

Commission B

Session	Number of slots
B01	10 (two sessions)
Antenna theory, design, and measurement 1 & 2	
Conveners: John Volakis, Debatosh Guha, Andrea Michel	
Convener Emails: jvolakis@fiu.edu, dgirpe@yahoo.co.in, andrea.michel@iet.unipi.it	
This session aims to present progress in the theory and practice of antenna design, measurements and their deployment in wireless systems. It covers novel antenna designs and their analysis, small antennas, antenna and propagation measurement techniques, active antennas, and matching techniques, as well as structures that enable improved antenna designs, including metamaterial-based surfaces and substrates.	

Session	Number of slots
B02	5
Memorial session for Prof. Thomas B. A. Senior	
Conveners: John Volakis, Kazuya Kobayashi, Paul Smith	
Convener Emails: jvolakis@fiu.edu, kazuya@tamacc.chuo-u.ac.jp, paulsmith2468@gmail.com	
Prof. Thomas B. A. Senior has played a central role in URSI and the development of diffraction methods for impedance surfaces and a variety of canonical bodies. He also served as the Vice President and President of URSI from 1993-1999. This session will honor his technical contributions and service to the scientific community and URSI. https://news.engin.umich.edu/2017/11/thomas-b-a-senior-1928-2017-in-memoriam/	

Session	Number of slots
B03	10 (two sessions)
Propagation and scattering: advances, trends and new applications 1 & 2	
Conveners: Robert Burkholder, Danilo Erricolo, Guido Lombardi, Carlo Riva	
Convener Emails: burkholder.1@osu.edu, derric1@uic.edu, guido.lombardi@polito.it, carlo.riva@polimi.it	
<p>Recently, there has been a sharp increase in activities related to the study of propagation and scattering phenomena at frequencies significantly above 5 GHz. One of the main reasons is that propagation and scattering studies are needed as part of the investigations related to the definitions of the standards for the upcoming 5G wireless communications. On the other hand, sensors to be used for self-driving vehicles operate in the 24 GHz and 77 GHz bands. For these reasons, a renewed interest in the physics of Electromagnetic wave propagation and scattering in complex environments has arisen. Theoretical, statistical and numerical models together with experimental data are the foci of this special session.</p>	

Session	Number of slots
B04	10 (two sessions)
Advanced algorithms in computational electromagnetics 1 & 2	
Conveners: Shinichiro Ohnuki, Vladimir Okhmatovski, Qing Huo Liu	
Convener Emails: ohnuki.shinichiro@nihon-u.ac.jp, Vladimir.Okhmatovski@umanitoba.ca, qhliu@duke.edu	
<p>This session will focus on most recent advances of numerical methods, numerical techniques, and their applications in computational electromagnetics. Potential topics may include (but are not limited to):</p> <ul style="list-style-type: none"> - Fast, efficient, and accurate methods - Recent advances in the integral equations of electromagnetics - Numerical modelling and optimization - Multiscale and multiphysics algorithms - High performance computing and computer architecture - Machine learning 	

Session	Number of slots
B05	5
Memorial session for Prof. Jean Van Bladel	
Conveners: Peter Van Daele, Piergiorgio L. E. Uslenghi, Ari Sihvola	
Convener Emails: Pet.VanDaele@UGent.be, uslenghi@uic.edu, ari.sihvola@aalto.fi	
<p>Prof. Jean Van Bladel has served URSI over many years in different positions: as Honorary President (1999-2018), Secretary General (1979-1993) and Chairman of Commission B (1975-1977) and had a lasting impact on science, the scientific community and engineering education and students for over more than half a century. Over his distinguished scientific career Jean Van Bladel received many prestigious awards such as Heinrich Hertz Medal and the Antennas and Propagation Society's 1997 Distinguished Achievement Award from the IEEE, an Honorary Doctor's Degree from the University of Liège and both in 1978 and 1984 he was awarded the Francqui Chair at the Free University of Brussels. Through his book "Electromagnetic fields" first printed by McGraw Hill (New York) in 1964, later reprinted by the Hemisphere Publ. co in New York in 1985 and the second edition in 2007 printed by IEEE Press and John Wiley and Sons, Jean Van Bladel has made vast and outstanding contributions to science in general and to electromagnetic theory and applications in particular. His work has been important resources to researchers and teachers alike, and they will stand the test of time.</p>	

Session	Number of slots
B06	5
Inverse scattering and imaging	
Conveners: Lianlin Li, Matteo Pastorino, Shouhei Kidera	
Convener Emails: lianlin.li@pku.edu.cn, matteo.pastorino@unige.it, kidera@ee.uec.ac.jp	
<p>This session aims to focus on Electromagnetic wave techniques, both active and passive and of interest to sensing and imaging related to security applications. Examples include landmine detection, identification of intruders, search and rescue in disaster events, vehicle collision avoidance, security checking at airports, etc. Wavelengths of interest include radio to X-ray waves, and UWB (Ultra-Wideband) signals to improve range and cross resolution for indoor and medical imaging. Some of these applications require super resolution and/or very fast computation for real time images with high quality and reliability. Theoretical investigations and studies aiming to other type of applications are also welcomed.</p>	

Session	Number of slots
B07	5
Integral equation, hybrid, and fast methods	
Conveners: Francesco Andriulli, Thomas Eibert	
Convener Emails: francesco.andriulli@polito.it, eibert@tum.de	
<p>Integral equation solutions provide very accurate and robust results of scattering, radiation and field transformation problems. Due to their global nature, they lead, however, in a straightforward solution approach to fully-populated operator equations, which in turn result in field solvers with a bad numerical complexity. Fast integral solvers aim at reducing the bad solution complexity and this can be achieved by a variety of different techniques. The focus of this session is primarily on integral equation formulations, discretization approaches, and corresponding hybrid methods as well as on fast iterative and direct solvers, which reduce the solver complexity of the operator equations in the context of radiation, scattering, or field transformation problems, where free-space or other Green's functions (as e.g. for layered media) are used. Improvements of existing techniques are as welcome as completely new approaches. The techniques can be based on purely algebraic, but also on physics motivated procedures. They can work in time-domain or in frequency domain, where low-frequency, high-frequency, and very wideband techniques are of interest.</p>	

Session	Number of slots
B08	10 (two sessions)
Novel mathematical methods in electromagnetics 1 & 2	
Conveners: Kazuya Kobayashi, Yury Shestopalov	
Convener Emails: kazuya@tamacc.chuo-u.ac.jp, Yury.Shestopalov@hig.se	
<p>This session will cover recent achievements in the area of advanced analytical and numerical methods as applied to various problems arising in all branches of electromagnetics. Topics of interest include, but are not limited to, the following areas: analytical regularization methods; canonical problems; computational electromagnetics; electromagnetic theory; gratings and periodic structures; guided waves; high-frequency techniques; integral equation methods; inverse problems; metamaterials; nonlinear phenomena; novel mathematical techniques; numerical methods; radar cross section; random media and rough surfaces; scattering and diffraction; time-domain techniques; waves in complex media; Wiener-Hopf technique.</p>	

Session	Number of slots
B09	10 (two sessions)
Mathematical modelling of EM problems 1 & 2	
Conveners: Paul Smith, Piergiorgio L. E. Uslenghi	
Convener Emails: paulsmith2468@gmail.com, uslenghi@uic.edu	
<p>This session will address recent developments in the mathematical modelling of electromagnetic problems by a variety of analytical, semi-analytical and numerical methods. Papers may consider significant modelling problems in any area of fields and waves including, for example, fundamental aspects of electromagnetic theory, material and media modelling, scattering and diffraction in the time or frequency domain, inverse problems and propagation. As appropriate, papers should discuss the analytical and/or numerical advantages of the chosen modelling framework over alternative approaches.</p>	

Session	Number of slots
B10	10 (two sessions)
Scattering and diffraction 1 & 2	
Conveners: Ludger Klinkenbusch, Giuliano Manara	
Convener Emails: lbk@tf.uni-kiel.de, giuliano.manara@iet.unipi.it	
<p>The session will review topics covering the wide range of scattering and diffraction. Methods and applications will be considered including asymptotic high-frequency methods, edge diffraction, surface waves, hybridization of numerical methods with high-frequency methods, and scattering from stochastic surfaces. Scattering from non-linear/anisotropic/dispersive media will also be emphasized. In addition, mathematical and analytical methods for scattering and diffraction will be considered. Specific attention will be also given to different types of illuminating fields, such as plane waves, rays, and beams.</p>	

Session	Number of slots
B11	10 (two sessions)
Electromagnetic theory 1 & 2	
Conveners: Daniel Sjöberg, Henrik Wallén	
Convener Emails: Daniel.Sjoberg@eit.lth.se, henrik.wallén@aalto.fi	
<p>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 modelling of complex structures and materials including aspects of periodicity and quasi-periodicity, topological aspects of ordered structures, solutions of canonical problems, analytic identities, guided waves, mathematical aspects of numerical methods, random and complex media, asymptotic methods, and antenna theory. Owing to the wide scope of Commission B and to the multi-disciplinary nature of contemporary research in electromagnetism, an extended view of the topics above is also welcome. This includes classical theories, as well as the incorporation of electromagnetism and quantum theory on the nano-scale. We expect contributions in this session to present unexpected phenomena, new paradigms or new interpretations of fundamental concepts, new solution methods, or to address questions with respect to well-posedness of different problems and models.</p>	

Session	Number of slots
B12	5
Materials in electromagnetics	
Conveners: Andrey Osipov, Paul Smith	
Convener Emails: Andre.Osipov@dlr.de, paulsmith2468@gmail.com	
<p>The session will address the various aspects related to modelling and applications of materials, with an emphasis on theoretical and computer-aided methods and artificial (or engineered) materials.</p> <p>The scope of the session will include the following areas:</p> <p>(1) Electromagnetic properties, modelling and design of artificial materials.</p> <p>(2) Scattering and propagation in the presence of artificial materials; approximate boundary conditions, reflection and transmission at interfaces of artificial materials (including FSS, metasheets and metasurfaces); canonical diffraction problems for finitely conducting (impedance, coated, dielectric, ferromagnetic, etc.) bodies.</p> <p>(3) Applications of artificial materials to microwave absorbers, lenses, antenna radomes, cloaking, RCS reduction and EMI shielding.</p>	

Session	Number of slots
B13	5
Electromagnetics of time-varying scatterers and materials	
Conveners: Sergei Tretyakov, Ana Díaz-Rubio, Viktor Asadchy	
Convener Emails: sergei.tretyakov@aalto.fi, ana.diazrubio@aalto.fi, viktar.asadchy@aalto.fi	
<p>Recently, various time-space modulation structures have been actively investigated, especially for creation of compact and efficient nonreciprocal devices. While the properties of time-varying bulk components in transmission-line and waveguide environments are well known, studies of artificial materials and thin sheets (metamaterials and metasurfaces) formed by time-modulated inclusions need deeper studies. This session will review recent results on scattering properties of arbitrary time-modulated objects and properties of ensembles of many time-modulated inclusions forming metamaterials and metasurfaces. General studies of electromagnetic phenomena in time-varying dispersive structures are also of interest.</p>	

Session	Number of slots
B14	5
Waves in nonlinear and inhomogeneous media	
Conveners: Yury Shestopalov, Eugen Smolkin	
Convener Emails: Yury.Shestopalov@hig.se, e.g.smolkin@hotmail.com	
<p>The GASS 2021 session “Waves in nonlinear and inhomogeneous media” will cover recent achievements in the area of advanced analytical and numerical methods as applied to the analysis of wave propagation, scattering, and diffraction in nonlinear and/or inhomogeneous media. Topics of interest include, but are not limited to: development of mathematical models for fields and waves in nonlinear and/or inhomogeneous media; mathematical techniques for nonlinear equations of electromagnetics and analytical approaches; nonlinear phenomena and new types of waves; numerical methods for nonlinear eigenvalue problems.</p>	

Session	Number of slots
B15	5
Forward scattering and propagation	
Conveners: Cristina Ponti, Andrea Randazzo	
Convener Emails: cristina.ponti@uniroma3.it , andrea.randazzo@unige.it	
<p>The modelling of scattering problems by targets of arbitrary shape placed in possibly complex environments is in many cases a challenging task. However, the availability of accurate and reliable forward-scattering techniques is of fundamental importance both for propagation prediction and for providing benchmarks for novel inversion algorithms and imaging techniques, as well as for better understanding the measured data. Possible fields of applications include remote sensing of buried objects or detection and localization of targets behind walls. Beyond the radar applications, a significant interest has been recently devoted to the propagation modelling at high frequencies in a building's interior with UWB sources, including the scattering of common objects in an indoor environment. Possible approaches may include numerical full-wave techniques, also optimized from the point of view of computational times and memory requirements. High frequency asymptotic techniques are also of interest for addressing the computational issues relevant to very large environments. Analytical methods may be considered, too, when target geometry can be described through canonical shapes. In all cases, shadowing effects, attenuation, multipath propagation, refraction, and diffraction need to be considered for an accurate modelling, especially when dealing with complex scenarios.</p>	

Session	Number of slots
B16	5
Antennas and microwave devices inspired by electromagnetic band gap	
Conveners: Karu Esselle, Ladislau Matekovits	
Convener Emails: karu@ieee.org , ladislau.matekovits@polito.it	
<p>Several antennas and other microwave devices make use of EBG and many more have been inspired by EBG. In this session, we explore recent advances in this still exciting and advancing area of research.</p>	

Session	Number of slots
B17	10 (two sessions)
Optimization techniques in electromagnetics: new trends and novel applications 1 & 2	
Conveners: Sembiam R. Rengarajan, Ahmad Hoorfar	
Convener Emails: sembiam.rengarajan@csun.edu, ahmad.hoorfar@villanova.edu	
Nature-inspired and other novel global optimization techniques have been revolutionizing the design of complex electromagnetic devices with demanding specifications. This session will provide a forum for discussing advances in developments of optimization techniques and their wide ranging applications in electromagnetics.	

Session	Number of slots
B18	5
Millimeter-wave antennas/5G communications	
Conveners: John L. Volakis, Jiro Hirokawa	
Convener Emails: jvolakis@fiu.edu, jiro@ee.e.titech.ac.jp	
Millimeter wave applications have seen a growing number of applications from 5G beam forming to automotive guidance, security and imaging for biology. This session is focusing on antennas and antenna arrays, beamforming, MIMO and imaging technologies relating to millimeter wave applications. Applications relating to 5G, biology, automotive guidance, vehicle to vehicle communications, near zone high data delivery, imaging and security are of particular interest.	

Session	Number of slots
B19	10 (two sessions)
Women's contributions in inverse electromagnetic problems 1 & 2	
Conveners: Martina Teresa Bevacqua, Rosa Scapatucci, Maria Antonia Maisto	
Convener Emails: martina.bevacqua@unirc.it , scapatucci.r@irea.cnr.it , mariaantonia.maisto@unicampania.it	
<p>Science is often considered a male-dominated field. Nowadays, women are still discouraged from entering the fields of technology, engineering and math. But despite challenges of gender discrimination, countless inspiring women in these fields have made historic contributions to science and helped advance understanding of the world around us. Their achievements have helped generations of female scientists to come. In this respect, the aim of this section is to promote and valorise women's contributions in the field of Inverse Electromagnetic Problems (IEPs). IEPs are an active area of research due to a rich theory and many interesting applications. In particular, they are relevant in geophysical exploration, medical imaging, nearfield optical microscopy, X-ray crystallography and antenna diagnostics and synthesis. Many researchers and scholars in the URSI community are very actively pursuing this topic, as testified by the huge number of papers in the past conference proceedings.</p>	

Session	Number of slots
B20	5
High-frequency and hybrid methods	
Conveners: Prabhakar Pathak, Giuliano Manara, Ludger Klinkenbusch	
Convener Emails: pathakph@gmail.com , giuliano.manara@iet.unipi.it , lbk@tf.uni-kiel.de	
<p>This session focuses on high frequency methods, as well as hybrid methods which combine high frequency methods with other techniques to solve complex electromagnetic radiation and scattering problems, whose solutions may become cumbersome or intractable by the use of a single method alone. An example of such hybrid techniques is the combination of any asymptotic high frequency method with a numerical method. The asymptotic high frequency methods may include geometrical optics (GO), physical optics (PO), uniform theories of diffraction such as UTD, STD, PTD, or ITD, etc., or complex source beam (CSB) and Gaussian beam (GB) methods, etc., while numerical methods may be based on integral or partial differential equation formulations.</p>	

Session	Number of slots
B21	5
International Union of Radio Science: 100 years of history and achievements of Commission B	
Conveners: Yahya Rahmat-Samii, W. Ross Stone, Ari Sihvola	
Convener Emails: rahmat@ee.ucla.edu, r.stone@ieee.org, ari.sihvola@aalto.fi	
The International Union of Radio Science (URSI) was established in 1919 and marks the centennial year in 2019. Commemorating the URSI 100 years in 2019, this session will focus on the history, the progress, and various achievements of URSI during the past 100 years, with a particular emphasis on URSI Commission B.	

Session	Number of slots
B22	10 (two sessions)
Advanced metamaterial concepts for electromagnetics 1 & 2	
Conveners: Andrea Alù, Nader Engheta, Dimitrios Sounas	
Convener Emails: aalu@gc.cuny.edu, engheta@seas.upenn.edu, dsounas@gmail.com	
Metamaterials have attracted significant attention during the past decade for various exotic new phenomena and applications. Conventionally, they are based on passive and time-invariant elements, but it has recently been shown that lifting these assumptions may open new exciting opportunities for this technology, including parity-time symmetric, topological, computational and nonreciprocal metamaterials. The purpose of this session is to discuss the latest conceptual, theoretical and experimental advances in metamaterials, with a particular focus on metamaterials that go beyond the conventional passivity and time-invariance assumptions, or that combine multiple physical phenomena, for applications over different portions of the electromagnetic spectrum.	

Session	Number of slots (choose 3 or 4 or 5)
B23	5
Spatial correlation estimation and channel modelling for massive MIMO and near-field communication systems	
Conveners: Debdeep Sarkar, Said M. Mikki, Yahia M. M. Antar	
Convener Emails: Debdeep.Sarkar@rmc-cmr.ca & debdeep1989@gmail.com, SMikki@newhaven.edu, antar-y@rmc.ca	
<p>Realization of compact massive MIMO base-stations for sub-6 GHz/mm-wave 5G ultra-dense wireless networks (UDNs) is currently motivating fundamental research on spatial correlation estimation, properly accounting for electromagnetic (EM) aspects like antenna patterns/polarization. Since antenna illumination is no longer in the form of far-zone plane-waves and there is significant near-field (NF) interaction, updated correlation/channel models are required for better MIMO system design. Moreover, communication engineers are envisioning deterministic modification of massive MIMO channels by using periodic EM structures for futuristic 6G networks. Therefore, the aim of proposed session in URSIGASS 2020 is to stimulate the much-needed unification of EM field and communication theory, regarding propagation channel modelling (FF/NF) of 5G and other emerging wireless technologies.</p>	

Session	Number of slots
B24	5
Electromagnetic methods for direct and inverse scattering involving stratified media	
Convener: Matteo Pastorino, Giuseppe Schettini	
Convener Emails: matteo.pastorino@unige.it, giuseppe.schettini@uniroma3.it	
<p>The study of stratified structures and more specifically, the quantitative characterization of materials and layers using direct and inverse electromagnetic wave scattering, involves interdisciplinary knowledge and plays an increasing role in many application areas. These range from nondestructive testing to defense and security, through the wall radar imaging and search and rescue applications, to environmental monitoring and cultural heritage prospection and preservation. Other possible applications, in course of evolution, are in the analysis of the quality of realization of electronic materials, done in a stratified way, that can be natural- or meta-structured, and can realize several system functions in various applications going from the internet of things, to telecommunications networks, to Thz or photonic devices, and so on. Even if a quite large amount of work has been carried out in last years, a lot of improvement is needed both on direct and inverse methods in order to reach a reliable and easy use of them. The Session will be focused also on such aspects.</p>	

Session	Number of slots
B25	10 (two sessions)
Semi-analytical modeling techniques in electromagnetics and photonics 1 & 2	
Conveners: Nikolaos Tsitsas, Grigorios Zouros	
Convener Emails: ntsitsas@csd.auth.gr, zouros@mail.ntua.gr	
<p>The need for developing fast and accurate numerical solvers for scattering and radiation problems by devices utilized in modern applications of Electromagnetics and Photonics emerges primarily by the requirement for efficient optimizations of the parameters of such devices achieving specific fields variations. To this end, it is desired to model the associated boundary-value problems by semi-analytical techniques and obtain solutions with controllable accuracy and with small execution time. The purpose of this Session is to include talks from experts on semi-analytical techniques with application domains including but not limited to particle scattering, metamaterials, direct and inverse scattering by inclusions in layered media, propagation in optical waveguides as well as dielectric resonators and lenses. The techniques applied for the modeling are expected to span from integral-equation/differential-equation based methodologies to Galerkin and eigenfunction series expansions techniques.</p>	

Session	Number of slots
B26	10 (two sessions)
Electromagnetics at the nanoscale and quantum effects 1 & 2	
Conveners: Amir Boag, Amir Natan	
Convener Emails: boag@eng.tau.ac.il, amirnatan@post.tau.ac.il	
<p>The size of nanoscale devices makes it impossible to ignore quantum effects. Therefore, there is a growing demand for a theoretical treatment that combines classical electromagnetics and the quantum behavior of nanoscale systems. In this session, we invite theoretical and experimental researchers that work with such systems to present and discuss their work. Specific session topics will include (but not limited to): quantum transport, nano-antennas, nano-devices with quantum effects, and theory for electromagnetic simulations at the nano-scale.</p>	

Session	Number of slots
B27	8 (two sessions)
Inverse problems in antenna and scattering in complex environments: Theory, challenges, and applications 1 & 2	
Conveners: Raffaele Solimene, Dominique Lesselier, Andrea Randazzo	
Convener Emails: Raffaele.SOLIMENE@unicampania.it, dominique.lesselier@l2s.centralesupelec.fr, Andrea.Randazzo@unige.it	
<p>Electromagnetic inverse problems are a pervasive research field that has largely progressed across the years fostered by countless applications, ranging from antenna design/testing to radar imaging and inverse scattering for non-invasive diagnostics. Significant advances have been and are being attained, even spurred by new paradigms like compressive sensing and deep learning. Yet, it is often required to act in harsh conditions, e.g., background is uncertain, outcomes need to be quick, data are limited and/or incomplete (phaseless), SNR is low, primary field is not precisely known. The Session aims to collect recent advances in this field, addressing theoretical, computational, or experimental aspects. Topics of interest include, but are not limited to, computational electromagnetics, phase retrieval, antenna design/diagnostics, radar imaging, inverse scattering algorithms, innovative applications.</p>	

Session	Number of slots
B28	5
Innovative Electromagnetic Solutions for Modern Sensing and Information Systems	
Conveners: Christian Canestri, Agostino Monorchio	
Convener Emails: Christian.Canestri@elt.it, agostino.monorchio@unipi.it	
<p>Nowadays, the capability to dominate the electromagnetic spectrum with a smart and flexible approach represents the fundamental aspect of innovative information systems. In this context, electromagnetic solutions are growing in terms of investments, integration and complexity. The challenge is to find new technologies in order to decrease volume, increase bandwidth and enhance performance of sensing systems maintaining high demanded environmental requirements. The scope of this session is to provide innovative electromagnetic solutions for modern sensing and information systems. Topics of interest include, but are not limited to: original UWB antennas, UWB array antennas for multifunctional operations, scattering reduction techniques, miniaturized antennas, antenna-less approach, conformal metamaterial-based antennas, antenna cloaking and coupling reduction techniques.</p>	

Session	Number of slots
B29	
Open session	
Conveners: Kazuya Kobayashi, John Volakis	
Convener Emails: kazuya@tamacc.chuo-u.ac.jp, jvolakis@fiu.edu,	
The session will host papers that do not adequately fall in the other topics of commission B.	