2014 URSI-Japan Radio Science Meeting (URSI-JRSM 2014)

Chuo University, Tokyo, Japan, September 8, 2014

Program and Abstracts

Sponsored by:
- The Institute of Electronics, Information and Communication Engineers (IEICE)

Co-sponsored by:
- Institute of Science and Engineering, Chuo University
- International Union of Radio Science (URSI)

In cooperation with:
- Chuo University
- Japan Geoscience Union
- Science Council of Japan
- The Astronomical Society of Japan
- The Institute of Electrical Engineers of Japan
- The Japan Society of Applied Physics
- The Laser Society of Japan
- The Remote Sensing Society of Japan

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Message from URSI-JRSM 2014 General Chair

It is our great pleasure to welcome all the participants to the "2014 URSI-Japan Radio Science Meeting" (URSI-JRSM 2014) held at Korakuen Campus of Chuo University, Tokyo, Japan on September 8, 2014.

The "URSI-Japan Radio Science Meeting" (URSI-JRSM) is a regional URSI conference organized by the Japan National Committee of URSI, and is held in Japan. The URSI-JRSM provides a scientific forum for radio scientists and engineers in Japan and in the countries of Asia. The objective of the Conference is to review current research trends, present new discoveries, and make plans for future research and special projects in all areas of radio science, and a particular emphasis is placed on promoting the URSI activities in the Asian countries. At present, there are only 5 URSI member countries in Asia (China, India, Japan, Korea, and Taiwan) and hence, it is desirable to create a cooperative relationship among the URSI national committees in these countries and enhance the visibility of URSI in the Asian region accordingly. Therefore the URSI-JRSM also aims at establishing close ties among the URSI Member Committees in Asia.

The URSI-JRSM 2014 is the first URSI-JRSM, and it consists of 3 Keynote Lectures and 10 Invited Talks by outstanding scientists from Japan and the Asian countries. Subject areas covered by the Conference are broad including topics related to the URSI Commissions A-K. We are planning to expand the URSI-JRSM so that it becomes the annual URSI conference in Japan having a scientific program with invited and contributed papers from Japan and overseas.

The URSI-JRSM 2014 is sponsored jointly by The Institute of Electronics, Information and Communication Engineers (IEICE), Institute of Science and Engineering of Chuo University, and International Union of Radio Science (URSI), in cooperation with various academic institutions and organizations including, Chuo University, Japan Geoscience Union, Science Council of Japan, The Astronomical Society of Japan, The Institute of Electrical Engineers of Japan, The Japan Society of Applied Physics, The Laser Society of Japan, and The Remote Sensing Society of Japan. In addition to the scientific program, we are also organizing the URSI-Japan Commission Business Meetings during the lunch break on September 8, 2014, which are open to all the Conference participants. For those of you who are interested in the Commission activities in Japan, please plan on attending these business meetings.

We hope that the "URSI-Japan Radio Science Meeting" (URSI-JRSM) will serve as one of the major, regional URSI conferences in the international radio science community. We would be happy to receive any suggestions on future directions of the URSI-JRSM conferences from all of you attending the URSI-JRSM 2014.

On behalf of the URSI-JRSM 2014 Committees, I would like to express a hearty welcome to all of you working in the area of radio science for your participation in the URSI-JRSM 2014. After the scientific program of the Conference is over, the Banquet will be held on the campus of Chuo University in the evening of September 8, 2014. We wish that you enjoy the Conference itself as well as the Banquet, and have a pleasant stay in Tokyo. We are hoping that the URSI-JRSM 2014 will lead to a great success and the URSI-JRSM will continue as the annual URSI conference from the year 2015.

Welcome to Tokyo, and welcome to the URSI-JRSM 2014!

September 8, 2014

Kazuya Kobayashi
General Chair, 2014 URSI-Japan Radio Science Meeting (URSI-JRSM 2014)
President, Japan National Committee of URSI
Vice-Chair, Commission B, URSI

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This conference is sponsored by:
- The Institute of Electronics, Information and Communication Engineers (IEICE)

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- The Institute of Electrical Engineers of Japan
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- The Murata Science Foundation

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Program and Time Table

Date and Time: 9:00-18:30, Monday, September 8, 2014

Venue: Room 5534, 5th Floor, Building No. 5, Korakuen Campus, Chuo University (Bunkyo-ku, Tokyo, Japan)

Program

9:00 **Opening Ceremony**

9:15 **Keynote Lecture 1**

Chair: Hiroshi Shirai (Commission B Chair, Japan National Committee of URSI)

Debatosh Guha (University of Calcutta, India)

New Techniques Leading to Advanced Designs of New Generation Antennas

10:00 **Invited Talk 1**

Chair: Yasuhiko Jimbo (Commission K Chair, Japan National Committee of URSI)

Masao Taki (Tokyo Metropolitan University, Japan)

Possible Health Risk of Electromagnetic Fields: Status Quo and the Way Forward

Coffee Break (15 minutes)

10:45 **Invited Talk 2**

Chair: Hiroshi Shirai (Commission B Chair, Japan National Committee of URSI)

Hisamatsu Nakano (Hosei University, Japan)

Natural and Metamaterial-Concept Antennas

11:15 **Invited Talk 3**

Chair: Masahiro Morikura (Commission C Chair, Japan National Committee of URSI)

Iwao Hosako (National Institute of Information and Communications Technology, Japan)

Recent R&D Trend of Communication Technologies using Terahertz-Band

11:45 **Invited Talk 4**

Chair: Tadao Nagatsuma (Commission D Chair, Japan National Committee of URSI)

Naoto Yoshimoto (Chitose Institute of Science and Technology, Japan)

Impact on Society and Industry due to Fusion of Light and Radio Waves in Future Information Communication Technologies

12:15 URSI-Japan Commission Business Meetings

13:45 Keynote Lecture 2

Chair: Mamoru Yamamoto (Commission G Chair, Japan National Committee of URSI)

Lou-Chuang Lee (Academia Sinica, Taiwan)

Ionosphere Density Variations and Generation of ULF Waves Driven by the Lithosphere and Thunderstorm Dynamos

14:30 Invited Talk 5

Chair: Masao Taki (Past Chair, Commission K, URSI)

Osami Wada (Kyoto University, Japan)

Evaluation and Simulation of Electromagnetic Interference to Digital Broadcasting and Communication

15:00 Invited Talk 6

Chair: Yasuyuki Maekawa (Commission F Chair, Japan National Committee of URSI)

Toshio Iguchi (National Institute of Information and Communications Technology, Japan)

Spaceborne Precipitation Radar: From TRMM to GPM

15:30 Invited Talk 7

Chair: Mamoru Yamamoto (Commission G Chair, Japan National Committee of URSI)

Takashi Maruyama (National Institute of Information and Communications Technology, Japan)

Contribution of GNSS Radio Signals to Ionospheric Research

Coffee Break (15 minutes)

16:15 Keynote Lecture 3

Chair: Masao Taki (Past Chair, Commission K, URSI)

Shoogo Ueno (The University of Tokyo / Kyushu University, Japan)

Studying the Brain by Electromagnetics in Biology and Medicine

17:00 Invited Talk 8

Chair: Yoshiharu Omura (Commission H Chair, Japan National Committee of URSI)

Yuto Katoh (Tohoku University, Japan)

Plasma Wave Emissions and Particle Acceleration in Planetary Magnetospheres

17:30 Invited Talk 9

Chair: Kenta Fujisawa (Commission J Chair, Japan National Committee of URSI)

Satoru Iguchi (National Astronomical Observatory of Japan, Japan)

Atacama Large Millimeter/submillimeter Array, ALMA

18:00 Invited Talk 10

Chair: Mitsuru Musha (Commission A Chair, Japan National Committee of URSI)

Hidetoshi Katori (The University of Tokyo, Japan)

Reading 18th Decimal Places of Time with Optical Lattice Clocks

18:30 Closing

18:45 Banquet (Room 31008, 10th Floor, Building No. 3)

Abstracts

New Techniques Leading to Advanced Designs of New Generation Antennas

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Significant advances in Wireless Technology demands the availability of efficient devices that can be operated at high data-rates and at low signal powers. Microwave researchers have been working towards the development of advanced RF front ends to meet the requirements. Various novel approaches have been explored to improve the performance of new generation low profile antennas.

This talk is aimed to address some new techniques, which have been developed in the recent years and find potential applications in designing advanced antennas using printed circuit technology. These include both microstrip and dielectric resonators as the antenna elements and the technique involves deliberately created defects on the ground plane, termed as Defected Ground Structure or more popularly 'DGS'. This specifically implies a single or limited number of defects on the ground plane and has been familiar to microwave community for a long time, although their applications to the antennas are relatively new.

The DGS actually evolved in early 2000's as a simpler variant of Electromagnetic Band Gap (EBG) structure. The EBGs are periodic structures exhibiting a property of preventing EM waves to propagate through them over a range of frequencies, called 'stop-band' and allowing EM waves to propagate over a range of frequencies, called 'pass-band'. Therefore, a DGS is a *simplified EBG realized in the form of a defect on the ground plane* of planar microwave circuit or antenna. A DGS is resonant in nature and may have different shape and size with different frequency response. The evolution of DGS, physical insight into the design, and a chronology of its major developments will be discussed.

The antenna designers initially employed DGS underneath printed feed lines to suppress higher harmonics. In 2005, the DGS was explored by the author for the first time for antenna application, in particular, to improve the radiation characteristics [1]. In 2006, DGS was successfully applied by the author and his collaborators to antenna arrays to minimize its mutual coupling problem [2]. Subsequently, antenna community had realized its tremendous potential and explored the techniques extensively leading to many possible applications. Some leading research labs have already adopted the DGS technique to realize advanced arrays for airborne radars. Over 1400 technical papers, 3 book chapters, and many granted patents, produced in a short span of last eight years, are a measure of the potential of this technique.

Anyone can search the key word 'Antenna with DGS' through internet. The topic still remains an open book for both researchers and application engineers. There are several unresolved issues which need to be addressed in the future for further advancements. The talk is aimed to address all these challenging issues including the fundamentals and the state-of-the-art advancements.

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Ionosphere Density Variations and Generation of ULF Waves Driven by the Lithosphere and Thunderstorm Dynamos

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The lithosphere or the thunderstorm can act as a "current dynamo" to derive currents through the atmosphere into the ionosphere and magnetosphere. We first formulate a coupling model for the lithosphere-atmosphere-ionosphere (LAI) system. The stressed-rock acts as a dynamo to provide currents for the coupling system. The electric fields and currents in the lithosphere, atmosphere and the lower boundary of ionosphere are obtained by solving the current continuity equation, $\mathbf{\nabla} \cdot \mathbf{J} = 0$, where $\mathbf{J}$ is the current density. A three-dimensional ionosphere simulation code (SAMI3) is then used to study the ionosphere dynamics based on the obtained electric fields and currents. The simulation results show that a dynamo current density of 1-100nAm^{-2} in an earthquake fault zone can cause 1-20% variations of the total electron content (TEC) Formation of plasma bubbles (equatorial spread F) can take place in the nighttime ionosphere. We also examine the effect of the thunderstorm current dynamo on the ionosphere. A thunderstorm dynamo with a charging rate of 2-15 C/s may cause a TEC variation of 1-20% and the formation of plasma bubbles in the nighttime ionosphere. The dynamo currents from the lithosphere or the thunderstorm can flow along the geomagnetic field lines to the conjugate ionosphere and be bounced back. The conjugate ionospheres act as capacitors (C) and the geomagnetic field lines as a self-inductance (L). The bouncing of currents between the northern and southern ionospheres leads to the generation of ULF waves.

Studying the Brain by Electromagnetics in Biology and Medicine

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The techniques of transcranial magnetic stimulation (TMS) of the human brain and magnetic resonance imaging (MRI) have opened new horizons in brain research and medicine in these decades. This paper reviews the recent advances in biomagnetic stimulation and imaging by TMS and MRI. In TMS studies, scientific bases for therapeutic applications are discussed, introducing the experiments of hippocampus functions in the rat brain. Various coil configurations are also introduced and discussed towards the deep brain stimulation. In MRI studies, imaging of impedance or conductivity in the brain and imaging of electrical currents in the brain are discussed towards the MR-based neuronal current imaging, or, MR neuroimaging.

Transcranial magnetic stimulation (TMS) is a technique to stimulate the human brain transcranially by pulsed magnetic fields generated by a coil positioned outside of the head. A method of localized TMS with a figure-eight coil has enabled us to stimulate the human cortex within a 5-mm resolution [1]. Promising applications of TMS for cognitive science and medical treatments have been widely studied. We have studied hippocampus functions in the rat brain treated by repetitive TMS (rTMS) to obtain scientific bases for therapeutic applications. A series of the experiments suggest that rTMS modulates memory function and contributes to learning and memory, neuronal plasticity, prevention of neurons against injury, recovery of injured neurons, and the acquisition of tolerance against cerebral ischemia. For the deep brain stimulation, various coil configurations have been proposed such as multi-channel coil array, H-coil and Halo coil systems. We discussed the focality of stimulation by theses coils, calculating the spatial distributions of electric fields in the brain induced by stimulation of these coil configurations.

Magnetic resonance imaging (MRI) is a powerful tool in medicine today. Conventional MRIs, however, give no information of electrical properties such as electrical impedance and currents in the brain. Imaging of impedance or conductivity in the brain based on MRI, called impedance MRI, and imaging of neuronal electric currents based on MRI, called current MAI or MR neuroimaging, have been studied in recent decades [2-3]. We proposed three different methods for impedance MRI. One of them is a conductivity MRI based on diffusion tensor MRI. The results show that the signals in corpus callosum exhibit high anisotropy due to the alignment of neuronal fibers. Regions with high anisotropic conductivity are also observed in the white matter. We estimated a theoretical limit of sensitivity of 10^{-8}-10^{-9} T for current MRI, and observed a transient decrease in signal intensity in the rat brain using a 4.7 T MRI system. Since the signal-to-noise ratio is essentially low in current MRI, the issue of fundamental factors such as RF inhomogeneity and the dielectric resonance effect need to be investigated. We proposed a method of RF inhomogeneity correction in MR imaging.

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Possible Health Risk of Electromagnetic Fields: Status Quo and the Way Forward

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Possible health impact of exposure to electromagnetic fields has been a matter of concern for a long time. The concern has been focused on chronic health effect due to long-term exposures to weak electromagnetic fields (EMF). The International EMF Project(1) was organized by World Health Organization (WHO) in 1996 in order to identify gaps in knowledge to make better health risk assessments and to provide a coordinated international response to the controversial issue of health effects of chronic exposures to EMF. The commission K of URSI has played an important role in this activity.

A huge amount of research resources has been devoted for 18 years since then. The project is supposed to be concluded in a couple of years with the publication of the final document of health risk assessment on radiofrequency (RF) electromagnetic fields following the one for static fields in 2005(2) and the one for extremely low frequency (ELF) EMF in 2007(3). We need to watch what will be the accomplishment and what will remain unresolved through the WHO's project.

The observation of the author is not optimistic but we have accumulated considerable amount of knowledge from coordinated research programs. The key issue is possible carcinogenicity suggested by epidemiological studies. These studies have provided limited evidences for this hypothesis. The International Agency of Research on Cancer (IARC) classified ELF magnetic field and RF electromagnetic field as Group 2B or possibly carcinogenic to humans(4). Those epidemiological studies should be carefully explored in consideration of the lack of support from animal studies and mechanistic plausibility.

The reality of epidemiological studies will be discussed in this talk especially with the focus on the limitation of exposure assessment. The situation is getting worse with the rapid changes in the wireless communication systems. It is inevitably important to break though the uncertainty of this issue to establish sound use of EMF energy.

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Natural and Metamaterial-Concept Antennas

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Recent advancements in wireless communication systems have been accelerating the development of antennas with dual-, multi-, wide-, and extremely wide-band operation. These antennas are categorized as either natural or metamaterial-concept antennas. The definition of natural and metamaterial (MTM)-concept antennas *for this talk* is in reference to the propagation phase constant of the current flowing from a voltage source F toward the antenna arm end E (out-going current) of the antenna under design. For the natural antenna, the out-going current has a positive propagation phase constant ($\beta > 0$). This means that the phase distribution takes a regressive form, i.e., the phase is delayed from F toward E (a right-handed property). In contrast, for the MTM-concept antenna, the propagation phase constant of the out-going current is either negative within a specific frequency band ($\beta < 0$) or zero at a specific frequency ($\beta = 0$). Note that the negative phase distribution takes a progressive form from F to E (a left-handed property [1][2]). Choice of either a natural antenna or an MTM-concept antenna depends on the requirements of the target communication system.

This talk comprises two chapters. **Chapter I** presents the radiation characteristics of representative natural antennas, including a short helical antenna [3]-[6], a fan-shaped antenna [7], a BOR-SPR base-station antenna (composed of a conducting body of revolution and a shorted parasitic ring element) [8], and a rhombic grid array antenna for frequency beam-scanning [9]. It should be emphasized that the BOR-SPR has an extremely wide VSWR frequency response (approximately 150%). **Chapter II** discusses two antennas, which are categorized as MTM-concept antennas: a line antenna, and a spiral antenna loaded using capacitors and inductors [10][11]. It is found that these MTM-concept antennas act as counter circularly-polarized dual-band antennas.

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Recent R&D Trend of Communication Technologies using Terahertz-Band

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The compound annual growth rate (CAGR) for global network traffic have been increasing exponentially over recent decades. For the upcoming decade this trend seems to be unbroken, for example, the Cisco® Visual Networking Index [1] forecasts the following points.

> "Global IP traffic has increased more than fivefold in the past 5 years, and will increase threefold over the next 5years (CAGR of 21 %)."
>
> And
>
> "Globally, mobile data traffic will increase 11-fold between 2013 and 2018 (CAGR of 61 %)."

This drastic increase in mobile data traffic will require much more bandwidth in wireless communications. However, the spectral resources are extremely limited because of the heavy use of today's conventional frequency range up to 60 GHz even with spectrally highly efficient quadrature amplitude modulation(QAM) and the spatial diversity achieved with multiple-input and multiple-output (MIMO) technology.

Millimeter-wave (MMW; 30-300 GHz) and higher-frequency bands such as sub-millimeter-wave (sub-MMW; 300-3,000 GHz), or terahertz (THz; 0.1-10THz) bands are the promising candidates for a new-generation wireless communication technology because of their broad available bandwidth. Recently, many research and development projects has focused on the above-mentioned frequency bands, because the high carrier frequencies promise unprecedented channel capacities (e.g. 100 Gbit/s).

This paper reviews recent progresses in wireless communication technologies using the THz-band [2-11, etc], and some situations for standardization both in the IEEE 802.15 WPAN™ and ITU-R.

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Impact on Society and Industry due to Fusion of Light and Radio Waves in Future Information Communication Technologies

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Until now, optical fiber infrastructure has massively been deployed in Japan to provide broadband services such as Internet access and IP-TV. As a result, the coverage area in population density has exceeded to 90 percent. Recently, 10 Giga-bit Ethernet Passive Optical Network (10G-EPON) and related Wavelength Division Multiplexing (WDM) systems have been developed as the next-generation optical access system to provide high-definition video services such as 4k/8k distribution toward 2020.

On the other side, mobile traffic expansion occurs due to popularity of various smart phones and tablet handsets. To achieve bandwidth upgrade scaled up 1,000 times compared with the current system Long Term Evolution (LTE), wireless access technology called “fifth generation (5G)” has been eagerly investigated. This trend means that the bandwidth of wireless access will be equal to that of optical access as shown in Figure 1. The size of the cell of the base station becomes smaller and its density increases more, which is close to the density of user of optical access.

Taking these trends into consideration, future access network should be reconstructed like near-reach optical access and the last-reach wireless access convergence. Such network has ideal features of both “optical stability and reliability” and “wireless ubiquity.” Figure 2 shows an image of our ultimate goal regarding as a future multiple-service access platform. Such wireless-based deep-penetrated optical fiber network infrastructure using advanced photonic technologies will play an important role in the construction of multiple-service platform with high resiliency that can provide not only future small-cell based wireless services toward 5G, but also machine-machine (M2M) towards big-data society. Consequently, it will trigger highly flexible knowledge distribution, which leads to both social and industrial evolution in future.

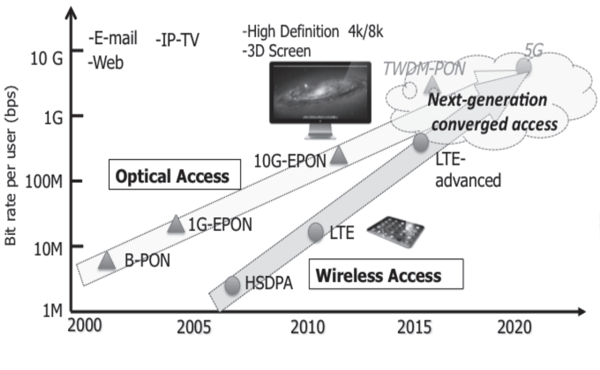

Figure 1. Bandwidth trend in access network

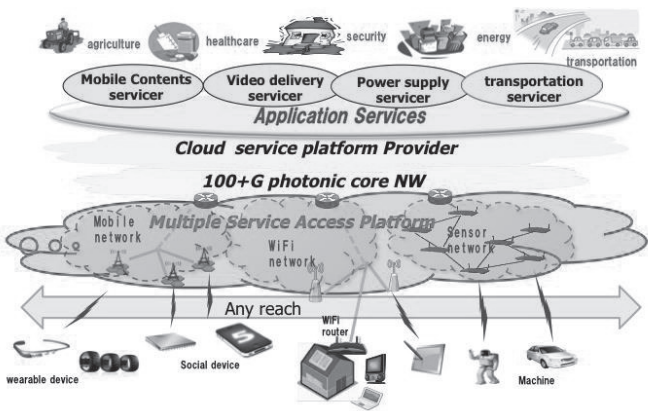

Figure 2. Multiple-access service platform

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Evaluation and Simulation of Electromagnetic Interference to Digital Broadcasting and Communication

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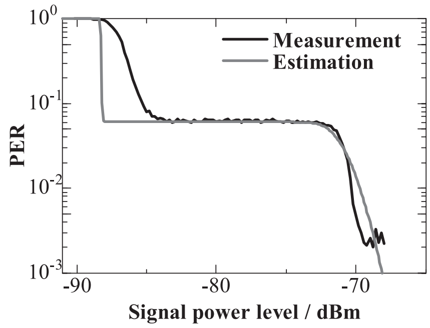
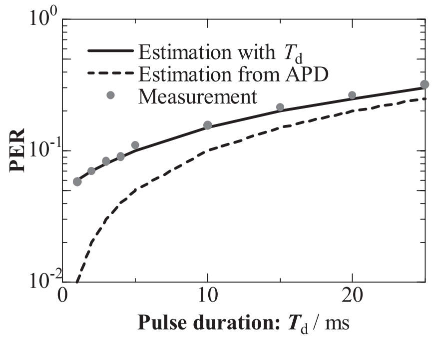
Conventionally electromagnetic interference (EMI) in radio frequency (RF) has been evaluated and regulated with peak, quasi-peak, or average level of RF disturbances in frequency domain. These measures have been adopted to protect analog communications. However, many of the wireless broadcasting and communication systems are now digital, and new evaluation measures are required. At CISPR (International Special Committee on Radio Disturbance) meeting in 1997 Japan national committee proposed a new statistical measurement method adopting amplitude probability distribution (APD) as a candidate for EMI regulation, and the first international standard on APD measurement was published in 2005. The latest version of the standard is reference [1], which describes the specifications of APD measuring equipment. APD has good correlation with bit error rate (BER) of digital communication such as PHS and W-CDMA systems [2], and the relations between APD and BER for major modulation schemes were theoretically shown in [3]. The first application of APD in international standards for commercial products is evaluation of RF disturbance from microwave ovens [4], and publication of the international standard CISPR 11, Ed. 6.0 is planned in 2014.

To improve the statistical evaluation of RF disturbance, we have recently discussed the impacts of burst disturbance with various pulse durations (T_d) on the packet error rate (PER) of a wireless LAN with the direct sequence spread spectrum (DSSS) system. Figure 1 (a) shows the PER with a constant burst pulse duration. Figure 1 (b) shows good agreement between measured PER and estimated one in variation of T_d. Further investigation on PER estimation is under discussion with variation of communication parameters.



(a) PER considering pulse duration (T_d) of burst disturbance; T_d = 1 ms.



(b) Variation of PER with different T_d.

Figure 1. Comparison of estimated PER.

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Spaceborne Precipitation Radar: From TRMM to GPM

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The world first spaceborne precipitation radar was realized when the Tropical Rainfall Measuring Mission's (TRMM's) satellite was launched in 1997. This Precipitation Radar (PR) onboard the TRMM satellite has demonstrated the significance of measuring rainfall from space. This paper describes the impact of the introduction of the TRMM satellite on measurements of global rainfall from space. In particular, the effect of information provided by PR data on the evolution of the rain retrieval algorithm for a microwave radiometer is emphasized.

The Global Precipitation Measurement (GPM) Mission's core satellite, which carries a precipitation radar and a microwave radiometer, was launched from Tanegashima on 28 February 2014. It is similar to, but an upgraded version of the TRMM satellite. The radiometer on it, which is called GMI, has additional frequency channels and higher spatial resolution than the TRMM Microwave Imager (TMI), and the radar operates at two frequencies. This Dual-frequency Precipitation Radar (DPR) not only inherits the success of the TRMM PR but also extends its capability. Some of the results from these two missions are described, and possible future satellite missions that carry precipitation radar are mentioned.

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Contribution of GNSS Radio Signals to Ionospheric Research

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The ionosphere is a part of the Earth's upper atmosphere, ranging from approximately 60 km to 1000 km in altitude, where a fraction of the atmospheric particles are ionized mainly by the solar extreme ultraviolet (EUV) radiations. The concentration of the electron peaks at around 300 km. The free electrons of the ionized gas strongly interact with radio waves. A prominent effect is the lowering of the group velocity depending on the frequency and the electron density. The electron density varies with the EUV flux, season, local time, and other chemical and dynamical factors. When viewed from a different angle, measuring ionospheric electron density can be diagnostics of a variety of atmospheric and solar processes.

The ionosonde has been the most widely used technique for measuring the ionosphere, which transmits short waves on the ground and receives radio signals reflected by the stratified ionosphere, i.e., a kind of radar. Thus, ionosondes observe the ionospheric region below the electron density peak height. The critical frequency for ionospheric reflection of vertically incident radio waves (foF2) corresponds to the peak value of electron density. A complementary technique is the total electron content (TEC) measurement using trans-ionospheric radio signals transmitted from satellites at frequencies much higher than foF2. This technique stands on the propagation delay of the satellite radio signals due to the free electron along the satellite radio pass. Thus, the TEC contains information on the electron density above the density peak height as well as below it.

Global Positioning System (GPS) satellites are the widely used radio source for the ionospheric TEC measurement. Some more satellite systems similar to GPS are recently established and those, including GPS, are called Global Navigation Satellite System (GNSS). The advantage of TEC measurement is that satellite radio receivers are easier to equip compared to ionosondes that are a high-power radar system. The GNSS Earth Observation Network (GEONET) is a GNSS satellite receiver network developed by the Geospatial Information Authority of Japan, which consists of more than 1200 receivers being spread over the entire Japan's area. We note that only 4 ionosondes are operated in Japan with 15 min intervals.

Continuous observations of ionospheric TEC using the dense receiver network of GEONET allows us to examine ionospheric variations with high spatial and temporal resolutions that we never attained before. TEC fluctuations observed after large earthquakes and meteorological disturbances such as tornados revealed dynamical coupling of whole atmospheres and lithosphere. Traveling atmospheric waves launched by the auroral activity were visualized on the TEC maps with high cadence. In these measurements, the ionosphere acted as a screen that reflects neutral atmospheric dynamics. On the one hand, the ionospheric plasma sometimes becomes unstable and is structured. Plasma bubbles are generated by the interchange plasma instability (Rayleigh Taylor instability) near the magnetic equator and expand towards middle-latitudes. Rapid fluctuations in TEC as observed by GPS radio signals outlined drifting plasma bubbles over Japan.

Ionosondes often have difficulty in measuring the maximum electron density due to blanketing by the developed sporadic E layer at middle-latitudes in summer. TEC measurement by GNSS satellite signals overcomes this difficulty. However, we point out that the TEC and foF2 are not the exactly the same parameters specifying the ionosphere, but they characterize the ionosphere from different aspects. During ionospheric storms, TEC and foF2 sometimes behave differently, reflecting different storm effects at different heights. When both TEC and foF2 are simultaneously available, the combined analysis of two provides comprehensive knowledge of the ionospheric and atmospheric variations.

Plasma Wave Emissions and Particle Acceleration in Planetary Magnetospheres

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Whistler-mode chorus is plasma wave emissions commonly observed in planetary magnetospheres. Chorus typically appears as a group of coherent wave elements in the frequency range from 0.1 to 0.8 f_{ce} with a narrow frequency gap at 0.5 f_{ce}, where f_{ce} is the electron cyclotron frequency. Observational and theoretical studies over a half of century suggest that chorus is generated by energetic electrons of tens of keV with anisotropic velocity distributions in the equatorial region of the magnetosphere. The characteristic of chorus attracting a lot of interest is its peculiar spectra showing rising or falling tones in the time scale less than 1 second. Progress in simulation studies has revealed the importance of nonlinear wave-particle interactions in the chorus generation process, which takes place in the region close to the magnetic equator [Katoh and Omura, 2007, 2011, 2013; Omura et al., 2008, 2009]. Recent simulation studies also clarified in the chorus generation process that a fraction of energetic electrons are nonlinearly trapped by a chorus element and are efficiently accelerated up to the relativistic MeV energy range. The nonlinear trapping of energetic electrons by chorus is a strong candidate of the generation mechanism of radiation belt electrons in the Earth's magnetosphere, which is the primal target of the upcoming JAXA satellite mission to be launched in 2015: Exploration of energization and Radiation in Geospace (ERG) project.

The theories of chorus generation and relativistic electron acceleration mechanisms have been applied to chorus in other planets. Katoh et al. [2011] revealed that intense chorus is observed in the inner Jovian magnetosphere and that, despite the huge spatial scale of the Jovian magnetosphere, the plasma environment of the chorus generation region is similar to that of the Earth's radiation belt. The nonlinear wave growth theory proposed by Omura et al. [2008, 2009] has also been applied to rising tone chorus emissions observed in the Saturn's magnetosphere. The theoretical estimations of the frequency sweep rate of rising tones are consistent with those of observed chorus emissions. These results suggest that nonlinear wave-particle interactions by chorus are ubiquitous in the magnetized planets and play fundamental roles in the acceleration mechanism of relativistic electrons of planetary radiation belts.

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Atacama Large Millimeter/submillimeter Array, ALMA

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The Atacama Large Millimeter/submillimeter Array (ALMA) is an international radio observatory under a global partnership among East Asia (led by Japan), Europe, and North America in cooperation with the Republic of Chile. The array is located at an altitude of about 5000 meters in the Chilean Andes with an operating wavelength range of 0.3 to 9 mm. By using an "Aperture Synthesis Technique," ALMA consists of a homogeneous array of 50 12-m diameter antennas and the Atacama Compact Array (ACA) in order to cover all spatial frequency Fourier components of the brightness distribution of observed sources. ACA is an array composed of 4 12-m diameter antennas in a single-dish mode and a homogeneous array of 12 7-m diameter antennas that has a very compact configuration to take short-baseline data corresponding to the low spatial frequency Fourier components. The Aperture Synthesis Telescope has accomplished both the high angular resolution and high sensitivity, and newly achieved the high-fidelity imaging by ALMA.

Early science operation started from September 30, 2011 with an initial Call for Proposal (Cycle 0). Second Call for Proposal (Cycle 1) and third Call for Proposal (Cycle 2) were already done on July 12, 2012 and December 5, 2013, respectively, with the limited number of antennas of less than 66. The observations during these initial stages, however, provided an exciting opportunity for science to utilize this unique world-class facility. The last 66th ALMA antenna arrived at array site on Jun 16, 2014 (Figure 1). This presentation provides an overview of the development of the observatory, the status of its construction, first results of Early Science observations, and also the future development programs to enhance ALMA.

Table 1. ALMA Receiver Noise Specifications.

Band No.	RF Range [GHz]	RX Type	Trx 80%, 100% [K]
1	35-50	SSB	17, 26
2	67-90	SSB	30, 47
3	84-116	2SB	39, 43
4	125-163	2SB	51, 82
5	163-211	2SB	65, 105
6	211-275	2SB	83, 136
7	275-373	2SB	147, 219
8	385-500	2SB	196, 292
9	602-720	DSB	175, 261
10	787-950	DSB	230, 344

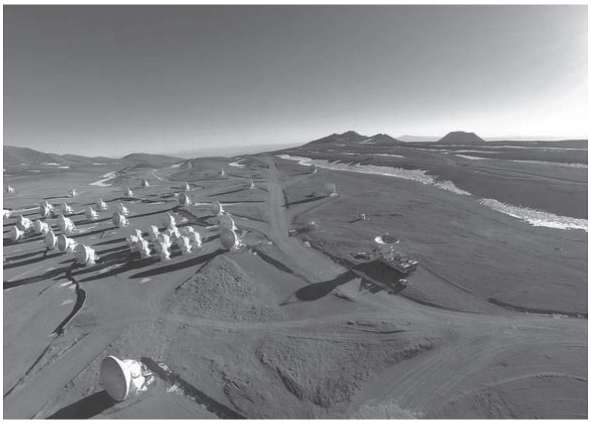

Figure 1. ALMA Operations Site: the 66th ALMA antenna arrived on Jun 16, 2014.
(Credit: Ariel Marinkovic / X-Cam)

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Reading 18th Decimal Places of Time with Optical Lattice Clocks

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Essential physics in the research of atomic clocks is found in their frequency comparison, which allows investigations of the constancy of the fundamental constants[1], their coupling to gravity[2], and the examination of the relativity. While single-ion optical clocks demonstrate supreme frequency uncertainty of 8×10^{-18} (Ref. 3), the necessary averaging time as long as $\tau \approx 1 \times 10^5$ s is limited by the quantum projection noise (QPN). As a consequence, the clocks' stability that improves as $\tau^{-1/2}$ becomes a serious experimental concern for further reducing the uncertainty down to 1×10^{-18}.

An optical lattice clock was proposed to improve the clock stability by $N^{-1/2}$ by applying a large number N of atoms[4]. We recently demonstrate agreement of two Sr based optical lattice clocks to within $(1.1 \pm 1.6) \times 10^{-18}$ (Ref. 5), where QPN limited stability of $N = 1000$ atoms allows us to reach 2×10^{-18} stability in two hours of clock operation.

We discuss possible impacts of this level of clock uncertainties, such as in relativistic geodesy that compares two clocks operated in distant places, and in investigations of the constancy of the fundamental constants that compare clocks consisted of different atomic elements.

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Biographical Sketches of Speakers

Keynote Lecture 1: "New Techniques Leading to Advanced Designs of New Generation Antennas"

Prof. Debatosh Guha, ***University of Calcutta, India***

Debatosh Guha is Professor in the Institute of Radio Physics and Electronics at the University of Calcutta, India. He spent about two years with the RMC, Canada as Visiting Research Professor working largely on the developments of various modern antennas. He has researched in developing various techniques for advancement of Microstrip and Dielectric Resonator Antenna technologies. Application of Defected Ground Structure in antenna designs is one of his major contributions. He has published over 200 technical papers and articles in top Journals and Conferences along with a Book entitled 'Microstrip and Printed Antennas: New Trends, Techniques and Applications' Wiley, UK, 2011. He has developed novel antennas for commercial wireless products, available in the North America since 2007.

Professor Guha is a Fellow of the Indian National Academy of Engineering (FNAE) and Senior Member of the IEEE. He is a recipient of 2012 RMTG Senior Researcher Award of IEEE AP-Society, URSI Young Scientist Award 1996, and Jawaharlal Nehru Memorial Fund Prize 1984.

He is present Chair of IEEE Kolkata Section and URSI Commission B Chair for Indian National Committee. He served IEEE AP-MTT Kolkata Chapter as the Founding Chair (2004), Vice-Chair (2007-2009), and Chair (2010-2011). He introduced IEEE Applied Electromagnetics Conference (AEMC) in 2007 as a major biennial conference in India and chaired its first three editions held in 2007, 2009, and 2011. He had also conceptualized Indian Antenna Week (IAW) as an annual IEEE AP-S Workshop in 2010 and chaired the event in 2010 and 2011. He has been associated with the organisation of many other international conferences including EUCAP 2014, EMTS 2013, APCAP 2012, etc.

His current research interests include DGS-inspired antennas, unresolved issues of microstrip antenna design, UWB Antennas, exploring unconventional modes for DRAs, and compact antennas for wireless applications.

Keynote Lecture 2: "Ionosphere Density Variations and Generation of ULF Waves Driven by the Lithosphere and Thunderstorm Dynamos"

Prof. Lou-Chuang Lee, ***Academia Sinica, Taiwan***

Lou-Chuang Lee was born on April 20, 1947. He received a B.S. degree in physics from National Taiwan University in 1969, and M.S. and Ph.D. degrees in physics from the California Institute of Technology in 1972 and 1975, respectively. He specializes in space science and plasma physics. From 1975 to 1995, he performed advanced research at the NASA/Goddard Space Flight Center and served as a professor at the University of Maryland and University of Alaska. Upon returning to Taiwan in 1995, Prof. Lee joined the faculty of Department of Physics at the National Cheng Kung University, and also served as the Dean of the College of Science. He was appointed the chief scientist at National Space Program Office in 1997, and made director of National Space Program Office in 2001. Since that time he has led the science and engineering teams implementing the FORMOSAT-2 and FORMOSAT-3 programs. In 2003, he became the first President of the National Applied Research Laboratories and the President of National Central University in 2006. In 2008, he was appointed the Minister of National Science Council. He is a distinguished research fellow of Institute of Earth Sciences, Academia Sinica since 2012.

Prof. Lee has received many international as well as national awards, including the Toray Science Foundation Fellow, the Terris Moore Award in space physics, the Outstanding Faculty Performance Award, the Fullbright Scholar Award, the Emil Usibelli Distinguished Research Award, the Foundation for the Advancement of Outstanding Scholarship Award, the Ministry of Education's Outstanding Academic Award, The Presidential Science Prize (The highest honor in science in Taiwan), Academician of Academia Sinica, Elected Member of the World Academy of Sciences (TWAS), Elected Member of International Academy of Astronautics (IAA), Elected Member of International Academy of Engineering, Russian Academy of Engineering (IAE) and Achievement Medal (First Rank), Executive Yuan, Taiwan.

Prof. Lee is a well-known space physicist. He has published more than 260 scientific papers as well as three academic monographs. During his career, Prof. Lee developed several new theories to explain observed space phenomena. His major research achievements include: (a) the turbulence spectrum of interstellar medium, (b) the cyclotron maser theory for the generation of auroral kilometric radiation, (c) the multiple X-line reconnection model for magnetic flux transfer events, (d) the formation mechanism of solar prominences, (e) a new mechanism for solar coronal heating, and (f) the discovery of "gigantic jets" in the Earth's upper atmosphere.

Keynote Lecture 3: "Studying the Brain by Electromagnetics in Biology and Medicine"

Prof. Shoogo Ueno, ***The University of Tokyo / Kyushu University, Japan***

Shoogo Ueno was born on October 1, 1943, in Arao, Kumamoto, Japan. He received the B.S., M.S., and Ph. D. (Dr. Eng.) degrees in electronic engineering from Kyushu University in 1966, 1968 and 1972, respectively. Dr. Ueno was an Associate Professor with the Department of Electronics, Kyushu University, from 1976 to 1986. From 1979 to 1981, he spent his sabbatical with the Department of Biomedical Engineering, Linkoping University, Linkoping, Sweden as a guest scientist. He served as a Professor in the Department of Electronics, Graduate School of Engineering, Kyushu University from 1986 to 1994. He subsequently served as a Professor in the Department of Biomedical Engineering, Graduate School of Medicine, the University of Tokyo from 1994 to 2006. During 1994-2006, he also served as a Professor in the Department of Electronic Engineering, Graduate School of Engineering, the University of Tokyo. In 2006 he retired from the University of Tokyo as Professor Emeritus. Since 2006, he has been a Professor with the Department of Applied Quantum Physics, Graduate School of Engineering, Kyushu University, and is also a Professor of the Faculty of Medical Technology, Teikyo University, Fukuoka.

Dr. Ueno is a Fellow of the Institute of Electrical and Electronics Engineers, IEEE (2001), and a Life Fellow (2011), and a Fellow of the American Institute for Medical and Biological Engineering, AIMBE (2001). He is a Fellow (2006) and Secretary (2012) of the Governing Council of the International Academy for Medical and Biological Engineering, IAMBE. He was a President of the Bioelectromagnetics Society, BEMS (2003-2004), Chairman of the Commission K on Electromagnetics in Biology and Medicine of the International Union of Radio Science (URSI) (2000-2003). He received the Honoris Causa from Linkoping University, Linkoping, Sweden (1998). He was a 150th Anniversary Jubiliee Visiting Professor at Chalmers University of Technology, Gothenburg, Sweden (2006), and a Visiting Professor at Simon Frasier University, Burnaby, Canada (1994) and Swinburne University of Technology, Hawthorn, Australia (2008). Dr. Ueno was awarded the IEEE Magnetics Society Distinguished Lecturer during 2010 and d'Arsonval Medal from the Bioelctromagnetics Society (2010). Recently, Dr. Ueno served URSI activities as a member of URSI Awards Panel 2013-2014, and K tutorial lecturer at URSI-GASS 2014 in Beijing, China.

Invited Talk 1: "Possible Health Risk of Electromagnetic Fields: Status Quo and the Way Forward"

Prof. Masao Taki, ***Tokyo Metropolitan University, Japan***

Masao Taki was born in Tokyo, Japan in 1953. He received the B.Eng. in 1976, the M. Eng. in 1978, and Dr. Eng. in 1981, respectively, from the Department of Electronic Engineering, the University of Tokyo. He joined the Department of Electrical Engineering, Tokyo Metropolitan University. He is now a Professor of the Department of Electrical and Electronic Engineering, Tokyo Metropolitan University. His research interest has been focused on biological effects of electromagnetic fields. He was a member of International Commission on Non-Ionizing Radiation Protection (ICNIRP) from 1996 to 2008. He was the Chairman of the Standing Committee III (Physics and Engineering) of ICNIRP from 2000 to 2004. He is the Chairman of Japanese National Committee for IEC TC106, and the Chairman of Japanese National Committee for CISPR. He served as the Chair of Commission K of URSI from 2011 to 2014.

Invited Talk 2: "Natural and Metamaterial-Concept Antennas"

Prof. Hisamatsu Nakano, ***Hosei University, Japan***

Hisamatsu Nakano received a Dr. E. degree in electrical engineering from Hosei University, Tokyo, in 1974. He has been a faculty member of Hosei University since 1973, where he is now a Professor in the Electrical and Electronic Engineering Department. His research topics include numerical methods for low- and high-frequency antennas and optical waveguides. He has published over 300 articles in major refereed journals and is the author or co-author of eight books.

One of his most significant contributions is the development of a parabolic reflector antenna using a backfire helical feed for reception of direct broadcast satellite (DBS) TV programs. He has also contributed to the development of two types of small flat DBS antennas using curled and helical elements.

In 1989, he received the IEE (currently IET) International Conference on Antennas and Propagation Best Paper Award. In 1992, he was elected an IEEE Fellow for contributions to the design of spiral and helical antennas, and, in 1994, he received the IEEE Transactions on Antennas and Propagation Best Application Paper Award (H. A. Wheeler Award). He also received the IEEE Antennas and Propagation Society Chen-To Tai Distinguished Educator Award, in 2006. More recently, in 2010, he received the Prize for Science and Technology from Japan's Minister of Education, Culture, Sports, Science, and Technology.

Prof. Nakano has served as a member of AdCom (2000-2002) and a Region 10 representative (2004-2010) of the IEEE Antennas and Propagation Society. He is an associate editor of several journals and magazines, such as Electromagnetics, IEEE Antennas and Propagation Society Magazine, and IEEE Antennas and Wireless Propagation Letters.

Invited Talk 3: "Recent R&D Trend of Communication Technologies using Terahertz-Band"

Dr. Iwao Hosako, ***National Institute of Information and Communications Technology, Japan***

Iwao Hosako received the B.S., M.S., and Ph.D. degrees from the University of Tokyo, Japan, in 1988, 1990, and 1993, respectively. After two years with NKK Corp's ULSI Laboratory from 1993 to 1994, he joined Communications Research Laboratory (former name of NICT). He is currently Director General of Advanced ICT Research Institute at the National Institute of Information and Communications Technology (NICT), Japan. His research during 1995–1998 focused on cryogenic readout circuits with emphasis on ultra-low 1/f-noise transistors for a far-infrared (terahertz) detector system. After 1999, he devoted considerable time to study terahertz semiconductor emitters such as p-type germanium lasers and quantum cascade lasers (QCLs). In 2006, he and his colleagues started a study for terahertz imaging system consisting of uncooled micro-bolometer array detector and QCL. Recently, he shifted his study field to wireless communication technology with terahertz waves. He is serving on several research committees for terahertz technologies. For example, He serves as vice chair of IEEE802.15.3d task group for '100Gbit/s wireless' standardization from May 2014.

Invited Talk 4: "Impact on Society and Industry due to Fusion of Light and Radio Waves in Future Information Communication Technologies"

Prof. Naoto Yoshimoto, ***Chitose Institute of Science and Technology, Japan***

Naoto Yoshimoto received B.S., M.S., and Ph.D. degrees in electronics and information engineering from Hokkaido University, Japan, in 1986, 1988, and 2003, respectively.

He joined NTT Photonic Laboratories in 1988, and moved to NTT Access Network Service Systems Laboratories in 2002, he has mainly engaged in the next generation broadband optical access systems, a future broadband access network architecture, and related advanced photonic devices. From 2014, he is a professor with the department of Opto-Electronic System Engineering, Chitose Institute of Science and Technology in Hokkaido.

Dr. Yoshimoto is a senior member of the IEICE Communication Society and IEEE Communication Society.

Invited Talk 5: "Evaluation and Simulation of Electromagnetic Interference to Digital Broadcasting and Communication"

Prof. Osami Wada, ***Kyoto University, Japan***

Osami Wada received the B.E., M.E., and Dr. Eng. degrees in Electronics from Kyoto University in 1981, 1983, and 1987, respectively. From 1988 to 2005, he was with the Faculty of Engineering, Okayama University, Japan. In 2005, he became a Full Professor in the Department of Electrical Engineering at Kyoto University. He has been engaged in the study of electromagnetic compatibility (EMC) of electronic circuits and systems, and development of EMC macro-models of integrated circuits. Prof. Wada is a member of IEEE, the Institute of Electronics, Information and Communication Engineers (IEICE), the Institute of Electrical Engineers of Japan (IEEJ), and the Japan Institute of Electronics Packaging (JIEP). Since 2012 he has been the chair of Commission E of Japan National Committee of URSI.

Invited Talk 6: "Spaceborne Precipitation Radar: From TRMM to GPM"

Dr. Toshio Iguchi, ***National Institute of Information and Communications Technology, Japan***

Toshio Iguchi received the B.Sc. degree from Hokkaido University, Sapporo, Japan, in 1976, the M.Sc. degree from The University of Tokyo, Tokyo, Japan, in 1978, and the Ph.D. degree from York University, Toronto, ON, Canada, in 1983. Since 1985, he has been with the National Institute of Information and Communications Technology (NICT), Koganei, Japan. From 1991 to 1994, he visited the Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, MD, performing the U.S.–Japan collaborative experiment for measuring rain using airborne radar. Since then, he has focused primarily on issues related to remote sensing of precipitation from space. He is currently Director General of Applied Electromagnetic Research Institute, NICT.

Invited Talk 7: "Contribution of GNSS Radio Signals to Ionospheric Research"

Dr. Takashi Maruyama, ***National Institute of Information and Communications Technology, Japan***

Takashi Maruyama received his B Eng. degree from University of Electro-Communications in 1973, M Sci. degree from Tokyo Metropolitan University in 1975, and ph D degree from Kyoto University in 1992. He joined Radio Research Laboratories (now National Institute of Information and Communications Technology) in 1975. His major research area is upper atmospheric science. He filled various positions, including Chiefs of Space Weather Prediction and Space Science Sections, Director of Hiraiso Solar Terrestrial Research Center, and Executive Researcher. In 1985-1986, he studied in Cornel University, USA as a visiting scholar. In 2011, Dr. Maruyama retired from National Institute of Information and Communications Technology.

Invited Talk 8: "Plasma Wave Emissions and Particle Acceleration in Planetary Magnetospheres"

Assoc. Prof. Yuto Katoh, ***Tohoku University, Japan***

Yuto Katoh received his Dr. Sci. degree in Graduate School of Science, Tohoku University, Japan, in 2003. He was a post-doctoral researcher of the Radio Science Center for Space and Atmosphere, Kyoto University since 2003, a JSPS research fellow since 2006. He was an assistant professor in Graduate School of Science, Tohoku University since 2009. From 2012, he has been an associate professor in Graduate School of Science, Tohoku University. He was awarded URSI Young Scientist Award in 2005, Obayashi Award of Society of Geomagnetism and Earth, Planetary and Space Sciences (SGEPSS) in 2007. He is a member of SGEPSS, JpGU, JPS, and AGU.

Invited Talk 9: “Atacama Large Millimeter/submillimeter Array, ALMA”

Prof. Satoru Iguchi, *National Astronomical Observatory of Japan, Japan*

Satoru Iguchi received the B.E., M.E. and Ph.D. degrees in the Department of Electronic Engineering from the University of Electro-Communications, Tokyo, Japan in 1995, 1997 and 2000, respectively. He has been the COE Research Associate, Assistant Professor, Associate Professor and Professor in the National Astronomical Observatory of Japan (NAOJ), from 2000, 2001, 2008 and 2012, respectively. He is also the Professor at the Department of Astronomical Science, the Graduate University for Advanced Studies (SOKENDAI). From 2002, he has been engaged in the Atacama Large Millimeter/Submillimeter Array (ALMA) project, and is the East Asian ALMA project manager in 2008 and operation manager in 2013. Dr. Iguchi is a member of the International Astronomical Union (IAU), a member of the Astronomical Society of Japan (ASJ), a member of the Institute of Electrical and Electronics Engineers (IEEE) and a member of the Institute of Electronics, Information and Communication Engineers (IEICE).

Invited Talk 10: “Reading 18th Decimal Places of Time with Optical Lattice Clocks”

Prof. Hidetoshi Katori, *The University of Tokyo, Japan*

Hidetoshi Katori was born in Tokyo, Japan, in 1964. He received the B. Eng. in Applied Physics from The University of Tokyo in 1988, and M. Eng. and D. Eng. in Applied Physics from the Graduate School of Engineering, The University of Tokyo in 1990 and 1994. From 1994 to 1997, he worked at Max Planck Institute for Quantum Optics in Garching, Germany, as a visiting scientist. He joined Engineering Research Institute, The University of Tokyo in 1999. Since then he has been engaged in the precision measurements with ultracold atoms, in particular “optical lattice clocks,” which he proposed in 2001.

He has been a professor in the department of applied physics, graduate school of engineering, The University of Tokyo since 2010. He serves as a research director, ERATO, “Katori Innovative Space-Time Project,” JST, since 2010 and a chief scientist, Quantum Metrology Laboratory, RIKEN, since 2011.

He was awarded the first JSPS Prize, European Time and Frequency Award, and The Julius Springer Prize for Applied Physics in 2005, Marubun special science award and IBM Japan Science Prize in 2006, Rabi Award in 2008, and Ichimura Academic Award, Special Prize in 2010, Asahi award in 2012, The 54th Fujihara Award in 2013, Nishina memorial award in 2013, and Tubingen distinguished guest professorship (2014-2017).

Conference Events

Opening Ceremony

9:00-9:15 (September 8, 2014)
Room 5534, 5th Floor, Building No. 5

MC: Yoshiharu Omura (Chair, URSI-JRSM 2014 Technical Program Committee)

Opening Address:

Kazuya Kobayashi (URSI-JRSM 2014 General Chair; President, Japan National Committee of URSI; Vice-Chair, Commission B, URSI)
Yasushi Ishii (Dean, Faculty of Science and Engineering, Chuo University, Japan)
Lou-Chuang Lee (President, China (SRS) National Committee of URSI)

URSI-Japan Commission Business Meetings (open to all participants)

12:15-13:45 (September 8, 2014)
Building No. 5

Commission A:	Room 5133, 1st Floor
Commission B:	Room 5134, 1st Floor
Commission C:	Room 5233, 2nd Floor
Commission D:	Room 5135, 1st Floor
Commission E:	Room 5136, 1st Floor
Commission F:	Room 5234, 2nd Floor
Commission G:	Room 5137, 1st Floor
Commission H:	Room 5235, 2nd Floor
Commission J:	Room 5138, 1st Floor
Commission K:	Room 5236, 2nd Floor

Banquet (tickets required)

18:45-20:45 (September 8, 2014)
Room 31008, 10th Floor, Building No. 3

MC: Yasuhiro Koyama (Chair, Commission A, URSI)

Welcome Address:

Yoshiharu Omura (Chair, URSI-JRSM 2014 Technical Program Committee)
Toshinari Kamakura (Director, Institute of Science and Engineering, Chuo University, Japan)
Debatosh Guha (Commission B Chair, India National Committee of URSI)

Toast:

Makoto Ando (Vice-President, URSI)

Closing Address:

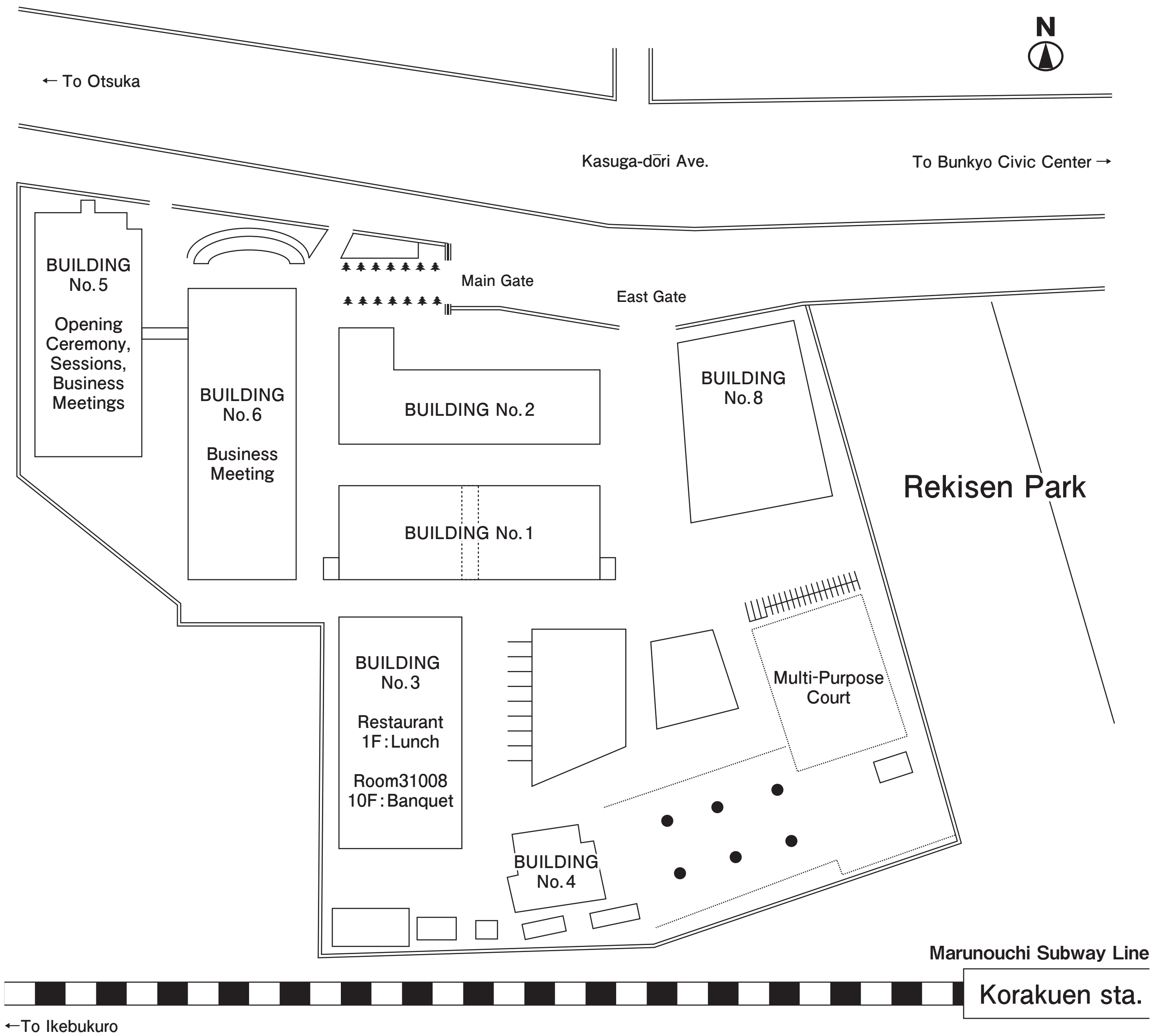
Shoogo Ueno (Past Chair, Commission K, URSI)

Business Meeting on URSI Networking in Asia (members only)

12:00-14:00 (September 9, 2014)
Room 6701, 7th Floor, Building No. 6

Floor Plans

Korakuen Campus, Chuo University



BUILDING No. 5