeneous cellular networks has spurred a new generation of cross-layer resource allocation criteria based on information coming from the physical layer. Such criteria can be either centralized or distributed, optimizing bandwidth and slot allocation strategies to traffic characteristics while maintaining QoS parameters. They are based on a number of non-conventional mathematical techniques like Game Theory or Intelligent algorithms, and keep into account the interference generated by users in a cell and also from neighbour cells. Resource allocation techniques are one of the key factors for network optimization and efficiency improvement.

Friday 22-08-14 16:00 - 17:40

**C10**

**Advanced Technologies for WLANs and WSNs**

*Session Conveners: Masahiro Morikura, Kyoto University, Japan; Shinichi Miyamoto, Osaka University, Japan*

Wireless LANs are finding new applications after more than two decades of development, for example in the field of localization or of communications and sensing for smart applications. The session will present new results in such fields, including techniques for the augmentation of efficiency and coverage.

Saturday 23-08-14 08:00 - 09:20

**C11**

**Communications Technologies for (high-speed) transportation systems (1)**

*Session Conveners: M. Berbineau, IFSTTAR, France; D.W. Matolak, University of South Carolina, USA*

To increase quality, reliability, safety and security of Railway systems (underground, conventional trains and High speed trains) while increasing accessibility and productivity, modern railway operations rely on ever increasing fluxes of information between operators' staff workstations, central databases and field devices widely distributed by the trackside and on board the train. This trend is accentuated by the development of automatic train control systems and driverless systems. The communications applications required in the railway domain are: safety-related services such as control and command, and non-safety related services such as passenger information, video surveillance, and internet on-board trains. Robustness, reliability, high data rate, spectral efficiency, optimization of radio resource usages are of significant interest for railway applications. Evaluating the performance of railway radio systems requires radio channel models for numerous propagation environments: rural areas, urban areas, tunnels, fast fading, Doppler effects, tunnels, cuttings, viaducts and electromagnetic interferences. Furthermore, dedicated antennas need be developed with adequate performance and placement. Security, robustness, throughput and latency are also strong requirements. The session will present the new results addressing these challenges.

Saturday 23-08-14 09:40 - 10:40

**C12**

**Communications Technologies for (high-speed) transportation systems (2)**

*Session Conveners: M. Berbineau, IFSTTAR, France; D.W. Matolak, University of South Carolina, USA*

To increase quality, reliability, safety and security of Railway systems (underground, conventional trains and High speed trains) while increasing accessibility and productivity, modern railway operations rely on ever increasing fluxes of information between operators' staff workstations, central databases and field devices widely distributed by the trackside and on board the train. This trend is accentuated by the development of automatic train control systems and driverless systems. The communications applications required in the railway domain are: safety-related services such as control and command, and non-safety related services such as passenger information, video surveillance, and internet on-board trains. Robustness, reliability, high data rate, spectral efficiency, optimization of radio resource usages are of significant interest for railway applications. Evaluating the performance of railway radio systems requires radio channel models for numerous propagation environments: rural areas, urban areas, tunnels, fast fading, Doppler effects, tunnels, cuttings, viaducts and electromagnetic interferences. Furthermore, dedicated antennas need be developed with adequate performance and placement. Security, robustness, throughput and latency are also strong requirements. The session will present the new results addressing these challenges.

**Commission D**

Monday 18-08-14 08:00 - 09:20

**D01****Micro and Nanophotonics (1)***Session Conveners: Michael Watts; Franz X Kaertner*

High index contrast micro- and nano-photonics devices, photonic crystals, plasmonics, electronic and photonic integration. High density integrated photonics based on group IV as well as group III-VI semiconductor materials, metals and dielectrics. Passive and active devices and a combination thereof, design tools, or micro and nano-fabrication techniques. Nonlinear effects in micro and nano devices, linear and nonlinear effects enhanced by high index contrast waveguides, photonic crystals and plasmons.

Monday 18-08-14 09:40 - 10:40

**D02****Micro and Nanophotonics (2)***Session Conveners: Michael Watts; Franz X Kaertner*

High index contrast micro- and nano-photonics devices, photonic crystals, plasmonics, electronic and photonic integration. High density integrated photonics based on group IV as well as group III-VI semiconductor materials, metals and dielectrics. Passive and active devices and a combination thereof, design tools, or micro and nano-fabrication techniques. Nonlinear effects in micro and nano devices, linear and nonlinear effects enhanced by high index contrast waveguides, photonic crystals and plasmons.

Monday 18-08-14 13:40 - 15:40

**D03****New frontiers and applications of optical fibers***Session Conveners: Stefano Selleri; Mrinmay Pal*

Optical fibers have been gaining new fields of applications for years, beside their original telecommunication business core. Nowadays different domains in medicine, industrial applications, sensing and biology are addressed by fiber based devices and they are more and more entering in our research programs and even in our everyday life. The established technologies, the use of new materials and the new potentialities offered by microstructured optical fibers allow the emergence of previously unpredictable new fields of applications and responses to new social problems. This session should attract papers on the design of advanced optical fiber based devices, on the new fabrication materials and techniques, and on the new ideas and concepts regarding their usage in different fields, like telecommunication, sensing and bio-sensing, industrial applications.

Monday 18-08-14 16:00 - 17:40

**D04****Network Oriented Modeling of Electromagnetic Fields and Microwave Structures***Session Conveners: Yury Kuznetsov; Peter Russer*

Due to the complexity of modern microwave structures and systems, an electromagnetic full-wave analysis of these structures/systems is often prohibitive due to limitations in processing and memory capabilities. Network models provide a compact description of electromagnetic structures and can contribute significantly to the formulation of electromagnetic field problems and their efficient solution. This session should attract papers on the network methods applied to electromagnetic field computation and characterization or microwave structure modeling applications

Tuesday 19-08-14 08:00 - 09:20

**DBC01**

**Energy Harvesting in Wireless Systems**

*Session Conveners: Apostolos Giorgiadis; Luciano Tarricone*

Advanced technical developments have increased the efficiency of devices in capturing trace amounts of energy from the environment and transforming them into electrical energy. In addition, advancements in microprocessor technology have increased power efficiency, effectively reducing power consumption requirements. In combination, these developments have sparked interest in the engineering community to develop more and more applications that utilize energy harvesting for power. Energy harvesting from a natural source where a remote application is deployed, and where such natural energy source is essentially inexhaustible, is an increasingly attractive alternative to inconvenient wall plugs and costly batteries. This essentially free energy source, when designed and installed properly, is available maintenance-free and is now available throughout the lifetime of the application. In addition, energy harvesting can be used as an alternative energy source to supplement a primary power source and to enhance the reliability of the overall system and prevent power interruptions.

Tuesday 19-08-14 09:40 - 12:00

**D05**

**Trends in RFID, from Identification to sensing**

*Session Conveners: Smail Tedjini; Gaetano Marrocco; Leena Ukkonen*

RadioFrequency Identification (RFID) is a relevant technology based on communication and monitoring by means of reflected electromagnetic waves. Nowadays it has thousands of applications in numerous professional domains and more and more in our every day life. The concepts and technologies behind RFID are rapidly evolving from Identification to sensing capabilities, which allow the emergence of cognitive devices and systems. This session should attract papers on the design of advanced RFID systems and devices and the new ideas and concepts in this very fruitful domain of radiosience. It should cover the main aspects of physics and technology behind RFID systems. A special attention will be given to the evolution of this identification passive technology to passive sensing capabilities and energy efficiency.

Tuesday 19-08-14 13:40 - 15:40

**DC01**

**Broadband Ubiquitous Network with Wired and Wireless convergence**

*Session Conveners: Katsumi Iwatsuki; Yuichi Kado; Katsutoshi Tsukamoto*

The bandwidth of next generation access networks will strongly require that of current optical access, due to the download of huge data, images, and videos, as well as to upload of a large number of sensor data, at anytime and anywhere. The technical convergence with wired and wireless plays an important role to achieve the broadband ubiquitous networks beyond the current access networks. The technologies innovated with technical convergence have an impact on core network architecture, as well. In this session, we will discuss optical/electronics device and system for recently emerging wired and wireless technologies for access and core networks including sensor networks.

Wednesday 20-08-14 08:00 - 09:20

**DB01**

**RF MEMS and NEMS**

*Session Conveners: Roberto Sorrentino; Fabio Coccetti*

Recent developments in micro and nano manipulation of materials conventionally used in microsystem technology (including MEMS) and the recent introduction of fascinating nanostructured matter such as carbon nanotubes and graphene, are expected to trigger a completely new class of devices and systems. These developments are based on the impressive achievements in manufacturing processing and on the convergence of multidisciplinary theoretical and experimental observations. Owing to the fact that the most severe shortcomings toward commercialization of RF MEMS devices have been curbed or alleviated a variety of applications are now being successfully explored by cost effective solutions by means of dedicated MEMS platforms or monolithic CMOS integration. On the other hand research on RF MEMS moved and is now focusing on advance device capabilities for enhanced lifetime and key performances such as speed and power handling. From these efforts, RF MEMS device are likely to bear the development of a new class of applications.

Wednesday 20-08-14 09:40 - 10:40

**DT**

**Tutorial D: Terahertz time-domain spectroscopy**

*Session Conveners: Dr. Smail Tedjini (France)*

*Tutorial Speaker: Jean-Louis Coutaz (France)*

Terahertz time-domain spectroscopy (THz-TDS) was proposed about 30 years ago by D. Auston as an amazing technique for characterizing materials and samples in the far infrared regime of the electromagnetic spectrum. As compared to the popular Fourier-transform spectroscopy, which was the single technique used before, THz-TDS operates at room temperature and the records are very fast. Moreover, it allows one to perform time-resolved measurements, but its frequency resolution is poorer. This tutorial will present the principles and performances of THz-TDS as well as an overview of recent technologies, systems and applications. THz-TDS in transmission, reflection or attenuated total reflection will be compared. We will also address the characterization of absorbing materials, scattering materials, anisotropic and chiral materials.



*Jean-Louis Coutaz is since 1993 a professor of physics at University of Savoie, in Le Bourget du Lac, France. He received a Ph.D. in Integrated Optics from University of Grenoble in 1981, and then a "Docteur d'Etat" degree (habilitation) in Nonlinear Optics from the same university in 1987. From 1983 to 1993, he was a full-time researcher at the French National Research Center (CNRS), working at the Technical University of Grenoble. In 1993, he started a research team at University of Savoie, whose research activities include terahertz time-domain spectroscopy, electro-optic sampling, ultrafast semiconductor and opto-microwaves. Since 2007, J.-L. Coutaz is the deputy director of the IMEP-LAHC laboratory, a common research institute of the Universities of Grenoble and University of Savoie. He serves in several scientific committees of international conferences and international commissions. He was the editor of the book "Optoélectronique TéraHertz", EDP Sciences, Paris, 2007 (in French) and of several special issues (IEE Optoelectronics, Comptes-Rendus). He was an invited professor at KTH Stockholm, Sweden (2000) and at Tohoku University, Sendai, Japan (2013).*

Wednesday 20-08-14 13:40 - 15:40

**DA01**

**Quantum Optics, Quantum Information, Quantum Precise Measurement and Quantum Metrology**

*Session Conveners: Hong Guo; Zhengyu Zhang*

This session will focus on physics, materials, and technology of electronic and photonic devices based on quantum technologies, with particular reference to radio science and telecommunications. Topics should include, but are not limited to, quantum frequency standard, quantum sensors and quantum metrology; quantum communication and cryptography; quantum information processing; generation, detection, characterization and application of squeezed, entangled, and other non-classical states; quantum measurement and control; single-photon sources and detectors; quantum repeaters; fundamental studies of decoherence, quantum measurement theory; novel quantum algorithms and protocols.

Wednesday 20-08-14 16:00 - 17:40

**D06**

**Nonlinear Optics and Guided Wave Devices**

*Session Conveners: G nter Steinmeyer*

This topic includes, but is not limited to fundamental optical effects like optical parametric processes, harmonic generation, nonlinear wave mixing, self- and cross-phase modulation, and stimulated scattering effects. Particular emphasis is on nonlinear optics in guided geometries and micro- or nanostructured materials, including waveguides, fibers, and metamaterials, quasi-phase matched devices as well as self-guiding such as in filaments. Applications of these effects include nonlinear wavelength conversion, continuum generation, optical solitons, nonlinear spectroscopy, pulse generation, mode-locking, pulse shaping, and any other novel applications of nonlinear phenomena, novel materials, and structures.

Thursday 21-08-14 08:00 - 09:20

**D07**

**Hybrid and monolithic digital-RF integrated Circuits**

*Session Conveners: Achour Ouslimani ; Krishna Busawon*

This session covers the field of advanced hybrid and monolithic digital-RF integrated circuits intended for the development of future applications, related particularly to the growing needs in telecommunication, defense electronic, high-precision instrumentation, green RF electronic. This requires digital-RF technologies with high performances and innovative architectures. This session allows to exploit high performance existing technologies to design and implement digital and RF integrated circuits with innovative performances. The papers proposed to this session must demonstrate a significant contribution in this area. Improvement of circuit performances and/or a new idea to reduce the complexity of these future systems by proposing simplified circuit architectures are some example of the main contributions.

Thursday 21-08-14 09:40 - 12:00

**DB02**

**Plasmonics**

*Session Conveners: F. De Fornel; N. Engheta*

Surface plasmons are interfacial electromagnetic modes that can be exploited to control the propagation and local oscillation of electromagnetic energy. This topical conference will explore fundamental and applied plasmonic concepts, the control and manipulation of local and propagating surface plasmons, plasmon dynamics, and novel plasmonic nanostructures for sensors and antennas applications, nanophotonics scenarios, and plasmonic beam manipulation.

Thursday 21-08-14 13:40 - 15:40

**DBC02**

**Signal Processing Antenna**

*Session Conveners: Yvan Duroc; Dr. Yuan Yao; Prof. Alexander Yarovoy*

For many RF designers, the antenna is the most important device and its performance will determine the overall characteristics of systems. With the huge development of wireless communication systems and their applications in many domains, the evolution of the concept of the antenna, both in terms of usage and model, becomes necessary. This session will focus on the evolution of the antenna function, which increasingly integrates active elements, electronics, sensors and signal processing. These new capabilities are transforming the original passive antenna to signal processing antenna (SPA). Signal processing antennas combine a complex-antenna-structure, e.g., an array with signal-processing capabilities or controlled reconfigurable antenna system in order to enable adaptive and knowledge aided processing in space and time. By sensing the spatial and spectral properties of the electromagnetic environment SPAs can adaptively optimize the spatial and temporal signal processing operations in order to enhance system relevant performance metrics like the spectral efficiency in wireless communication systems, the probability of detection in radar or the enhancement of wireless security. Furthermore, limits of adaptive SPAs can be overcome by combining prior knowledge with measured data (knowledge-aided processing) and using novel approaches from automatic control theory.

Friday 22-08-14 08:00 - 09:20

**DB03**

**Multiphysics Modelling in Radio Frequency Nanoelectronics (1)**

*Session Conveners: P.Russer; Andreas Cangellaris; Costas D. Sarris*

The future development of radio-frequency nanoelectronics will be characterized by a further increase of integration density, higher frequencies, lower power consumption and enhanced functionality. Wireless technology and vehicular technology and the need for high-speed digital circuits are major drivers for the increased demand for high-frequency and optoelectronic devices. The design of radio-frequency nanoelectronic devices and systems requires advanced multi-physics and multi-scale design tools. Multi-physics modeling is achieved by a synoptic combination of electromagnetic, mechanical, acoustic, thermal and quantum mechanical effects governed by Maxwell's equations, Hamiltonian systems in point mechanics, elasticity theory and acoustics, heat-conduction, electronic transport (Boltzmann equations), and the Schroedinger equation. Methods of solution comprise analytic tools (e.g. integral equation (IE) methods and method of moments (MoM)), numerical tools (finite difference (FD), finite difference time domain (FDTD), finite difference frequency domain (FDFD), transmission line matrix (TLM) wave digital filter (WDF) methods), and hybrid combinations of these methods. To achieve an accurate and efficient analysis of problems with widely separated time scales the method of multi-time partial differential equations are of interest. For nano-patterned structures exhibiting extremely large aspect ratios in their geometry also space multi-scale methods will be applied.

Friday 22-08-14 09:40 - 10:40

**DB04**

**Multiphysics Modelling in Radio Frequency Nanoelectronics (2)**

*Session Conveners: P.Russer; Andreas Cangellaris; Costas D. Sarris*

The future development of radio-frequency nanoelectronics will be characterized by a further increase of integration density, higher frequencies, lower power consumption and enhanced functionality. Wireless technology and vehicular technology and the need for high-speed digital circuits are major drivers for the increased demand for high-frequency and optoelectronic devices. The design of radio-frequency nanoelectronic devices and systems requires advanced multi-physics and multi-scale design tools. Multi-physics modeling is achieved by a synoptic combination of electromagnetic, mechanical, acoustic, thermal and quantum mechanical effects governed by Maxwell's equations, Hamiltonian systems in point mechanics, elasticity theory and acoustics, heat-conduction, electronic transport (Boltzmann equations), and the Schroedinger equation. Methods of solution comprise analytic tools (e.g. integral equation (IE) methods and method of moments (MoM)), numerical tools (finite difference (FD), finite difference time domain (FDTD), finite difference frequency domain (FDFD), transmission line matrix (TLM) wave digital filter (WDF) methods), and hybrid combinations of these methods. To achieve an accurate and efficient analysis of problems with widely separated time scales the method of multi-time partial differential equations are of interest. For nano-patterned structures exhibiting extremely large aspect ratios in their geometry also space multi-scale methods will be applied.

Friday 22-08-14 13:40 - 15:40

**D08**

**THz systems and applications**

*Session Conveners: Prof. Jean-Louis Coutaz; Prof. Taiichi Otsuji,*

The present huge progress in THz science and technology is based on involving many complementary techniques depending on the studies, devices and systems to be addressed. Smart quantum semiconductor devices, compact optoelectronic systems, room-temperature bolometers, ultrafast spectroscopy, waveguides and meta-materials are among these new techniques and new devices that may lead soon to the transfer of THz science from the laboratories to everyday life applications. In this session, specialists will give an overview of their last research results and of the last developments in THz science and technology.



Friday 22-08-14 16:00 - 17:40

**DFC01**

**Trends in THz Communications**

*Session Conveners: Tadao Nagatsuma; Ci-Ling Pan; Thomas Kuerner*

Recently, there has been an increasing interest in the application of terahertz waves to broadband wireless communications. In particular, the use of frequencies above 275 GHz is one of the strong concerns among radio scientists and engineers, because these frequency bands have not yet allocated at specific active services, and there is a possibility to employ extremely large bandwidths for ultra-broadband wireless communications. This session will focus on recent advances in ultrahigh-speed wireless communications technologies using carrier frequencies from 100 GHz to 1 THz. Enabling technologies such as signal generators, modulators, detectors, amplifiers, antennas, and filters, system demonstrations, applications, wave propagation/interference, and standardization issues will be discussed.

Saturday 23-08-14 08:00 - 09:20

**D09**

**60GHz Electronics (1)**

*Session Conveners: Kiat Seng YEO; Kai Xue MA*

Since the Federal Communications Commission (FCC) allocated 7GHz in the 57â€“64GHz band for unlicensed use in 2001, increasing interest are drawn in this band for high speed communication. A 60GHz link could be used to replace various cables used today in the office or home, making wireless display, wireless docking station available. As a result, the evolving 60GHz standard offers new products, markets and applications. However, there are still many technical challenges at 60GHz and it ranges from device modeling, antenna, circuit and system design, to packaging, test and assembly. This session aims to address the major problems encountered with the arrival of 60GHz technology. Topics of interest would include beamforming, transceiver design, phase arrays, MAC/PHY management, secure network authentication, baseband, antenna design as well as innovative design methods to generating stable local oscillators, reducing power consumption and suppressing unwanted interferences, harmonics and sub-harmonics at 60GHz.

Saturday 23-08-14 09:40 - 10:40

**D10**

**60GHz Electronics (2)**

*Session Conveners: Kiat Seng YEO; Kai Xue MA*

Since the Federal Communications Commission (FCC) allocated 7GHz in the 57â€“64GHz band for unlicensed use in 2001, increasing interest are drawn in this band for high speed communication. A 60GHz link could be used to replace various cables used today in the office or home, making wireless display, wireless docking station available. As a result, the evolving 60GHz standard offers new products, markets and applications. However, there are still many technical challenges at 60GHz and it ranges from device modeling, antenna, circuit and system design, to packaging, test and assembly. This session aims to address the major problems encountered with the arrival of 60GHz technology. Topics of interest would include beamforming, transceiver design, phase arrays, MAC/PHY management, secure network authentication, baseband, antenna design as well as innovative design methods to generating stable local oscillators, reducing power consumption and suppressing unwanted interferences, harmonics and sub-harmonics at 60GHz.

**Commission E**

Monday 18-08-14 08:00 - 09:20

**E01****EMC in Complex Systems (1)***Session Conveners: F. Canavero; P. Degauque*

The session addresses one of the central issues in electromagnetic compatibility and interference, namely the treatment of complexity. Complex systems consist of many interacting components participating to the EM interaction response. The complexity of a system increases with the number of distinct components, the sophistication of the components and their interactions. The scope of the session is to present work which focuses on modeling, simulation and experimental characterization of complex systems, the effects of ground on electromagnetic coupling phenomena and the coupling of electromagnetic waves through the structures.

Monday 18-08-14 09:40 - 10:40

**E02****EMC in Complex Systems (2)***Session Conveners: F. Canavero; P. Degauque*

The session addresses one of the central issues in electromagnetic compatibility and interference, namely the treatment of complexity. Complex systems consist of many interacting components participating to the EM interaction response. The complexity of a system increases with the number of distinct components, the sophistication of the components and their interactions. The scope of the session is to present work which focuses on modeling, simulation and experimental characterization of complex systems, the effects of ground on electromagnetic coupling phenomena and the coupling of electromagnetic waves through the structures.

Monday 18-08-14 13:40 - 15:40

**E03****High Power Electromagnetics and Intentional EMI (1)***Session Conveners: M. Bäckström; W. Radasky; L.H. Shi; D.V. Giri; R.L.Gardner*

The sessions address intentional electromagnetic interference (IEMI), or the intentional malicious generation of electromagnetic energy introducing noise or signals into electric and electronic systems, thus disrupting, confusing or damaging these systems for terrorist or criminal purposes. The technical area of HPE consists of the physics and engineering associated with electromagnetic sources where nonlinear effects associated with high-field regions (and air breakdown) must be included in the analysis and design. This include EMP simulators, high-power narrowband and mesoband sources and antennas, and hyperband (impulse) sources and antennas.

Monday 18-08-14 16:00 - 17:40

**E04****High Power Electromagnetics and Intentional EMI (2)***Session Conveners: M. Bäckström; W. Radasky; L.H. Shi; D.V. Giri; R.L.Gardner*

The sessions address intentional electromagnetic interference (IEMI), or the intentional malicious generation of electromagnetic energy introducing noise or signals into electric and electronic systems, thus disrupting, confusing or damaging these systems for terrorist or criminal purposes. The technical area of HPE consists of the physics and engineering associated with electromagnetic sources where nonlinear effects associated with high-field regions (and air breakdown) must be included in the analysis and design. This include EMP simulators, high-power narrowband and mesoband sources and antennas, and hyperband (impulse) sources and antennas.

Tuesday 19-08-14 08:00 - 09:20

**E05**

**Stochastic Techniques in EMC (1)**

*Session Conveners: L. Arnaut; S. Pignari*

The EMC community is increasingly interested in the development of analysis and design techniques which take account of the inherent uncertainty of system parameters. In fact, the system response is affected by the statistics of such parameters, and varies widely within a distribution. Typical areas of interest include effects due to unknown wave parameters of interfering signals, statistical nature of fields inside metallic enclosures, uncertainty in the location of conductors inside multiwire structures and routing of bundles in metallic enclosures, values of termination impedances, values of stray parameters and material parameters, etc. The session will address these issues and give updated information on developments in EMC characterization and testing based on statistical analysis and design techniques.

Tuesday 19-08-14 09:40 - 12:00

**E06**

**EMC in Wired and Wireless Systems**

*Session Conveners: A. Zeddami; F. Rachidi; F. Gronwald*

The session addresses the propagation of signals and interference in wired and wireless systems, with particular focus on ADSL and PLC.

Tuesday 19-08-14 13:40 - 15:40

**E07**

**Lightning and Related Phenomena**

*Session Conveners: V. Rakov; S. Yoshida*

The session addresses the characterization of terrestrial and planetary electromagnetic noise, as well as natural noise from terrestrial and extra-terrestrial sources with a view towards the interests of CCIR and the advancement of knowledge.

Wednesday 20-08-14 08:00 - 09:20

**EJ01**

**Spectrum Management (1)**

*Session Conveners: A. Tiplady; T. Tjelja; R. Struzak; A. Jessner*

The focus of this session on spectrum management and spectrum utilization is of high interest to the community. We expect to give a short report of the related WG06 activities during the last period, along with our views on spectrum management, and on hot topics of today. International and local Chinese contributors will be invited such that first-hand reports on controversial spectrum management issues will be presented.

Wednesday 20-08-14 09:40 - 10:40

**EJ02**

**Spectrum Management (2)**

*Session Conveners: A. Tiplady; T. Tjelja; R. Struzak; A. Jessner*

The focus of this session on spectrum management and spectrum utilization is of high interest to the community. We expect to give a short report of the related WG06 activities during the last period, along with our views on spectrum management, and on hot topics of today. International and local Chinese contributors will be invited such that first-hand reports on controversial spectrum management issues will be presented.

Wednesday 20-08-14 13:40 - 15:40

**E08**

**Special session on EMC of power electronics**

*Session Conveners: Yu-Kang Lo*

The session on EMC in Power Electronics deals with (switched mode) power units of the order of 100 kW and more, for example in trains.

Wednesday 20-08-14 16:00 - 17:40

**E09**

**Stochastic Techniques in EMC (2)**

*Session Conveners: L. Arnaut; S. Pignari*

The EMC community is increasingly interested in the development of analysis and design techniques which take account of the inherent uncertainty of system parameters. In fact, the system response is affected by the statistics of such parameters, and varies widely within a distribution. Typical areas of interest include effects due to unknown wave parameters of interfering signals, statistical nature of fields inside metallic enclosures, uncertainty in the location of conductors inside multiwire structures and routing of bundles in metallic enclosures, values of termination impedances, values of stray parameters and material parameters, etc. The session will address these issues and give updated information on developments in EMC characterization and testing based on statistical analysis and design techniques.

Thursday 21-08-14 09:40 - 12:00

**E10**

**EMC for IC, PCB and Package (1)**

*Session Conveners: C. Holloway; E.P. Li*

Rapid growth and convergence of digital computing and wireless communication have resulted in complex EMC which cannot be easily addressed by conventional methods. This session will address the various techniques for modeling and simulation of EMC problems, such as Signal integrity/power integrity, numerical modeling of automotive EMC, aerospace EMC, integrated circuit EMC. In addition, the material property on electromagnetic performance, aging effects, thermal-electrical coupling.

Thursday 21-08-14 09:40 - 12:00

**EB01**

**Modelling**

*Session Conveners: Giuliano Manara; Anton Tjihuis; A. Cangellaris*

The session will focus on modern approaches for modeling the electromagnetic behavior of large, complex systems from all areas of electrical engineering. Applications include but are not restricted to antenna arrays, metamaterials, RF structures, cabling, and bio-electromagnetics. Even with the growing calculation power of modern computers such configurations cannot be handled by brute force methods only. The analysis needs to be carried out on different scales, covering the entire setup and its global behavior on the one hand, and the level where the detailed electromagnetic interaction takes place on the other hand. Moreover, engineers are actually interested in the sensitivity of such devices to manufacturing tolerances, in the effects of a stochastically varying environment, or even in synthesis of part of such a geometry. Therefore, the capability of analyzing electromagnetic fields in large, complex structures is only the first step towards meeting their needs. Both original ideas to approach this problem and applications of existing methods to actual structures from the practice of electrical engineering will be covered.

Thursday 21-08-14 13:40 - 15:40

**EGH01**

**Terrestrial and Planetary Electromagnetics**

*Session Conveners: Masashi Hayakawa; Yasuhide Hobara; Colin Price*

This session aims at presenting recent works on electromagnetic noise and phenomena in the terrestrial atmosphere and upper atmosphere (ionosphere/magnetosphere). Different kinds of electromagnetic noises will be dealt with, including atmospheric noises originated in lightning discharges (ELF Schumann resonances, mesospheric optical emissions etc.), man-made noise and noise due to wave-particle and wave-wave interactions. Corresponding electromagnetic noise environments on other planets will also be welcome.

Friday 22-08-14 08:00 - 09:20

**E11**

**EMC for IC, PCB and Package (1)**

*Session Conveners: C. Holloway; E.P. Li*

Rapid growth and convergence of digital computing and wireless communication have resulted in complex EMC which cannot be easily addressed by conventional methods. This session will address the various techniques for modeling and simulation of EMC problems, such as Signal integrity/power integrity, numerical modeling of automotive EMC, aerospace EMC, integrated circuit EMC. In addition, the material property on electromagnetic performance, aging effects, thermal-electrical coupling.

Friday 22-08-14 09:40 - 10:40

**E12**

**Recent developments**

*Session Conveners: P. Russer; W.Q. Che*

Stochastic electromagnetic fields play an important role in wireless communications, electromagnetic metrology and electromagnetic interference. Their random fluctuations may either originate from thermal noise or from electromagnetic interference originating from specific transmitters. In communications and in most sensorics applications, stochastic electromagnetic signals are interfering signals, degrading the signal to noise plus interference ratio of systems. Due to the high bandwidth and their low power levels, modern electronic systems are highly sensitive to electronic disturbances. The design of electronic systems requires the consideration of active and passive EMC. This session will deal with methods for modeling of stochastic electromagnetic fields, the influence of electromagnetic noise on systems and methods for the measurement of EM noise and interference. Because of similarity with E05 and E09, lectures could be transferred to those sessions.

Friday 22-08-14 13:40 - 14:40

**ET**

**Tutorial E: SKA and EMC: The Need for Science and Engineering Dialogue**

*Session Conveners: Dr. Alexander P.J. Van Deursen (the Netherlands)*

*Tutorial Speaker: H. Reader*

The tutorial will examine the science ambitions of the SKA and the influence they have in framing the engineering developments and host sites. Or should that be the engineering and site realities and how they constrain the science aspirations? The engineering challenges, directed by the science goals, regularly push the design teams into uncharted waters. Functional, deadline-driven dialogue between international partners, where contractors have to watch their profit lines, sets part of the boundaries. The presentation will be illustrated with some contemporary developments, which will be related to broader SKA project progress, especially with respect to telescopes, aperture arrays, development metrology, deployment and lightning/RFI protection. The over-arching theme of the tutorial will be the components of the SKA project and instrument design which maximize the EMC and radio astronomy science. Some experience from European sites and South Africa's MeerKAT will underpin the reflections. Project success will not be possible without an intimate dialogue between radio astronomers, engineers and contractors.

Howard C. Reader holds the Chair of High Frequency Electronics in the Department of EEEng, University of Stellenbosch, South Africa. He received the received a Ph.D. in Time Domain Electromagnetics from St. John's College, Cambridge, U.K., in 1985. From 1986 to 1994, he was a Lecturer, a Senior Lecturer, and an Associate Professor at the University of Natal, South Africa. In 1994, he was appointed to his present position. His research interests include electromagnetic compatibility, HF metrology and microwave dielectric heating. Current academic and professional work is directed towards the EMI characterization and management of South Africa's SKA activities. Howard has published widely in his research fields, is a senior member of the IEEE and has recently co-founded the new South African IEEE EMC Chapter. He is a member of the Institution of Engineering and Technology, a Chartered Engineer (U.K.), and serves as South Africa's Union Radio-Scientifique Internationale Commission E (EMI) chair.

Friday 22-08-14 14:40 - 15:40

**E13**

**EMC in Power Engineering (1)**

*Session Conveners: X. Cui; J. He*

This session addresses the environmental effects of ac and dc power transmission systems, including electrical and magnetic fields, radio interference and the special ion current phenomena generated by dc transmission lines. The electromagnetic interferences on secondary systems in substations or convertor stations are also included.

Friday 22-08-14 16:00 - 17:40

**E14**

**EMC in Power Engineering (2)**

*Session Conveners: X. Cui; J. He*

This session addresses the environmental effects of ac and dc power transmission systems, including electrical and magnetic fields, radio interference and the special ion current phenomena generated by dc transmission lines. The electromagnetic interferences on secondary systems in substations or convertor stations are also included.


Saturday 23-08-14 08:00 - 09:20

**E15**

**Measuring Techniques (1)**

*Session Conveners: P. Besnier; R. Serra*

The session addresses the raft of techniques that are involved in making electromagnetic compatibility measurements. The wide variety of available measurement techniques and the ever-increasing challenges faced by development and test engineers, makes the measurement and analysis of EMC phenomena a significant discipline. The scope of the session is to contribute with original research work spanning the whole spectrum of measurement techniques




Saturday 23-08-14 09:40 - 10:40

**E16**

**Measuring Techniques (2)**

*Session Conveners: P. Besnier; R. Serra*

The session addresses the raft of techniques that are involved in making electromagnetic compatibility measurements. The wide variety of available measurement techniques and the ever-increasing challenges faced by development and test engineers, makes the measurement and analysis of EMC phenomena a significant discipline. The scope of the session is to contribute with original research work spanning the whole spectrum of measurement techniques



**Commission F**

Monday 18-08-14 08:00 - 09:20

**F01****Remote Sensing of Snow and Ice (1)**

*Session Conveners: M. Hallikainen (Finland); Y. Qiu (China CIE)*

Global information on the extent and characteristics of snow and ice can best be acquired by remote sensing. This session will focus on new scientific results obtained by using microwave, optical, and joint microwave/optical methods. Topics will comprise physical models and retrieval algorithms, field experiments for validation purposes, and the use of data from advanced spaceborne and airborne sensors. Contributions related to the use of remotely sensed snow and ice products for climate change and regional comparative studies are also welcome.

Monday 18-08-14 09:40 - 10:40

**F02****Remote Sensing of Snow and Ice (2)**

*Session Conveners: M. Hallikainen (Finland); Y. Qiu (China CIE)*

Global information on the extent and characteristics of snow and ice can best be acquired by remote sensing. This session will focus on new scientific results obtained by using microwave, optical, and joint microwave/optical methods. Topics will comprise physical models and retrieval algorithms, field experiments for validation purposes, and the use of data from advanced spaceborne and airborne sensors. Contributions related to the use of remotely sensed snow and ice products for climate change and regional comparative studies are also welcome.

Monday 18-08-14 13:40 - 15:40

**F03****Millimeter Propagation and Remote Sensing (1)**

*Session Conveners: S. Reising (USA); A. Gasiewski (USA); J. Wu (China CIE)*

The progress in observation and data inversion techniques, as well as transceiver technology from radio frequencies to the higher microwave frequencies, has generated increased interest in using the millimeter-wave spectrum (i.e., frequencies above 30 GHz) for remote sensing. This session focuses on new developments in millimeter-wave propagation models and experiments, including the effects of reflection, refraction, emission and scintillation, along with their application in passive and active remote sensing. Passive systems for remote sensing include atmospheric sounders, surface imagers and path-dependent transmissometers that can be realized by using either real aperture antennas, aperture synthesis or interferometers. Active systems for remote sensing include monostatic, bistatic, and multistatic radars, as well as, all forms of phased-, and digitally beamformed arrays and synthetic aperture systems. Papers are welcomed that focus on one or more of the above areas as applied to remote sensing of the environment.

Monday 18-08-14 16:00 - 17:40

**F04****Millimeter Propagation and Remote Sensing (2)**

*Session Conveners: S. Reising (USA); A. Gasiewski (USA); J. Wu (China CIE)*

The progress in observation and data inversion techniques, as well as transceiver technology from radio frequencies to the higher microwave frequencies, has generated increased interest in using the millimeter-wave spectrum (i.e., frequencies above 30 GHz) for remote sensing. This session focuses on new developments in millimeter-wave propagation models and experiments, including the effects of reflection, refraction, emission and scintillation, along with their application in passive and active remote sensing. Passive systems for remote sensing include atmospheric sounders, surface imagers and path-dependent transmissometers that can be realized by using either real aperture antennas, aperture synthesis or interferometers. Active systems for remote sensing include monostatic, bistatic, and multistatic radars, as well as, all forms of phased-, and digitally beamformed arrays and synthetic aperture systems. Papers are welcomed that focus on one or more of the above areas as applied to remote sensing of the environment.



Tuesday 19-08-14 08:00 - 09:20

**F05**

**Advances in Spaceborne SAR Imaging and Applications (1)**

*Session Conveners: A. Moreira (Germany); R. Wang (China); S. Motoyuki (Japan)*

Spaceborne Synthetic Aperture Radar (SAR) provides high-resolution, day-and-night and weather-independent images for a multitude of applications. These applications range from geoscience and climate change research, environmental and natural disaster monitoring, global 2-D and 3-D mapping, change detection, 4-D mapping (space and time) and security-related applications; many of techniques find use in planetary exploration. With the development of new imaging technologies and techniques, an era for innovative SAR applications has begun. This session will provide an overview of the latest advancement.

Tuesday 19-08-14 09:40 - 12:00

**F06**

**Advances in Spaceborne SAR Imaging and Applications (2)**

*Session Conveners: A. Moreira (Germany); R. Wang (China); S. Motoyuki (Japan)*

Spaceborne Synthetic Aperture Radar (SAR) provides high-resolution, day-and-night and weather-independent images for a multitude of applications. These applications range from geoscience and climate change research, environmental and natural disaster monitoring, global 2-D and 3-D mapping, change detection, 4-D mapping (space and time) and security-related applications; many of techniques find use in planetary exploration. With the development of new imaging technologies and techniques, an era for innovative SAR applications has begun. This session will provide an overview of the latest advancement.

Tuesday 19-08-14 13:40 - 15:40

**F07**

**Fixed Terrestrial Links: Measurements, Models and Planning-Procedures**

*Session Conveners: M. Chandra (Germany); L. Da Silva Mello (Brazil)*

The session welcomes contributions relating to measurements, modeling, and prediction-procedures of propagation parameters for fixed terrestrial links. The topics may include the general areas of attenuation, depolarization, and scintillations. In particular, contributions addressing rain-attenuation prediction, synthesizers, and dynamics are of interest. The papers can be based on data analysis, measurements and algorithms for quantitatively and qualitatively assessing terrestrial-fixed-link properties. The session-papers are expected to reflect the state-of-the-art methods used in design and planning of fixed terrestrial links in respect to fading-outages, spatial and temporal dependence of rain-intensity, and possibly depolarization, and scintillations. The session seeks contributions that particularly emphasize cross-connections to current research campaigns, international actions and system developments.

Wednesday 20-08-14 08:00 - 09:20

**F08**

**Remote Measurement of Precipitation at Local, Regional and Global Scales (1)**

*Session Conveners: V. Chandrasekar (USA); Ushio (Japan)*

Water is fundamental to life and civilization, therefore extensive efforts have been made to measure rainfall (or more generally precipitation which includes rain and snow) at local and global scales. Rainfall measurement at local scales has been used to study and predict flooding, and also to manage water resources; measurement at global scales has been employed to study the influence of the water cycle, as well as, its effect on energy and the environment. Fresh water availability has huge economic and societal impact. This session will cover techniques and technologies for remote measurement of precipitation at local and global scales. The session will examine the latest scientific and technological advances this area, such as dual-polarization and dual-wavelength techniques, including measurement programs for quantitative remote sensing of rainfall. Scientific advances on understanding the microphysics of precipitation will also be covered.

Wednesday 20-08-14 09:40 - 10:40

**F09**

**Remote Measurement of Precipitation at Local, Regional and Global Scales (2)**

*Session Conveners: V. Chandrasekar (USA); Ushio (Japan)*

Water is fundamental to life and civilization, therefore extensive efforts have been made to measure rainfall (or more generally precipitation which includes rain and snow) at local and global scales. Rainfall measurement at local scales has been used to study and predict flooding, and also to manage water resources; measurement at global scales has been employed to study the influence of the water cycle, as well as, its effect on energy and the environment. Fresh water availability has huge economic and societal impact. This session will cover techniques and technologies for remote measurement of precipitation at local and global scales. The session will examine the latest scientific and technological advances in this area, such as dual-polarization and dual-wavelength techniques, including measurement programs for quantitative remote sensing of rainfall. Scientific advances on understanding the microphysics of precipitation will also be covered.

Wednesday 20-08-14 13:40 - 15:40

**F10**

**Mobile Propagation Models and Measurements (1)**

*Session Conveners: M. Herben (The Netherlands); R. Bultitude (Canada); S. Torrico (USA)*

As personal indoor and mobile radio communications (PIMRC) systems evolve, and their users demand better quality of service at higher and higher data rates, it becomes increasingly more important to make efficient use of the radio spectrum. To do this, it is imperative to have accurate radio propagation and radio channel models available for all aspects of a radio link that are pertinent to digital communications. This requires knowledge of transmission loss, delay dispersion and frequency dispersion, and more recently, angular dispersion. In addition, it is important to know how these radio link characteristics vary in space and time for different environments, such as those with significant vegetation. This session aims at presenting the latest results on radio propagation measurements, data analysis and channel modeling to estimate and model the characteristics of various radio links, including but not limited to, those associated with: outdoor (macro, micro, small-cell, and picocell), indoor, outdoor-to-indoor, satellite-to-mobile, and vehicle-to-vehicle radio propagation scenarios in a range of different operating environments.

Wednesday 20-08-14 16:00 - 17:40

**F11**

**Mobile Propagation Models and Measurements (2)**

*Session Conveners: M. Herben (The Netherlands); R. Bultitude (Canada); S. Torrico (USA)*

As personal indoor and mobile radio communications (PIMRC) systems evolve, and their users demand better quality of service at higher and higher data rates, it becomes increasingly more important to make efficient use of the radio spectrum. To do this, it is imperative to have accurate radio propagation and radio channel models available for all aspects of a radio link that are pertinent to digital communications. This requires knowledge of transmission loss, delay dispersion and frequency dispersion, and more recently, angular dispersion. In addition, it is important to know how these radio link characteristics vary in space and time for different environments, such as those with significant vegetation. This session aims at presenting the latest results on radio propagation measurements, data analysis and channel modeling to estimate and model the characteristics of various radio links, including but not limited to, those associated with: outdoor (macro, micro, small-cell, and picocell), indoor, outdoor-to-indoor, satellite-to-mobile, and vehicle-to-vehicle radio propagation scenarios in a range of different operating environments.

Thursday 21-08-14 08:00 - 09:20

**F12****Microwave Remote Sensing of Vegetation and Terrestrial Snow (1)**

*Session Conveners: S. Paloscia (Italy); R. Lang (USA); J. Shi (China CIE)*

The use of microwave radiometers and radars to sense soil moisture, vegetation biomass and terrestrial snow characteristics are the subject matter of this session. Experimental activities concerning the observation of soil moisture, vegetation and snow from ground-based instruments, aircraft and satellites will be discussed. Passive and active sensing of terrestrial snow in open areas or forested regions are subjects of interest. Microwave models of emission and backscatter from soils covered by snow and/or vegetation using advanced radiative transfer models will be considered. Finally, retrieval of main parameters of soil, snow, and vegetation by using statistical inversion algorithms are of interest.

Thursday 21-08-14 09:40 - 11:00

**F13****Microwave Remote Sensing of Vegetation and Terrestrial Snow (2)**

*Session Conveners: S. Paloscia (Italy); R. Lang (USA); J. Shi (China CIE)*

The use of microwave radiometers and radars to sense soil moisture, vegetation biomass and terrestrial snow characteristics are the subject matter of this session. Experimental activities concerning the observation of soil moisture, vegetation and snow from ground-based instruments, aircraft and satellites will be discussed. Passive and active sensing of terrestrial snow in open areas or forested regions are subjects of interest. Microwave models of emission and backscatter from soils covered by snow and/or vegetation using advanced radiative transfer models will be considered. Finally, retrieval of main parameters of soil, snow, and vegetation by using statistical inversion algorithms are of interest.

Thursday 21-08-14 11:00 - 12:00

**FT****Tutorial F: Looking at the Earth as a Planet: Passive Remote Sensing of Land Surfaces**

*Session Conveners: Dr. Roger H. Lang (U.S.A)*

Tutorial Presenter: Paolo Pampaloni (Italy)

The availability of timely and accurate sets of global data about the Earth's systems is of great importance for studying trends and anomalies of weather and climate. In general, this will improve our knowledge of the earth. Multi-frequency microwave radiometry from satellites is an excellent tool for providing a continuous monitoring of land surfaces. It is also crucial for making long-term decisions about water resources, agriculture, forestry, energy, tourism and transportation; it will provide the ability to detect natural and manmade disasters quickly. A passive microwave remote sensing system makes use of highly sensitive and stable receivers that measure the brightness temperature,  $T_b$ , of the observed surfaces. In turn,  $T_b$  is related to the physical and geometrical characteristics of the emitting bodies. The problem of remote sensing is to invert the measurements and to retrieve the quantities of interest from the observed multi-frequency and polarimetric  $T_b$ . After a short description of the observation instruments and techniques, the tutorial will focus on the retrieval of some significant land surface quantities (soil moisture, agricultural and natural vegetation, snow cover) that affect the water cycle and are important indicators of climate changes.



*Paolo Pampaloni is Head of Research at the Institute of Applied Physics IFAC of the Italian National Research Council (CNR). He received his Dr. degree in Electronic Engineering from the University of Bologna, Italy, in 1964. His current research deals with active and passive microwave remote sensing of land surfaces and the study of microwave emission and scattering from natural media. He has been Director of the Institute of Remote Sensing and Environmental Analysis (CNR) in Florence, Italy, collaborator of the European Space Agency (ESA) as member of the Land Application Working Group, the Microwave Imaging Multichannel Radiometer (MIMR) expert team, and the MIMR Scientific Advisory Group. He also served in the ESA Earth Observation Advisory Group (EOAC). He has been Deputy team leader of the NASA/ASI/DLR X SAR/SIR-C project, Principal Investigator and Co-Investigator of several international and national projects in Europe. He has served as General Chairman of the 2nd and 6th Specialist Meetings on Microwave Radiometry and Remote Sensing (MICRORAD 88 and 99) and of the 15th International Geoscience and Remote Sensing Symposium (IGARSS'95). He has been Adjunct Professor at the Electromagnetics Academy Zhejiang University. He has published over 180 papers on International Journal and Conference Proceedings and has edited three books with VSP Press (The Netherlands). He is an Associate Editor of IEEE Transactions on Geoscience and Remote Sensing and has served as reviewer for many international journals. Dr. Paolo Pampaloni is the Italian Official member of URSI Comm F. He is Fellow of IEEE, and of the Electromagnetic Academy (USA), Past President of the IEEE Italy Section. He has been the recipient of the 2004 Distinguished Achievement Award of IEEE Geoscience and Remote Sensing Society.*

Thursday 21-08-14 13:40 - 15:40

#### **F14**

##### **Radio Frequency Interference (RFI)**

*Session Conveners: Y. Kerr (France), P. de Matthaëis (USA)*

Remote sensing microwave radiometers rely on the use of protected frequency bands to operate. However, the spectrum has become more and more crowded; this leads to unwanted emissions in the protected bands. In particular, L-band is important for remote sensing of soil moisture and ocean salinity, two variables important for understanding the global water cycle and ocean dynamics. This session will focus on the RFI issue with a particular stress on L band (1400 -1427 MHz) as 3 missions are either flying (SMOS and Aquarius) or due for launch soon (SMAP). Suggested Topics: 1) Results from SMOS and Aquarius: detection and characterization of RFI, various approaches and their accuracy/efficiency. 2) Temporal evolution of the RFI sources: comparison between different satellite detection principles with respect to their characteristics. 3) Status of SMAP: RFI mitigation approach, RFI for Active instruments.

Friday 22-08-14 08:00 - 09:20

#### **F15**

##### **Remote Sensing of Biomass (1)**

*Session Conveners: T. Le Toan (France), S. Saatchi (USA)*

The session will address the use of spaceborne SAR systems for the retrieval of biomass from tropical, temperate and boreal forests for carbon assessment at regional and global scales. The topics may include methodology development based on measurements and modeling of SAR data over forests. Of particular interest are papers related to advanced SAR techniques including polarimetry, Pol-InSAR and tomography. A focus will be put on the forthcoming ESA Earth Explorer P-band Biomass satellite, with contributions dealing with the science requirements, mission design, conduct of measurement campaigns, and development of algorithms. The session will also welcome papers on the state-of-the-art in biomass retrieval based on existing SAR systems (e.g. ALOS-PALSAR, ASAR).

Friday 22-08-14 09:40 - 10:40

#### **F16**

##### **Remote Sensing of Biomass (2)**

*Session Conveners: T. Le Toan (France), S. Saatchi (USA)*

The session will address the use of spaceborne SAR systems for the retrieval of biomass from tropical, temperate and boreal forests for carbon assessment at regional and global scales. The topics may include methodology development based on measurements and modeling of SAR data over forests. Of particular interest are papers related to advanced SAR techniques including polarimetry, Pol-InSAR and tomography. A focus will be put on the forthcoming ESA Earth Explorer P-band Biomass satellite, with contributions dealing with the science requirements, mission design, conduct of measurement campaigns, and development of algorithms. The session will also welcome papers on the state-of-the-art in biomass retrieval based on existing SAR systems (e.g. ALOS-PALSAR, ASAR).

Friday 22-08-14 13:40 - 15:40

**F17**

**Remote Sensing of Land and Sea at L band (1)**

*Session Conveners: D. Le Vine (USA), Y. Kerr (France), M. Moghaddam (USA)*

L-band is important for remote sensing of soil moisture and ocean salinity, two variables important for understanding the global water cycle and ocean dynamics. There are soon to be three satellite missions with L-band sensors devoted to measuring these variables: The ESA Soil Moisture and Ocean Salinity (SMOS) mission and the NASA Aquarius/SAC-D mission, which are already in orbit and NASA's Soil Moisture Active Passive (SMAP) mission scheduled for launch in the Fall of 2014. The latter two missions employ both passive (radiometer) and active (radar) sensors at L-band. This session will focus on results and status of these three missions but will also entertain new applications (e.g. application to the cryosphere such as L-band monitoring of sea ice) and active/passive synergy at L-band. Suggested topics are: 1) Results from Aquarius: Sea Surface Salinity; Soil Moisture, Remote Sensing Algorithm. 2) Results from SMOS: Ocean Salinity; Soil Moisture, Remote Sensing Algorithm. 3) Status of SMAP: Instrument Algorithm and plans, Active/Passive Synergy: Disaggregation using radar, Enhanced products. 4) New Applications: Sea Ice extent; Sea Ice Thickness, Drought indices, Root zone soil moisture.

Friday 22-08-14 16:00 - 17:40

**F18**

**Remote Sensing of Land and Sea at L band (2)**

*Session Conveners: D. Le Vine (USA), Y. Kerr (France), M. Moghaddam (USA)*

L-band is important for remote sensing of soil moisture and ocean salinity, two variables important for understanding the global water cycle and ocean dynamics. There are soon to be three satellite missions with L-band sensors devoted to measuring these variables: The ESA Soil Moisture and Ocean Salinity (SMOS) mission and the NASA Aquarius/SAC-D mission, which are already in orbit and NASA's Soil Moisture Active Passive (SMAP) mission scheduled for launch in the Fall of 2014. The latter two missions employ both passive (radiometer) and active (radar) sensors at L-band. This session will focus on results and status of these three missions but will also entertain new applications (e.g. application to the cryosphere such as L-band monitoring of sea ice) and active/passive synergy at L-band. Suggested topics are: 1) Results from Aquarius: Sea Surface Salinity; Soil Moisture, Remote Sensing Algorithm. 2) Results from SMOS: Ocean Salinity; Soil Moisture, Remote Sensing Algorithm. 3) Status of SMAP: Instrument Algorithm and plans, Active/Passive Synergy: Disaggregation using radar, Enhanced products. 4) New Applications: Sea Ice extent; Sea Ice Thickness, Drought indices, Root zone soil moisture.

Saturday 23-08-14 08:00 - 09:20

**FB01**

**Electromagnetic modeling and applications of underground imaging (1)**

*Session Conveners: D. Erricolo (USA); L. Capineri (Italy)*

The capability of imaging underground is paramount for rescue operations in the case of a natural disasters such as an earthquake, as well as, for monitoring in security or defense applications. Electromagnetic waves play a primary role in probing these scenarios due to their ability to penetrate various media. However, imaging in these scenarios is challenging because this is an inverse problem complicated by many factors, including the presence of unknown materials and obstacles geometries. Solutions have been obtained, in many cases, using simplified scattering models. Existing imaging systems are based on single or multiple antennas, which could either be fixed or moving. Topics of interest include: 1) Systems for underground exploration, such as ground penetrating radars or antennas specifically designed for this purpose; 2) Propagation methods in complex media, geophysical tomography, multiple scattering, forward modeling of the electromagnetic scattering and propagation; 3) Ability to tackle the complexity of the scenarios in realistic conditions by accounting for factors including antenna modeling, computational complexity, and medium characterization; 4) Inversion methods for high resolution of large regions and effective imaging of hidden and buried targets in 3D scenarios; 5) Inversion approaches for "quantitative" reconstruction in controlled and realistic conditions; and, 6) Development and analysis of new methods for multiple antenna systems data processing.

Saturday 23-08-14 09:40 - 10:40

**FB02**

**Electromagnetic modeling and applications of underground imaging (2)**

*Session Conveners: D.Erricolo (USA); L.Capineri (Italy)*

The capability of imaging underground is paramount for rescue operations in the case of a natural disasters such as an earthquake, as well as, for monitoring in security or defense applications. Electromagnetic waves play a primary role in probing these scenarios due to their ability to penetrate various media. However, imaging in these scenarios is challenging because this is an inverse problem complicated by many factors, including the presence of unknown materials and obstacles geometries. Solutions have been obtained, in many cases, using simplified scattering models. Existing imaging systems are based on single or multiple antennas, which could either be fixed or moving. Topics of interest include: 1) Systems for underground exploration, such as ground penetrating radars or antennas specifically designed for this purpose; 2) Propagation methods in complex media, geophysical tomography, multiple scattering, forward modeling of the electromagnetic scattering and propagation; 3) Ability to tackle the complexity of the scenarios in realistic conditions by accounting for factors including antenna modeling, computational complexity, and medium characterization; 4) Inversion methods for high resolution of large regions and effective imaging of hidden and buried targets in 3D scenarios; 5) Inversion approaches for "quantitative" reconstruction in controlled and realistic conditions; and, 6) Development and analysis of new methods for multiple antenna systems data processing.

**Commission G**

Monday 18-08-14 08:00 - 09:20

**G01****Impacts of the Ionosphere on Radio Systems: Observations, Data Management***Session Conveners: Iwona Stanislawska; Bruno Zolesi; Mike Warrington; Paul Cannon*

Knowledge of the behavior of the ionosphere is very important for radio systems. A wide variety of ground based and satellite existing and future systems (communications, radar, surveillance, intelligence gathering, satellite operation, etc.) is affected by the ionosphere. There are the needs for reliable and efficient support for such systems against natural hazard and minimization of the risk failure. This session is devoted to science, techniques and to more application oriented areas of ionospheric investigation in order to support radio systems such as GNSS (Global Navigation Satellite System) and HF radio systems. Requested topics concern the studies based on data mining philosophy increasing the knowledge of ionospheric physical properties, modeling prediction and forecasting capabilities and gain applications of various procedures in ionospheric monitoring and forecasting, international and national activities embedded in joint integrated efforts.

Monday 18-08-14 09:40 - 10:40

**G02****Impacts of the Ionosphere on Radio Systems: Products as the Result of Models and Theory including Maps, Forecasts, and Alerts***Session Conveners: Iwona Stanislawska; Bruno Zolesi; Mike Warrington; Paul Cannon*

Knowledge of the behavior of the ionosphere is very important for radio systems. A wide variety of ground based and satellite existing and future systems (communications, radar, surveillance, intelligence gathering, satellite operation, etc.) is affected by the ionosphere. There are the needs for reliable and efficient support for such systems against natural hazard and minimization of the risk failure. This session is devoted to science, techniques and to more application oriented areas of ionospheric investigation in order to support radio systems such as GNSS (Global Navigation Satellite System) and HF radio systems. Requested topics concern the studies based on data mining philosophy increasing the knowledge of ionospheric physical properties, modeling prediction and forecasting capabilities and gain applications of various procedures in ionospheric monitoring and forecasting, international and national activities embedded in joint integrated efforts.

Monday 18-08-14 13:40 - 15:40

**G03****Advances in Incoherent Scatter Radar (1) (note: links to ISR working group)***Session Conveners: F. Lind; Ingemar Hågström; M. Milla*

This session will focus on advances in the field of incoherent scatter radar measurement of the Geospace environment. Incoherent scatter radar provides powerful measurement capabilities for study of the ionosphere and its coupling to the lower atmosphere and magnetosphere. Instrument capabilities are rapidly evolving with new radars, operational modes, and measurement techniques. Papers which focus on new developments in incoherent scatter radar systems, analysis techniques, technology, and science applications are welcome. This session will also foster collaboration among the global community of Geospace Radar systems to encourage coordinated scientific and technical efforts.

Monday 18-08-14 16:00 - 17:40

**G04****Advances in Incoherent Scatter Radar (2) (note: links to ISR working group)***Session Conveners: F. Lind; Ingemar Hågström; M. Milla*

This session will focus on advances in the field of incoherent scatter radar measurement of the Geospace environment. Incoherent scatter radar provides powerful measurement capabilities for study of the ionosphere and its coupling to the lower atmosphere and magnetosphere. Instrument capabilities are rapidly evolving with new radars, operational modes, and measurement techniques. Papers which focus on new developments in incoherent scatter radar systems, analysis techniques, technology, and science applications are welcome. This session will also foster collaboration among the global community of Geospace Radar systems to encourage coordinated scientific and technical efforts.

Tuesday 19-08-14 08:00 - 09:20

**G05**

**Studies of Irregularities and Scintillation (1) (note: links to Beacon Satellite working group)**

*Session Conveners: Hal Strangeways; Biagio Forte*

This session seeks to review the latest developments in the study of ionospheric irregularities and scintillation. Papers that focus on the problems of scintillation on satellite based systems such as GNSS (Global Navigation Satellite System) at both high and equatorial latitudes will be particularly welcome. The session's scope will also include relevant theory, observations of beacon and GNSS satellites over both satellite to ground and satellite to satellite links and statistical descriptions of scintillation together with mitigation methods and strategies (both hardware and software) to model and combat its effect.

Tuesday 19-08-14 09:40 - 12:00

**G06**

**Studies of Irregularities and Scintillation (2) (note: links to Beacon Satellite working group)**

*Session Conveners: Hal Strangeways; Biagio Forte*

This session seeks to review the latest developments in the study of ionospheric irregularities and scintillation. Papers that focus on the problems of scintillation on satellite based systems such as GNSS (Global Navigation Satellite System) at both high and equatorial latitudes will be particularly welcome. The session's scope will also include relevant theory, observations of beacon and GNSS satellites over both satellite to ground and satellite to satellite links and statistical descriptions of scintillation together with mitigation methods and strategies (both hardware and software) to model and combat its effect.

Tuesday 19-08-14 13:40 - 15:40

**GH01**

**Plasma Waves**

*Session Conveners: Erhan Kudeki (H); Meers Oppenheim (H)*

Plasma density irregularities in the ionosphere affect radiowave propagation and interfere with Earth-space communication such as GPS. Progress in measuring, modeling, and understanding the evolution of ionospheric E- and F-region plasma structures and irregularities encompassing scales ranging from meters to hundreds of kilometers will be the main focus of this session. Phenomena of interest include F-region equatorial plasma bubbles, mid-latitude E and F region irregularities and SAPS, storm time enhancement of mid and high latitude irregularities, incomplete/unsolved problems of 150 km irregularities and non-linear behavior of Farley-Buneman and gradient-drift waves and turbulence.

Wednesday 20-08-14 08:00 - 09:20

**GH02**

**Radio sounding in magnetospheres and ionospheres (1)**

*Session Conveners: Vikas Sonwalkar (lead convener); Gordon James (H); Bodo Reinisch (G); Bob Benson*

This session will present the latest technical and scientific results and concepts of space-borne radio sounding in terrestrial and extra-terrestrial ionospheres and magnetospheres including previous, current, and planned space-borne sounders. The basic physics of plasma-wave propagation and of active or passive antennas, in magnetoplasmas in laboratory or space, are important related topics. Investigations of geospace plasma density structures using injected whistler-mode waves are also solicited, as are reviews of earlier radio-sounding accomplishments highlighting outstanding questions yet to be addressed by radio sounders.



Wednesday 20-08-14 09:40 - 10:40

**GH03**

**Radio sounding in magnetospheres and ionospheres (2)**

*Session Conveners: Vikas Sonwalkar (lead convener); Gordon James (H); Bodo Reinisch (G); Bob Benson*

This session will present the latest technical and scientific results and concepts of space-borne radio sounding in terrestrial and extra-terrestrial ionospheres and magnetospheres including previous, current, and planned space-borne sounders. The basic physics of plasma-wave propagation and of active or passive antennas, in magnetoplasmas in laboratory or space, are important related topics. Investigations of geospace plasma density structures using injected whistler-mode waves are also solicited, as are reviews of earlier radio-sounding accomplishments highlighting outstanding questions yet to be addressed by radio sounders.

Wednesday 20-08-14 13:40 - 15:40

**G07**

**Radio Studies of Equatorial and Low-Latitude Aeronomy (note: links to ISEA meetings)**

*Session Conveners: Koki Chau; Anthea Coster; Baylie Damtie*

This session covers the wide-range of equatorial phenomena observed by radar and radio instrumentation. Papers are solicited on topics that include instability processes and irregularities associated with the equatorial electrojet and the equatorial ionization anomaly. In addition, papers are solicited on topics that cover the coupling between the different atmospheric regions (Mesosphere and Lower Thermosphere and Magnetosphere/Ionosphere coupling) and different atmospheric drivers (ionospheric dynamics and electrodynamics) in the equatorial region. New trends, techniques and experiments, important scientific issues and future directions of equatorial and low-latitude aeronomy will be covered.

Wednesday 20-08-14 16:00 - 17:40

**G08**

**Radio Studies of Polar Aeronomy**

*Session Conveners: T. Sato; C. Heinselmann; M. Kosch*

This session will report recent progress and discuss future plans in polar aeronomy with various radio instruments, such as MST radars and lidars. In the last few years, two major VHF MST radars have been constructed in the polar regions; MAARSY radar in the Arctic, and PANSY radar in the Antarctic. The former is already in its full operation, and the latter is expected to complete construction by the time of the Assembly. There is also a plan to move UHF AMISR to the Antarctica. These radars are expected to clarify important phenomena such as PMSE and PMWE (Polar Mesospheric Summer/Winter Echoes), the generation mechanism of PSC and PMC (Polar Stratospheric/Mesospheric Clouds), dynamical coupling of the middle and upper atmosphere. Coordinated studies with optical instruments will play an important role in understanding physical processes governing these phenomena.

Thursday 21-08-14 08:00 - 09:20

**GH04**

**The Geospace Environment and Meteors (1)**

*Session Conveners: S. Close (G); Meers Oppenheim (H); Pellinen-Wannberg Asta*

This session will cover advances in the detection, interaction, and characterization of meteors in the near-Earth space environment. Topics of interest include meteor detection and modeling in Earth's atmosphere, and plasmas generated from hypervelocity impacts of both meteoroids and orbital debris. In particular, many questions remain on our estimates of global meteoroid flux, composition and density, and the influence of meteors on E-region electrodynamics. Papers that address the radio science and plasma instability issues implicit to meteors are encouraged.

Thursday 21-08-14 09:40 - 12:00

**GH05****The Geospace Environment and Meteors (2)**

*Session Conveners: S. Close (G); Meers Oppenheim (H); Pellinen-Wannberg Asta*

This session will cover advances in the detection, interaction, and characterization of meteors in the near-Earth space environment. Topics of interest include meteor detection and modeling in Earth's atmosphere, and plasmas generated from hypervelocity impacts of both meteoroids and orbital debris. In particular, many questions remain on our estimates of global meteoroid flux, composition and density, and the influence of meteors on E-region electrodynamic. Papers that address the radio science and plasma instability issues implicit to meteors are encouraged.

Thursday 21-08-14 13:40 - 15:40

**G09****Modeling the Geospace Environment**

*Session Conveners: M. Foerster; A.A. Namgaladze*

This session is devoted to the latest achievements in the area of the Earth's atmosphere-ionosphere-plasmasphere-magnetosphere system modeling including its electrodynamic. The coupling processes of interactions between various regions of the geospace environment will be considered using modern physical-numerical models. The problems of the inputs, initial and boundary conditions of the models will be discussed as well as results of their validation via comparisons between the models and observations of such upper atmosphere parameters as electron density and total electron content, thermosphere mass density and winds, electric fields and plasma drifts, and so forth. This session will foster the collaboration among modelers, data providers and research communities in order to improve mutual understanding and state-of-the-art data analyses of geospace missions like CHAMP (CHALLENGING Minisatellite Payload), Swarm and others.

Friday 22-08-14 08:00 - 09:20

**G10****Ionosphere and Plasmasphere Density Profiles (note: links with the IRI Working Group)**

*Session Conveners: Lee-Anne McKinnell; Dieter Bilitza; Bodo Reinisch*

This session will emphasize the importance of ionosphere and plasmasphere electron density profiles in characterizing the upper atmosphere from the bottomside through to the topside and plasmasphere. Measurements of ionospheric characteristics like hmF2 and NmF2 provide essential inputs for any model, but they are not sufficient to describe the global density distribution in the ionosphere up to the plasmasphere. Total Electron Content measurements from GNSS (Global Navigation Satellite System) satellites on the other hand only provide integral information up to the satellite altitude. This session will review the current state of profile modeling covering both the ionosphere and plasmasphere. Presentations are solicited that discuss current modeling approaches and their global reliability, as well as future mission and measurement plans. The session will consist of invited, contributed, and poster presentations.

Friday 22-08-14 09:40 - 10:40

**GT****Tutorial G: Electron density distribution in ionosphere and plasmasphere**

*Session Conveners: Prof. John D. Mathews (U.S.A)*

Tutorial Presenter: Bodo Reinisch

Abstract not available yet

Friday 22-08-14 13:40 - 15:40

**G11**

**Open Session and Latest Results (1)**

*Session Conveners: M. Rietveld; J. D. Mathews*

This session welcomes all papers related to the Commission G terms of reference, particularly those not covered by the other G and G/x sessions. The session also welcomes the latest and perhaps more controversial results. Topics may include papers on the radio science of scattering, on the global morphology, theory, modeling and modification of the ionosphere, on the development of tools and networks to measure ionospheric parameters and trends, on the theory and practice of ionospheric radio propagation, and on the application of ionospheric knowledge to radio systems.

Friday 22-08-14 16:00 - 17:40

**G12**

**Open Session and Latest Results (2)**

*Session Conveners: M. Rietveld; J. D. Mathews*

This session welcomes all papers related to the Commission G terms of reference, particularly those not covered by the other G and G/x sessions. The session also welcomes the latest and perhaps more controversial results. Topics may include papers on the radio science of scattering, on the global morphology, theory, modeling and modification of the ionosphere, on the development of tools and networks to measure ionospheric parameters and trends, on the theory and practice of ionospheric radio propagation, and on the application of ionospheric knowledge to radio systems.

Saturday 23-08-14 08:00 - 09:20

**GHE01**

**Electromagnetic Effects in Lithosphere-Atmosphere-Ionosphere Coupling (1)**

*Session Conveners: E. Masashi Hayakawa; Yasuhide Hobara; J. Y. Liu (G)*

Recent successes in the development of electromagnetic techniques for earthquake precursor registration makes seismo-electromagnetics widely acknowledged by the scientific community. But still we lack the physical substantiation of many of registered effects. Multi-parameter measurements in seismically active regions and cross-validation of results obtained by different groups will help to understand the background physics of the observed anomalies. This session will accept papers demonstrating progress in understanding the electromagnetic effects preceding strong earthquakes including experimental findings and theoretical papers on lithosphere-atmosphere-ionosphere coupling.

Saturday 23-08-14 09:40 - 10:40

**GHE02**

**Electromagnetic Effects in Lithosphere-Atmosphere-Ionosphere Coupling (2)**

*Session Conveners: E. Masashi Hayakawa; Yasuhide Hobara; J. Y. Liu (G)*

Recent successes in the development of electromagnetic techniques for earthquake precursor registration makes seismo-electromagnetics widely acknowledged by the scientific community. But still we lack the physical substantiation of many of registered effects. Multi-parameter measurements in seismically active regions and cross-validation of results obtained by different groups will help to understand the background physics of the observed anomalies. This session will accept papers demonstrating progress in understanding the electromagnetic effects preceding strong earthquakes including experimental findings and theoretical papers on lithosphere-atmosphere-ionosphere coupling.

**Commission H**

Monday 18-08-14 08:00 - 09:20

**HG01****Active Experiments (1)***Session Conveners: T. Pedersen (H); M. Kosch (G)*

This session will cover recent advances in active space experiments, especially ionospheric perturbations or other effects on the space environment actively produced by high-power RF waves, chemical releases, rocket exhaust, or other means. In addition to presentations of observations and measurements from recent or novel experiments, theoretical and modeling developments that advance theory beyond the prevailing qualitative and descriptive state toward quantitative and predictive capabilities will also be welcomed. Topics of interest include wave generation stimulated by or propagation modified by artificial effects. Presentations on technologies, such as RF sources or chemical reactions, which may enable new or improved applications in active space experimentation, are also sought.

Monday 18-08-14 09:40 - 10:40

**HG02****Active Experiments (2)***Session Conveners: T. Pedersen (H); M. Kosch (G)*

This session will cover recent advances in active space experiments, especially ionospheric perturbations or other effects on the space environment actively produced by high-power RF waves, chemical releases, rocket exhaust, or other means. In addition to presentations of observations and measurements from recent or novel experiments, theoretical and modeling developments that advance theory beyond the prevailing qualitative and descriptive state toward quantitative and predictive capabilities will also be welcomed. Topics of interest include wave generation stimulated by or propagation modified by artificial effects. Presentations on technologies, such as RF sources or chemical reactions, which may enable new or improved applications in active space experimentation, are also sought.

Monday 18-08-14 13:40 - 15:40

**HGE01****Ionospheric, magnetospheric and high energy effects of lightning (1)***Session Conveners: Ningyu Liu (H); Victor Pasko (G); Martin Fullekrug (E)*

The recent discovery that lightning discharges can cause energetic radiation, relativistic particles, and transient luminous events has marked a profound advance in our understanding of the Earth's atmospheric electrodynamic behavior. This session explores these novel processes and their impact on the near-Earth environment. The session solicits contributions that advance knowledge in the areas of the global atmospheric electric circuit, lightning physics, transient luminous events, energetic radiation, relativistic particles, and their impact on the Earth's upper atmosphere and the magnetosphere. Interdisciplinary studies which emphasize the connection between atmospheric layers and the relation between lightning-related effects and climate change are particularly welcome.

Monday 18-08-14 16:00 - 17:40

**HGE02****Ionospheric, magnetospheric and high energy effects of lightning (2)***Session Conveners: Ningyu Liu (H); Victor Pasko (G); Martin Fullekrug (E)*

The recent discovery that lightning discharges can cause energetic radiation, relativistic particles, and transient luminous events has marked a profound advance in our understanding of the Earth's atmospheric electrodynamic behavior. This session explores these novel processes and their impact on the near-Earth environment. The session solicits contributions that advance knowledge in the areas of the global atmospheric electric circuit, lightning physics, transient luminous events, energetic radiation, relativistic particles, and their impact on the Earth's upper atmosphere and the magnetosphere. Interdisciplinary studies which emphasize the connection between atmospheric layers and the relation between lightning-related effects and climate change are particularly welcome.

Tuesday 19-08-14 08:00 - 09:20

### H01

#### **Wave-particle Interactions and Their Effects on Planetary Radiation Belts (1)**

*Session Conveners: Jacob Bortnik; Craig J. Rodger; Richard B. Horne*

Wave-particle interactions are a ubiquitous physical phenomenon that allows the exchange of energy and momentum between natural plasma waves, and energetic radiation belt particles. In so doing, the wave can act as an energy conduit between different particle energies, species, or both. In this session we discuss the various plasma waves that control planetary radiation belt dynamics, their specific effects on the particles, both individually and in concert, and the various modes of wave-particle interactions, for instance linear, quasi-linear, nonlinear and non-resonant. We welcome both theoretical and observational studies involving the radiation belts of the Earth or other planets. We particularly encourage early results from the Van Allen Probes. Note that studies directed towards radiation belt particle precipitation and its effects are likely better suited to the complementary sessions HG03-HG04.

Tuesday 19-08-14 09:40 - 10:40

### H02

#### **Wave-particle Interactions and Their Effects on Planetary Radiation Belts (2)**

*Session Conveners: Jacob Bortnik; Craig J. Rodger; Richard B. Horne*

Wave-particle interactions are a ubiquitous physical phenomenon that allows the exchange of energy and momentum between natural plasma waves, and energetic radiation belt particles. In so doing, the wave can act as an energy conduit between different particle energies, species, or both. In this session we discuss the various plasma waves that control planetary radiation belt dynamics, their specific effects on the particles, both individually and in concert, and the various modes of wave-particle interactions, for instance linear, quasi-linear, nonlinear and non-resonant. We welcome both theoretical and observational studies involving the radiation belts of the Earth or other planets. We particularly encourage early results from the Van Allen Probes. Note that studies directed towards radiation belt particle precipitation and its effects are likely better suited to the complementary sessions HG03-HG04.

Tuesday 19-08-14 11:00 - 12:00

### HT

#### **Tutorial H: Theory and simulations of nonlinear wave-particle interactions in the planetary radiation belts**

*Session Conveners: Dr. Ondrej Santolik (Czech Republic)*

Tutorial Presenter: Yoshiharu Omura, Kyoto University

There has been significant progress in understanding the generation mechanism of whistler-mode chorus emissions in recent years. This is partly due to the successful reproduction of chorus emissions by computer simulations and partly due to precise observations of the emissions by spacecraft. We give a brief review of the nonlinear theory and simulations on the generation mechanism of chorus emissions that have been revealed by the simulations and observations. We describe the nonlinear dynamics of resonant electrons and the formation of electromagnetic electron holes or hills that result in resonant currents generating rising-tone emissions or falling-tone emissions, respectively. We also describe the mechanism of nonlinear wave damping due to quasi-oblique propagation, which results in the formation of a gap at half the electron cyclotron frequency. The nonlinear wave growth theory of chorus emissions can also be applied to the generation mechanism of electromagnetic ion cyclotron (EMIC) triggered emissions recently found in spacecraft observations. Hybrid code simulations have confirmed that coherent rising-tone emissions are generated by energetic protons at frequencies below the proton cyclotron frequency. EMIC waves can also interact with relativistic electrons. Both chorus emissions and EMIC triggered emissions play important roles in controlling radiation belt particle dynamics.



*Yoshiharu OMURA is a Professor of Research Institute for Sustainable Humanosphere, Kyoto University. He received Dr. Eng. degree in electrical engineering from Kyoto University in 1985. He served as the vice-chair and chair of URSI Commission H (2005-2011), the chair of Long Range Planning Committee of URSI (2011-2014), and the president of Space and Planetary Science Section of Japan Geoscience Union (2012-2014). He is a recipient of Zeldovich Award of COSPAR, Committee on Space Research (1992), Tanakadate Award of SGEPS, Society of Geomagnetism and Earth, Planetary and Space Sciences (1996), and Science and Technology Award presented by Minister of Culture, Sports, Science, and Technology in Japan (2006). His main research interest is in nonlinear wave-particle interactions in space plasmas. He has published about 150 papers in refereed international journals and edited two books on space plasma simulations.*

Tuesday 19-08-14 13:40 - 15:40

### H03

#### **Wave-particle Interactions and Their Effects on Planetary Radiation Belts (3)**

*Session Conveners: Jacob Bortnik; Craig J. Rodger; Richard B. Horne*

Wave-particle interactions are a ubiquitous physical phenomenon that allows the exchange of energy and momentum between natural plasma waves, and energetic radiation belt particles. In so doing, the wave can act as an energy conduit between different particle energies, species, or both. In this session we discuss the various plasma waves that control planetary radiation belt dynamics, their specific effects on the particles, both individually and in concert, and the various modes of wave-particle interactions, for instance linear, quasi-linear, nonlinear and non-resonant. We welcome both theoretical and observational studies involving the radiation belts of the Earth or other planets. We particularly encourage early results from the Van Allen Probes. Note that studies directed towards radiation belt particle precipitation and its effects are likely better suited to the complementary sessions HG03-HG04.

Wednesday 20-08-14 08:00 - 09:20

### H04

#### **Laboratory simulations of space plasma waves**

*Session Conveners: A. Fredriksen; E. Tejero*

The plasma environments surrounding the Earth and other solar system bodies display a rich variety of phenomena, which can now be observed with unprecedented spatial and temporal resolution by modern space probes and ground-based observatories. These plasmas consist of thermal and energetic particle populations, a variety of ion and neutral species, and also charged particulate matter, which can influence the dynamics of the system. While high-resolution observations can provide tantalizing snapshots of events and statistical overviews of dynamical behavior, repeatable experiments under strictly controlled conditions are not possible in space. Laboratory experiments can provide useful insight in space phenomena by investigating the underlying physics under appropriately scaled, controlled plasma conditions. Among these are experimental studies of wave propagation characteristics, wave-particle interactions, nonlinear dynamics and instabilities, dusty plasma dynamics, double layer and beam formation, development of plasma thrusters, and plasma astrophysics. Papers on basic and applied laboratory studies addressing such space processes are solicited.

Wednesday 20-08-14 09:40 - 10:40

#### H05

##### **Wave-particle Interactions and Their Effects on Planetary Radiation Belts (4)**

*Session Conveners: Jacob Bortnik; Craig J. Rodger; Richard B. Horne*

Wave-particle interactions are a ubiquitous physical phenomenon that allows the exchange of energy and momentum between natural plasma waves, and energetic radiation belt particles. In so doing, the wave can act as an energy conduit between different particle energies, species, or both. In this session we discuss the various plasma waves that control planetary radiation belt dynamics, their specific effects on the particles, both individually and in concert, and the various modes of wave-particle interactions, for instance linear, quasi-linear, nonlinear and non-resonant. We welcome both theoretical and observational studies involving the radiation belts of the Earth or other planets. We particularly encourage early results from the Van Allen Probes. Note that studies directed towards radiation belt particle precipitation and its effects are likely better suited to the complementary sessions HG03-HG04.

Wednesday 20-08-14 13:40 - 15:40

#### HG03

##### **Drivers, detection, and ionospheric impacts of precipitation from the radiation belts (1)**

*Session Conveners: Craig Rodger (H); Mark Clilverd (G)*

Particle precipitation into the atmosphere is believed to be one of the dominant mechanisms for the loss of energetic electron from the Van Allen radiation belts, as well causing losses of ring current ions. Waveparticle interactions with ULF through to VLF waves are thought to be important drivers of these loss-events. This session is targeted at both ground-based and satellite experimental observations, as well as theoretical investigations, into the precipitation of energetic (>20 keV) and relativistic electrons or ring current ions. Papers considering wave-particle interactions driving losses, measurement of loss fluxes, or the effects of this precipitation on the ionosphere are welcome. We particularly welcome early results from the Van Allen Probes, the BARREL (Balloon Array for RBSP Relativistic Electron Losses) campaign, or studies from existing ground and space based experiments. Note that studies directed towards radiation belt electron acceleration or transport are likely better suited to the complementary sessions H01-H03.

Wednesday 20-08-14 16:00 - 17:40

#### HG04

##### **Drivers, detection, and ionospheric impacts of precipitation from the radiation belts (2)**

*Session Conveners: Craig Rodger (H); Mark Clilverd (G)*

Particle precipitation into the atmosphere is believed to be one of the dominant mechanisms for the loss of energetic electron from the Van Allen radiation belts, as well causing losses of ring current ions. Waveparticle interactions with ULF through to VLF waves are thought to be important drivers of these loss-events. This session is targeted at both ground-based and satellite experimental observations, as well as theoretical investigations, into the precipitation of energetic (>20 keV) and relativistic electrons or ring current ions. Papers considering wave-particle interactions driving losses, measurement of loss fluxes, or the effects of this precipitation on the ionosphere are welcome. We particularly welcome early results from the Van Allen Probes, the BARREL (Balloon Array for RBSP Relativistic Electron Losses) campaign, or studies from existing ground and space based experiments. Note that studies directed towards radiation belt electron acceleration or transport are likely better suited to the complementary sessions H01-H03.

Thursday 21-08-14 08:00 - 09:20

#### H06

##### **Boundary layers in terrestrial and planetary environments: Macro/micro-scale kinetic processes (1)**

*Session Conveners: B. Lembège, France; G. Lakhina, India; I. Shinohara, Japan*

Natural boundary layers play a key role in the energy and momentum transfer between the solar wind and the planetary magnetosphere and/or between different regions within the magnetosphere itself. But, such layers are the sites of intricate microscopic/macroscopic processes which develop over micro/meso/macro-scales. These are based on various wave-particle interactions, nonlinear effects and nonstationary mechanisms, which partially or fully control the overall dynamics of these frontiers. The present session welcomes the discussion of results issued from theory, mono/multi-dimensional numerical simulations and experimental data obtained from various space missions. The comparison between these approaches is possible thanks to refined measurements obtained on board of recent multi-spacecraft missions (e.g., Cluster, Themis). Comparison with data issued from other missions (Geotail, Wind, Double Star, etc.) are also encouraged. Applications include magnetospheric, ionospheric and space plasma physics. Examples of boundary layers include: (i) collisionless shocks, (ii) the magnetopause, (iii) plasma sheet currents, (iv) magnetotail dynamics (including substorms), (v) plasmopause, (vi) potential drops in the ionosphere and cusp dynamics, (vii) basic particle acceleration processes, and (viii) dynamics of interfaces in active space experiments. Any contributions related to these topics are very welcome. Comparative analysis of results dedicated to terrestrial and planetary environments are also strongly encouraged, in order to approach a more synthetic view of their understanding.

Thursday 21-08-14 09:40 - 12:00

#### H07

##### **Boundary layers in terrestrial and planetary environments: Macro/micro-scale kinetic processes (2)**

*Session Conveners: B. Lembège, France; G. Lakhina, India; I. Shinohara, Japan*

Natural boundary layers play a key role in the energy and momentum transfer between the solar wind and the planetary magnetosphere and/or between different regions within the magnetosphere itself. But, such layers are the sites of intricate microscopic/macroscopic processes which develop over micro/meso/macro-scales. These are based on various wave-particle interactions, nonlinear effects and nonstationary mechanisms, which partially or fully control the overall dynamics of these frontiers. The present session welcomes the discussion of results issued from theory, mono/multi-dimensional numerical simulations and experimental data obtained from various space missions. The comparison between these approaches is possible thanks to refined measurements obtained on board of recent multi-spacecraft missions (e.g., Cluster, Themis). Comparison with data issued from other missions (Geotail, Wind, Double Star, etc.) are also encouraged. Applications include magnetospheric, ionospheric and space plasma physics. Examples of boundary layers include: (i) collisionless shocks, (ii) the magnetopause, (iii) plasma sheet currents, (iv) magnetotail dynamics (including substorms), (v) plasmopause, (vi) potential drops in the ionosphere and cusp dynamics, (vii) basic particle acceleration processes, and (viii) dynamics of interfaces in active space experiments. Any contributions related to these topics are very welcome. Comparative analysis of results dedicated to terrestrial and planetary environments are also strongly encouraged, in order to approach a more synthetic view of their understanding.

Thursday 21-08-14 13:40 - 15:40

#### H08

##### **Open session and latest results (1)**

*Session Conveners: M. Oppenheim; O. Santolucito*

This session solicits papers on all aspects of waves in space and laboratory plasmas that do not fit into other sessions within Commission H, including solar and planetary plasmas, spacecraft-plasma interactions, applications of space weather, the use of space as a laboratory, spacecraft and laboratory instrumentation, and recent results from spacecraft missions and laboratory experiments.



Friday 22-08-14 08:00 - 09:20

#### H09

##### **Plasma interactions with solar system bodies (1)**

*Session Conveners: C. Mazelle; Y. Kasahara*

Plasma interactions with solar system bodies drastically change depending on the environment of the bodies such as presence of intrinsic magnetic field, atmosphere, and solid surface. For instance, the solar wind plasma directly impacts on the exosphere, atmosphere or surface of non-magnetized bodies such as Mars, Venus and moon and plasma wake is created in the nightside tail region, while magnetized planets are protected by their intrinsic magnetic fields and the solar wind-magnetosphere coupling plays an important role in plasma dynamics. As signatures of the interaction, various kinds of radio emissions and plasma waves are generated in numerous regions of our solar system. The aim of this session is to present recent progress in spacecraft observations, computer simulations and theoretical studies on plasma physics related to the solar wind and plasma flow interaction with solar system bodies. Papers related to future missions and research projects are also welcome.

Friday 22-08-14 09:40 - 10:40

#### H10

##### **Plasma interactions with solar system bodies (2)**

*Session Conveners: C. Mazelle; Y. Kasahara*

Plasma interactions with solar system bodies drastically change depending on the environment of the bodies such as presence of intrinsic magnetic field, atmosphere, and solid surface. For instance, the solar wind plasma directly impacts on the exosphere, atmosphere or surface of non-magnetized bodies such as Mars, Venus and moon and plasma wake is created in the nightside tail region, while magnetized planets are protected by their intrinsic magnetic fields and the solar wind-magnetosphere coupling plays an important role in plasma dynamics. As signatures of the interaction, various kinds of radio emissions and plasma waves are generated in numerous regions of our solar system. The aim of this session is to present recent progress in spacecraft observations, computer simulations and theoretical studies on plasma physics related to the solar wind and plasma flow interaction with solar system bodies. Papers related to future missions and research projects are also welcome.

Friday 22-08-14 13:40 - 15:40

#### H11

##### **Remote sensing of the Plasmasphere (1)**

*Session Conveners: J. Lichtenberger; A. Collier*

The dynamics of the plasmasphere play an important role in Earth's space weather system, and are governed by solar activity. The plasmasphere is permanently influenced by the regions below (ionosphere) and above (outer magnetosphere). The plasmasphere forms the cold plasma background for the overlapping 'warm' (ring current) and 'hot' (radiation belts) regions and its plasma distribution is a fundamental parameter for the description and modelling of the acceleration, decay and transport of radiation belt particles. The dynamics of the plasmasphere require monitoring, modeling and forecasting. This session focuses on various remote-sensing techniques (active and passive ground-based measurements using ULF-ELF-VLF electromagnetic waves as well as satellite-based methods; in-situ density measurements, radio sounding and imaging) and integration of the data obtained by them into various (physics based and data driven) plasmasphere models.

Friday 22-08-14 16:00 - 17:40

**H12**

**Remote sensing of the Plasmasphere (2)**

*Session Conveners: J. Lichtenberger; A. Collier*

The dynamics of the plasmasphere play an important role in Earth's space weather system, and are governed by solar activity. The plasmasphere is permanently influenced by the regions below (ionosphere) and above (outer magnetosphere). The plasmasphere forms the cold plasma background for the overlapping 'warm' (ring current) and 'hot' (radiation belts) regions and its plasma distribution is a fundamental parameter for the description and modelling of the acceleration, decay and transport of radiation belt particles. The dynamics of the plasmasphere require monitoring, modeling and forecasting. This session focuses on various remote-sensing techniques (active and passive ground-based measurements using ULF-ELF-VLF electromagnetic waves as well as satellite-based methods; in-situ density measurements, radio sounding and imaging) and integration of the data obtained by them into various (physics based and data driven) plasmasphere models.

Saturday 23-08-14 08:00 - 09:20

**H13**

**Open session and latest results (2)**

*Session Conveners: M. Oppenheim; O. Santol'ak*

This session solicits papers on all aspects of waves in space and laboratory plasmas that do not fit into other sessions within Commission H, including solar and planetary plasmas, spacecraft-plasma interactions, applications of space weather, the use of space as a laboratory, spacecraft and laboratory instrumentation, and recent results from spacecraft missions and laboratory experiments.

Saturday 23-08-14 09:40 - 10:40

**H14**

**Open session and latest results (3)**

*Session Conveners: M. Oppenheim; O. Santol'ak*

This session solicits papers on all aspects of waves in space and laboratory plasmas that do not fit into other sessions within Commission H, including solar and planetary plasmas, spacecraft-plasma interactions, applications of space weather, the use of space as a laboratory, spacecraft and laboratory instrumentation, and recent results from spacecraft missions and laboratory experiments.

**Commission J**

Monday 18-08-14 08:00 - 09:20

**J01****Radio Astronomy in China**

*Session Conveners: Bo Peng (NAOC, CN); Xiaoyu Hong (SHAO, CN); Di Li (BAO, CN)*

A number of new radio astronomy facilities are being planned and built in China, the host country for the 2014 URSI GASS. The 65-m SHAO radio telescope has been commissioned recently, and the massive FAST telescope is under construction. Projects in the pipeline include the 110-m QTT steerable dish, and the 2-element space VLBI mission planned by SHAO. This session will highlight developments in radio astronomy in China.

Monday 18-08-14 09:40 - 10:40

**JT****Tutorial J:**

*Session Conveners: Prof. Justin Jonas (South Africa)*

Abstract not available yet

Monday 18-08-14 13:40 - 15:40

**J02****Observatory Reports (1)**

*Session Conveners: Willem Baan (ASTRON, NL); Justin Jonas (Rhodes, ZA)*

This is a standing item on the Commission J programmes of all URSI General Assemblies. A large number of radio observatories are each given a short slot (between 5 and 10 minutes, depending on number of presentations) to present a technical update for their facility, highlighting developments over the past triennium. There is no Q&A opportunity in this session.

Monday 18-08-14 16:00 - 17:40

**J03****Observatory Reports (2)**

*Session Conveners: Willem Baan (ASTRON, NL); Justin Jonas (Rhodes, ZA)*

This is a standing item on the Commission J programmes of all URSI General Assemblies. A large number of radio observatories are each given a short slot (between 5 and 10 minutes, depending on number of presentations) to present a technical update for their facility, highlighting developments over the past triennium. There is no Q&A opportunity in this session.

Tuesday 19-08-14 08:00 - 09:20

**J04****New Generation Radio Telescopes (1)**

*Session Conveners: Phil Diamond (SKA); Tony Beasley (NRAO, US); Marco de Vos (ASTRON, NL)*

There are currently a large number of new and upgraded radio astronomy facilities being designed, built, commissioned and operated. These instruments span the entire radio spectrum, and they all push boundaries in observation parameter space. An incomplete list is: SKA, ALMA, LOFAR, JVLA, MeerKAT, ASKAP, MWA, PAPER, LWA, CHIME, Spektr-R. Many of these instruments are pathfinders and precursors for the SKA. This session will highlight the technical and scientific accomplishments of these new facilities.

Tuesday 19-08-14 09:40 - 12:00

**J05**

**New Generation Radio Telescopes (2)**

*Session Conveners: Phil Diamond (SKA); Tony Beasley (NRAO, US); Marco de Vos (ASTRON, NL)*

There are currently a large number of new and upgraded radio astronomy facilities being designed, built, commissioned and operated. These instruments span the entire radio spectrum, and they all push boundaries in observation parameter space. An incomplete list is: SKA, ALMA, LOFAR, JVL, MeerKAT, ASKAP, MWA, PAPER, LWA, CHIME, Spektr-R. Many of these instruments are pathfinders and precursors for the SKA. This session will highlight the technical and scientific accomplishments of these new facilities.

Tuesday 19-08-14 13:40 - 15:40

**J06**

**Polarization and magnetic fields from the solar system to the CMBR**

*Session Conveners: Anna Scaife (Southampton, UK); Russ Taylor (Calgary, CA); Athol Kembell (Illinois, US); Michael Jones (Oxford, UK)*

The understanding of the origins of cosmic magnetism and its effect in diverse astrophysical processes throughout the universe is a growing research field. It is one of the key science topics for the SKA, and the intrinsic polarization of the CMBR probes the physics within the first moments after the Big Bang. This session will review the science, instruments, experiments and results that define the state of the art in this field.

Wednesday 20-08-14 08:00 - 09:20

**J07**

**Observing the mm and sub-mm Universe: from the CMBR to local molecules**

*Session Conveners: Roy Booth; Richard Hills; Tony Readhead*

The mm and sub-mm region of the radio spectrum provides a unique view of thermal processes in the universe, and also provides an ultra-high resolution probe of compact objects. A diverse range of ground and space-based instruments cover a wide range of science topics. This session will highlight recently commissioned and planned instruments (e.g. ALMA, CARMA, CCAT, SPT, ACT, Planck, , QUIET, SMA, HTT), together with their science objectives and results.

Wednesday 20-08-14 09:40 - 10:40

**J08**

**Observing the mm and sub-mm Universe: from the CMBR to local molecules**

*Session Conveners: Roy Booth; Richard Hills; Tony Readhead*

The mm and sub-mm region of the radio spectrum provides a unique view of thermal processes in the universe, and also provides an ultra-high resolution probe of compact objects. A diverse range of ground and space-based instruments cover a wide range of science topics. This session will highlight recently commissioned and planned instruments (e.g. ALMA, CARMA, CCAT, SPT, ACT, Planck, , QUIET, SMA, HTT), together with their science objectives and results.

Wednesday 20-08-14 13:40 - 15:40

**J09**

**Probing the Hydrogen Universe (1)**

*Session Conveners: Leon Koopmans (Groningen, NL); Yashwant Gupta (NCRA, IN); Jacqueline van Gorkom (Colombia, US)*

Radio observations of neutral hydrogen provide a unique probe of the universe over most of cosmic time, yielding results that drive modern cosmology, astrophysics and fundamental physics. Key science objectives include the detection and characterization of the Epoch of Reionization (EoR), detection and characterization of Baryonic Acoustic Oscillations (BAOs), and the history of Galaxy Evolution from the time of the first galaxies to the present day. These science topics will be addressed by the SKA, and a number of pathfinder experiments and facilities have been established to obtain early science results.

Wednesday 20-08-14 16:00 - 17:40

**J10**

**Probing the Hydrogen Universe (2)**

*Session Conveners: Leon Koopmans (Groningen, NL); Yashwant Gupta (NCRA, IN); Jacqueline van Gorkom (Colombia, US)*

Radio observations of neutral hydrogen provide a unique probe of the universe over most of cosmic time, yielding results that drive modern cosmology, astrophysics and fundamental physics. Key science objectives include the detection and characterization of the Epoch of Reionization (EoR), detection and characterization of Baryonic Acoustic Oscillations (BAOs), and the history of Galaxy Evolution from the time of the first galaxies to the present day. These science topics will be addressed by the SKA, and a number of pathfinder experiments and facilities have been established to obtain early science results.

Thursday 21-08-14 08:00 - 09:20

**J11**

**Correlation, calibration and imaging across all wavelengths (1)**

*Session Conveners: Paul Alexander (Cambridge, UK); Oleg Smirnov (Rhodes, ZA); Steven Tingay (ICRAR, AU); Brent Carlson (NRC, CA); Sanjay Bhatnagar (NRAO, US)*

Radio interferometry is a well-established technique used for imaging radio sources, and an increasing number of radio telescope arrays are being built to provide unprecedented views of the radio universe. The goal is to achieve thermal noise limited images that display no residual instrumental or systematic artifacts, so that the full sensitivity of new instruments, such as the SKA, can be harnessed. The wide bandwidths and fields of view of these instruments provide unprecedented challenges, requiring new technologies, techniques and algorithms to handle the data flow and volume. This session will review the state of the art in array imaging process, and will investigate how various compute platforms match to the various stages in the data flow.

Thursday 21-08-14 09:40 - 12:00

**J12**

**Correlation, calibration and imaging across all wavelengths (2)**

*Session Conveners: Paul Alexander (Cambridge, UK); Oleg Smirnov (Rhodes, ZA); Steven Tingay (ICRAR, AU); Brent Carlson (NRC, CA); Sanjay Bhatnagar (NRAO, US)*

Radio interferometry is a well-established technique used for imaging radio sources, and an increasing number of radio telescope arrays are being built to provide unprecedented views of the radio universe. The goal is to achieve thermal noise limited images that display no residual instrumental or systematic artifacts, so that the full sensitivity of new instruments, such as the SKA, can be harnessed. The wide bandwidths and fields of view of these instruments provide unprecedented challenges, requiring new technologies, techniques and algorithms to handle the data flow and volume. This session will review the state of the art in array imaging process, and will investigate how various compute platforms match to the various stages in the data flow.

Thursday 21-08-14 13:40 - 15:40

**J13**

**Solar radio emission: astrophysics and space weather applications**

*Session Conveners: Yihua Yan (NAOC, CN); K.-L. Klein (Paris-Meudon Obs., FR)*

Several multi-purpose or solar-dedicated radio telescopes have recently started operations: the Chinese Spectral Radio heliograph (CSRH) in the decimetre band, LOFAR and MWA at metre wavelengths. They open new windows to the observation of the quiet and active Sun. At the same time existing facilities continue to produce significant results. All will remain important in the near future as a ground-based support for the major space projects in solar and heliospheric physics, Solar Orbiter and Solar Probe +. Due to their sensitivity to large-scale disturbances of the corona and the Heliosphere and to energetic electrons, radio emissions are also a tool for space weather predictions. This session has the objective to present the new instruments and their first solar observations, to show new results of radio and multi-wavelength studies for the on-going solar maximum, and to discuss space weather investigations, where solar radio emission may as well be a hazard (GPS) as a valuable tool for research and predictions.

Friday 22-08-14 08:00 - 09:20

**J14**

**Time domain radio astronomy: an example of Big Data in astronomy (1)**

*Session Conveners: Ben Stappers (Manchester, UK); Michael Kramer (MPIfR, DE); Joseph Lazio (JPL, US)*

Fast radio transient sources, including pulsars, are excellent laboratories for studying fundamental physics, such as General Relativity, and high-energy astrophysics. Current and planned surveys to detect and study these objects provide severe challenges for the telescopes and associated instrumentation (including SKA) because of the extreme data rates requiring on-line processing. This session will highlight the scientific goals of high-speed time-domain radio astronomy, and introduce the associated technical challenges and proposed solutions.

Friday 22-08-14 09:40 - 10:40

**J15**

**Time domain radio astronomy: an example of Big Data in astronomy (2)**

*Session Conveners: Ben Stappers (Manchester, UK); Michael Kramer (MPIfR, DE); Joseph Lazio (JPL, US)*

Fast radio transient sources, including pulsars, are excellent laboratories for studying fundamental physics, such as General Relativity, and high-energy astrophysics. Current and planned surveys to detect and study these objects provide severe challenges for the telescopes and associated instrumentation (including SKA) because of the extreme data rates requiring on-line processing. This session will highlight the scientific goals of high-speed time-domain radio astronomy, and introduce the associated technical challenges and proposed solutions.

Friday 22-08-14 13:40 - 15:40

**J16**

**Latest observations and results (1)**

*Session Conveners: Ken Kellermann (NRAO, US); Luigina Feretti (INAF, IT); Sean Dougherty (NRC, CA)*

This is a standing item on the Commission J programmes of all URSI General Assemblies. The session will consist of papers that highlight prominent and high impact observations and discoveries over the past triennium. New observatories, such as ALMA, LOFAR and Spektr-R have shown how the observational envelope is being stretched by these new facilities.

Friday 22-08-14 16:00 - 17:40

**J17**

**Latest observations and results (2)**

*Session Conveners: Ken Kellermann (NRAO, US); Luigina Feretti (INAF, IT); Sean Dougherty (NRC, CA)*

This is a standing item on the Commission J programmes of all URSI General Assemblies. The session will consist of papers that highlight prominent and high impact observations and discoveries over the past triennium. New observatories, such as ALMA, LOFAR and Spektr-R have shown how the observational envelope is being stretched by these new facilities.

Saturday 23-08-14 08:00 - 09:20

**J18**

**Antennas, detectors and receivers for new generation radio telescopes (1)**

*Session Conveners: Arnold van Ardenne (ASTRON, NL); Mariana Ivasina (Chalmers, SE); Rich Bradley (NRAO, US)*

The new generation of radio telescopes needs a new generation of receptors. This need for enabling technologies is driven by science requirements that call for increased bandwidth, field of view and sensitivity, but also by pragmatic requirements of low capital and operations costs. This session will highlight developments in radio astronomy receptors, from the capture of incident wave fronts through to digital outputs. Technical topics include electromagnetic design, antenna and feed structures, low-noise amplifiers, beamformers and digitizers.

Saturday 23-08-14 09:40 - 10:40

**J19**

**Antennas, detectors and receivers for new generation radio telescopes (2)**

*Session Conveners: Arnold van Ardenne (ASTRON, NL); Mariana Ivasina (Chalmers, SE); Rich Bradley (NRAO, US)*

The new generation of radio telescopes needs a new generation of receptors. This need for enabling technologies is driven by science requirements that call for increased bandwidth, field of view and sensitivity, but also by pragmatic requirements of low capital and operations costs. This session will highlight developments in radio astronomy receptors, from the capture of incident wave fronts through to digital outputs. Technical topics include electromagnetic design, antenna and feed structures, low-noise amplifiers, beamformers and digitizers.

**Commission K**

Monday 18-08-14 08:00 - 09:20

**K01****Interaction Between EMF and Biosystems (1)***Session Conveners: Guglielmo D'Inzeo (Rome, IT)*

In view of never-ending controversy about the possible effects of weak electromagnetic fields it is warranted to take mechanistic approaches in addition to experimental and epidemiological approaches. This session will focus on the considerations about mechanism of interaction between electromagnetic fields and biological systems to explore the feasibility of health consequence of weak EMFs.

Monday 18-08-14 09:40 - 10:40

**K02****Interaction Between EMF and Biosystems (2)***Session Conveners: Guglielmo D'Inzeo (Rome, IT)*

In view of never-ending controversy about the possible effects of weak electromagnetic fields it is warranted to take mechanistic approaches in addition to experimental and epidemiological approaches. This session will focus on the considerations about mechanism of interaction between electromagnetic fields and biological systems to explore the feasibility of health consequence of weak EMFs.

Monday 18-08-14 13:40 - 15:40

**K03****Biological Effects of EMF (1)***Session Conveners: Nam Kim (Korea), Zhou Zhou (China)*

Studies have been continued to collect evidences to assess health hazards of electromagnetic fields. In spite of the long history of these researches there are still uncertainties in possible biological effect of long-term low level exposures. New approaches for breakthrough have been awaited to obtain scientific evidences for or against those possible effects. The researches have been focused on frequencies and waveforms used for wireless communications such as mobile phones. New technologies other than those are now emerging. They use different frequencies and waveforms. The possible health effects should also be explored. On the other hand beneficial use of the effect of electromagnetic fields has become of more concern for the development of novel applications in biotechnology and medicine. This session call for papers on recent development of experimental studies as well as epidemiological studies on biological effects of electromagnetic fields of various approaches.

Monday 18-08-14 16:00 - 17:40

**K04****Millimeter and THz Waves in Medicine and Biology***Session Conveners: Kodo Kawase (Japan), Joo-Hiuk Son (Korea)*

Applications of millimeter and THz waves are expected to become common in daily lives in the near future. There have been suggestion of non-thermal effects of those waves but few data have been obtained so far. This session will deal with interaction of millimeter and THz waves with biological systems. The scope includes theoretical and experimental studies for both hazard identification and medical applications. Basic researches are also welcome such as electric constant measurement in frequency region of those waves.

Tuesday 19-08-14 08:00 - 09:20

**Vacant slot**



Tuesday 19-08-14 09:40 - 12:00

**KAE01**

**Dosimetry and Safety of EM wave**

*Session Conveners: Jafer Keshvari (Finland), Jeong-Ki Paek (Korea)*

The exposure scenario becomes more and more complex due to the recent progress in the applications of electromagnetic fields including wireless communications. The compliance with safety guidelines is not easily demonstrated in the complex situation. Dosimetry considerations are requested to keep up with the recent change in the exposure. This session deals with progress in the dosimetry and safety consideration including compliance testing.

Tuesday 19-08-14 13:40 - 14:40

**KT**

**Tutorial K:**

*Session Conveners: Dr. Masao Taki (Japan)*

Abstract not available yet

Tuesday 19-08-14 14:40 - 15:40

**K05**

**Biological Effects of EMF (2)**

*Session Conveners: Nam Kim (Korea), Zhou Zhou (China)*

Studies have been continued to collect evidences to assess health hazards of electromagnetic fields. In spite of the long history of these researches there are still uncertainties in possible biological effect of long-term low level exposures. New approaches for breakthrough have been awaited to obtain scientific evidences for or against those possible effects. The researches have been focused on frequencies and waveforms used for wireless communications such as mobile phones. New technologies other than those are now emerging. They use different frequencies and waveforms. The possible health effects should also be explored. On the other hand beneficial use of the effect of electromagnetic fields has become of more concern for the development of novel applications in biotechnology and medicine. This session call for papers on recent development of experimental studies as well as epidemiological studies on biological effects of electromagnetic fields of various approaches.

Wednesday 20-08-14 08:00 - 09:20

**K06**

**Therapeutic Applications of High-frequency EM (1)**

*Session Conveners: James Lin (USA), Koichi Ito (Japan)*

This session is devoted to recent progress in therapeutic applications of electromagnetic radiation including microwaves, lasers and infrared. Specific applications would include ablation, coagulation, hyperthermia, oncothermia, and other biomedical applications involving high power. Basic, applied and clinical research papers are welcome.

Wednesday 20-08-14 09:40 - 10:40

**K07**

**Therapeutic Applications of High-frequency EM (2)**

*Session Conveners: James Lin (USA), Koichi Ito (Japan)*

This session is devoted to recent progress in therapeutic applications of electromagnetic radiation including microwaves, lasers and infrared. Specific applications would include ablation, coagulation, hyperthermia, oncothermia, and other biomedical applications involving high power. Basic, applied and clinical research papers are welcome.

Wednesday 20-08-14 13:40 - 15:40

**KE01**

**EMC of Wireless Power Transfer**

*Session Conveners: Teruo Onishi (Japan), Yang-bae Chun (Korea)*

Wireless power transfer attracts attentions of researchers and engineers in various fields with expectation to become a common technology of practical use. Safety issue should be investigated prior to the introduction to daily lives. This session deals with interaction of electromagnetic fields emitted from wireless power transfer systems with human body or medical equipment.

Wednesday 20-08-14 16:00 - 17:40

**K08**

**EMF Exposure Assessment**

*Session Conveners: Niels Kuster (Switzerland), Tongning WU (China)*

The electromagnetic environment has become more and more complex due to the development of emerging wireless technologies. This session highlights the recent knowledge about exposure from environmental electromagnetic fields in the real world.

Thursday 21-08-14 08:00 - 09:20

**Vacant slot**

Thursday 21-08-14 09:40 - 12:00

**KB01**

**Antennas for Wireless Medical Telemetry**

*Session Conveners: Erdem Topsakal (USA), Yahya Rahmat-Samii (USA)*

The advances in wireless power and data telemetry technologies combined with the low power electronic circuit components played a key role in design and development of wireless medical devices in healthcare. As a result, numerous applications in medical diagnostics became a reality such as cardiac pacemakers and defibrillators, visual prosthesis, brain computer interfaces, and body area networks for sensing oxygen, glucose, pH level, pressure, and temperature. One major component in these systems is the onboard antennas. Because most electronic components are low power and relatively small, the overall size of the device is dictated by the antenna size. Usable frequencies for both implantable and body centric antennas are the Medical Device Radiocommunications Service - MedRadio (401 - 406 MHz, 413 - 419 MHz, 426 - 432 MHz, 438 - 444 MHz, and 451 - 457 MHz), the Wireless Medical Telemetry Service -WMTS (608 - 614 MHz, 1395 - 1400 MHz, and 1427 - 1432 MHz) and the Industrial, Scientific and Medical -ISM (433-434.8 MHz, 902-928 MHz, 2.4-2.5 GHz, and 5.725-5.875 GHz) bands. These relatively low frequencies combined with the complexity and lossy nature of the human body result in antenna design challenges such as antenna size, flexibility, power transmission efficiency, heat dissipation, SAR, maximum available data rate. In addition, biocompatibility is also a challenge for implantable systems. In order to address these challenges, this joint URSI Commissions KB session will focus on the design of antennas for next generation devices for wireless medical telemetry systems.

Thursday 21-08-14 13:40 - 15:40

**K09**

**Interactions between Human Body and Implanted Systems field applications**

*Session Conveners: Jianqing Wang (Japan), Konstantina S. Nikita (Greece)*

Electromagnetic fields interact with (active or passive) medical systems implanted in the human body. The interaction can cause hazardous interference with medical systems. The interaction can also be used for intentional use to transmit information and/or energy between implanted devices and equipment outside of human body. This session focuses on the electromagnetic interaction through human body in the transmission path including both interference and intentional use.

Friday 22-08-14 08:00 - 09:20

**KBE01**

**Uncertainty Management (1)**

*Session Conveners: J. Wiart (France), Francesco Andriulli (France)*

Abstract not available yet

Friday 22-08-14 09:40 - 10:40

**KBE02**

**Uncertainty Management (2)**

*Session Conveners: J. Wiart (France), Francesco Andriulli (France)*

Abstract not available yet

Friday 22-08-14 13:40 - 15:40

**K10**

**Biomedical Applications: Static, ELF and pulsed field applications**

*Session Conveners: Shoogo Ueno (Japan), Frank Prato (Canada)*

Biological applications of static, ELF and pulsed electromagnetic fields have been widely studied for medicine and basic research. This session focuses on topics in recent advances in biomedical applications. The topics include TMS (Transcranial Magnetic Stimulation), DBS (Deep Brain Stimulation), MRI (Magnetic Resonance Imaging), tissue engineering and regenerative medicine using electromagnetic fields and therapy by electromagnetic fields.

Friday 22-08-14 16:00 - 17:40

**KB02**

**Electromagnetic Modeling of the Human Body**

*Session Conveners: Tomoaki Nagaoka (Japan), Ursula van Rienen (Germany)*

Electromagnetic Modeling of the Human Body plays a key role in simulations related to many actual problems, especially those from Electromagnetic Compatibility (EMC) and Biomedical Engineering. In EMC, detailed and highly reliable knowledge on the interaction of high-power EM fields with the human body is needed. Those fields are widely used in communications and in magnetic resonance imaging (MRI) systems. The waves deposit significant amounts of energy in the tissues and can cause serious damage to cells. This risk has to be avoided for the user of the communication system as well as to the patients and the operators of MRI. Another field from biomedical engineering covers electrically stimulating implants but also the use of electric or magnetic fields for impedance tomography. Highly resolved human body models are vital in order to achieve reliable predictions. Recently, the focus of interest went into discrimination between the various user groups, i.e. children, elderly people, men, woman and also typically physiognomies, and uncertainty quantification gained in importance. This session focuses on advanced computational models of whole-body or a part for the electromagnetic modeling of the human body and their applications with various approaches of numerical methods.

Saturday 23-08-14 08:00 - 09:20

**KB03**

**Non-ionizing Electromagnetic Medical Imaging (1)**

*Session Conveners: Jie Tian (China)*

This session is devoted to non-ionizing electromagnetic (and hybrid-electromagnetic) systems for breast imaging, tissue characterization, and the detection/identification of tumors. Much progress has been made on the development of such systems ranging from very low frequencies all the way up to optical frequencies. Examples include electrical impedance tomography, microwave imaging, near-infrared tomography, and THz imaging. Specific topics of interest include, but are not limited to, tomographic and other image construction algorithms and experimental results from laboratory and clinical imaging systems. Breast imaging is the principal topic but other applications of similar principle are also acceptable.

Saturday 23-08-14 09:40 - 10:40

**KB04**

**Non-ionizing Electromagnetic Medical Imaging (2)**

*Session Conveners: Jie Tian (China)*

This session is devoted to non-ionizing electromagnetic (and hybrid-electromagnetic) systems for breast imaging, tissue characterization, and the detection/identification of tumors. Much progress has been made on the development of such systems ranging from very low frequencies all the way up to optical frequencies. Examples include electrical impedance tomography, microwave imaging, near-infrared tomography, and THz imaging. Specific topics of interest include, but are not limited to, tomographic and other image construction algorithms and experimental results from laboratory and clinical imaging systems. Breast imaging is the principal topic but other applications of similar principle are also acceptable.