

# 2021 IEEE AP-S International Symposium & USNC-URSI Radio Science Meeting

4-10 December 2021

Marina Bay Sands, Singapore



IEEE



*The Local Organising Committee would like to acknowledge the following organisations for their generous support and contributions towards the success of the conference. We would also like to show appreciation to all the various committees, reviewers, presenters, authors, delegates, volunteers etc.*

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Structural design and development for antenna

Location: Dongguan, Xi'an, Chengdu

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## Conference at a Glance

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### Friday, 3 December

08:00-10:00 Student Paper Competition (*Virtual*)

20:00-21:40 Student Paper Competition (*Virtual*)

### Sunday, 5 December

08:20-12:00 Workshops and Short Courses (*Hybrid/Virtual*)

08:20-12:00 Student Design Contest (*Hybrid*)

08:20-17:40 High School Student Experience (*Physical*)

14:00-17:40 Workshops and Short Courses (*Hybrid/Virtual*)

### Monday, 6 December

08:20-12:00 Technical Sessions (*Hybrid*)

12:05-12:45 Industry Talk (Sponsor) (*Virtual*)

14:00-17:40 Technical Sessions (*Hybrid*)

18:40-19:40 Welcome Reception

### Tuesday, 7 December

08:20-12:00 Technical Sessions (*Hybrid*)

09:00-17:30 Exhibition

12:05-12:45 Industry Talk (Sponsor) (*Virtual*)

14:00-17:40 Technical Sessions (*Hybrid*)

18:40-20:00 Reviewers' Event/Meeting (*Virtual*)

21:00-22:00 Master Class (*Virtual*)

### Wednesday, 8 December

08:20-12:00 Technical Sessions (*Hybrid*)

09:00-17:30 Exhibition

12:05-12:50 Industry Talk (Sponsor) (*Virtual*)

12:05-13:00 Awards Ceremony (*Hybrid*)

14:00-17:40 Technical Sessions (*Hybrid*)

19:00-21:30 Conference Banquet (*Hybrid*)

### Thursday, 9 December

08:20-12:00 Technical Sessions (*Hybrid*)

09:00-17:30 Exhibition

12:05-13:00 Distinguished Industry Speaker Talk (*Hybrid*)

14:00-17:40 Technical Sessions (*Hybrid*)

19:00-21:30 Students and Young Professionals' Event (*Hybrid*)

### Friday, 10 December

08:20-12:00 Technical Sessions (*Hybrid*)

12:05-13:00 Women in Engineering Panel Discussion (*Hybrid*)

14:00-17:40 Technical Sessions (*Hybrid*)

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## General Chair's Welcome

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On behalf of the Local Organization Committee, we warmly welcome you to the 2021 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting (APS/URSI)!

The APS/URSI 2021 will be held on 4-10 December 2021 at Marina Bay Sands, Singapore. The joint conference is sponsored by the IEEE Antennas and Propagation Society (AP-S) and the US National Committee (USNC) of the International Union of Radio Science (URSI).

APS/URSI is the premier international event in the field of antennas and wireless propagation. As a flagship event, the IEEE APS/URSI 2021 has created several "firsts" in the AP-S and APS/URSI's history, especially during the challenging COVID-19 pandemic.

- APS 2021 is the first version to be held outside North America since its establishment in 1949.
- APS/URSI 2021 is the first version outside North America since URSI and Institute of Radio Engineers (IRE) started collaboration on joint meetings in 1952.
- APS/URSI 2021 is the first version to be held in Singapore, organized by a team comprising local researchers from National University of Singapore, Nanyang Technological University, Agency of Science, Technology and Research, and Singapore University of Technology and Design.
- APS/URSI 2021 is the first version to be held in December but still basking in Singapore's "summer" sunshine.
- APS/URSI 2021 is the first hybrid version with online and onsite presentations across 142 sessions, hosting the papers to be presented by researchers from more than 60 countries/regions. In addition, many technical and social activities have been organized, such as workshops, short courses, student paper competition, student design contest, industry talks, exhibitions, award ceremony, students' tour, young professionals' event, etc.

With the integration of Eastern and Western cultures, "Singapore has positioned itself as a center of innovation and research and development at the heart of the world's most dynamic economic region." (Forbes 2018). As the hub for education, innovation and research, the local researchers from the top three universities and public research organizations have actively carried out excellent research and development on electromagnetic theory, antenna technology, and wireless propagation by collaborating with overseas universities and companies.

Located at one-and-a-half degrees north of the equator, Singapore is a foodie's paradise with a unique food culture and having almost all kinds of seasonal fruits and seafood.

Let us witness the historic moment of IEEE APS/URSI 2021 together and our Merlion welcomes all of you to enjoy a warm winter in Singapore!

With best regards,

Zhi Ning Chen  
General Chair

Zhongxiang Shen  
General Co-Chair

Xianming Qing  
General Co-Chair

## Sessions at a Glance

### Monday, December 6

	Morning	Afternoon	
Virtual (Melati Ballroom 4002)	MO-A1.1A: Antenna Theory I	MO-A1.1P: Antenna Theory II	
Melati Ballroom 4104	MO-A5.1A: Wireless Power Transmission I	MO-A5.1P: Wireless Power Transmission II	MO-SP.1P: Antennas for Wireless Energy Harvesting and Power Transfer Applications
Peony Junior Ballroom 4411	MO-SP.1A: High Sensitivity Phased Array Receivers for Location Services, 5G, Radio Astronomy, and Satellite Communications	MO-UB.1P: Antenna Arrays	
Melati Ballroom 4103	MO-A1.2A: Broadband Antennas I	MO-A1.2P: Broadband Antennas II	
Melati Ballroom 4102	MO-A1.3A: Reconfigurable Antennas and Arrays I	MO-A1.3P: Reconfigurable Antennas and Arrays II	
Peony Ballroom 4402	MO-A2.1A: Metasurfaces in Beam Steering and Beam Forming I	MO-A2.1P: Metasurfaces in Beam Steering and Beam Forming II	
Peony Ballroom 4501AB	MO-SP.2A: 5G and 6G Antenna Systems for Mobile Devices: Present Challenges and Future Opportunities	MO-SP.2P: 5G and 6G Antenna Systems for Mobile Devices: Relevant Technologies	
Peony Junior Ballroom 4412	MO-A5.2A: Biomedical Applications I	MO-A5.2P: Biomedical Applications II	
Virtual (Melati Ballroom 4002)	MO-A1.4A: Magneto-Electric Dipole and Microstrip Antennas I	MO-A1.4P: Magneto-Electric Dipole and Microstrip Antennas II	
Peony Junior Ballroom 4512	MO-A5.3A: RFID Antennas and Systems I	MO-A5.3P: RFID Antennas and Systems II	MO-UB.2P: Millimeter-Wave and Terahertz Antennas
Peony Ballroom 4403	MO-A2.2A: Metasurfaces I	MO-A2.2P: Metasurfaces II	
Peony Junior Ballroom 4511	MO-A3.3A: Integral Equation Methods I	MO-A3.1P: Integral Equation Methods II	
Virtual (Peony Ballroom 4502)	MO-A4.1A: Propagation and Wireless Communications I	MO-A4.1P: Propagation and Wireless Communications II	



## Tuesday, December 7

		<b>Morning</b>	<b>Afternoon</b>
Virtual (Melati Ballroom 4002)	TU-A1.1A: Antenna Feeds and Matching Circuits I		TU-A1.1P: Antenna Feeds and Matching Circuits II
Melati Ballroom 4104	TU-A1.2A: Electrically Small Antennas I		TU-A1.2P: Electrically Small Antennas II
Peony Junior Ballroom 4411	TU-A1.3A: Phased Array Antennas I		TU-A1.3P: Phased Array Antennas II
Melati Ballroom 4103	TU-A5.1A: Ultra-Wideband Antennas and Systems I		TU-A1.4P: Ultra-Wideband Antennas and Systems II
Melati Ballroom 4102	TU-A1.4A: Reconfigurable Antennas and Arrays III		TU-SP.1P: Reconfigurable Antennas for Compact Devices
Peony Ballroom 4402	TU-SP.1A: Beam-Steerable Antenna Systems for Mobile Satellite Communications		TU-SP.2P: Beam-Steerable Antenna Systems for Communications
Peony Ballroom 4501AB	TU-SP.2A: 5G and 6G Antenna Systems for Mobile Devices: Innovative Approaches	TU-SP.3A: Low Cost Antenna Design and Analysis	TU-SP.3P: Unconventional Design Approaches for Low Cost Antennas
Peony Junior Ballroom 4412	TU-A5.2A: Biomedical Applications III		TU-A5.1P: Wearable and Implantable Antennas I
Virtual (Melati Ballroom 4002)	TU-UB.1A: Electromagnetic Interaction and Coupling	TU-UE.1A: Electromagnetic Environment and Interference	TU-A5.2P: Millimeter-Wave Antennas I
Peony Junior Ballroom 4512	TU-A2.1A: Electromagnetic Theory, Material Properties and Measurements I		TU-A2.1P: Electromagnetic Theory, Material Properties and Measurements II
Peony Ballroom 4403	TU-A2.2A: Metasurface Applications I		TU-A2.2P: Metasurface Applications II
Peony Junior Ballroom 4511	TU-SP.4A: Towards a Unified View of Computational Electromagnetics (With a Retrospective at the Occasion of Prof. Hoefler's 80th Birthday)		TU-A3.1P: Computational Electromagnetics I
Virtual (Peony Ballroom 4502)	TU-A4.1A: Propagation Modeling and Analysis I		TU-A4.1P: Propagation Modeling and Analysis II

## Wednesday, December 8

		<b>Morning</b>	<b>Afternoon</b>
Virtual (Melati Ballroom 4002)	WE-A1.1A: Mutual Coupling in Antenna Arrays I		WE-A1.1P: Mutual Coupling in Antenna Arrays II
Melati Ballroom 4104	WE-A1.2A: Electrically Small Antennas III		WE-A1.2P: Dielectric Resonator Antennas
Peony Junior Ballroom 4411	WE-A1.3A: Phased Array Antennas III		WE-A1.3P: Wideband Phased Array Antennas I
Melati Ballroom 4103	WE-A1.4A: Wideband Antennas		WE-A1.4P: Wideband Circularly Polarized Antennas
Melati Ballroom 4102	WE-A1.5A: Adaptive, Reconfigurable and Active Antennas		WE-A2.1P: Reconfigurable Metasurfaces and Antennas
Peony Ballroom 4402	WE-A5.1A: MIMO Implementations and Applications		WE-A5.1P: MIMO Implementations and Applications II
Peony Ballroom 4501AB	WE-SP.1A: Workshop: Quantum Technology Related to Electromagnetics		WE-SP.1P: Innovative Trends in Antenna Tolerance Analysis and Robust Design
			WE-SP.2P: Material Intelligence for Next Generation Wireless Systems
Peony Junior Ballroom 4412	WE-SP.2A: Future Technologies for Biomedical Applications		WE-A5.2P: Wearable and Implantable Antennas II
Virtual (Melati Ballroom 4002)	WE-A5.2A: Millimeter-Wave Antennas II		WE-A5.3P: Millimeter-Wave Antennas III
Peony Junior Ballroom 4512	WE-UF.1A: Propagation Effects, Models and Measurements	WE-A4.1A: Propagation and Scattering in Random or Complex Media	WE-A4.1P: Scattering, Diffraction and RCS
Peony Ballroom 4403	WE-A2.1A: Metasurfaces, FSS and EBG Materials I		WE-A2.2P: Metasurfaces, FSS and EBG Materials II
Peony Junior Ballroom 4511	WE-A3.1A: Computational Electromagnetics II		WE-A3.1P: Computational Electromagnetics III
Virtual (Peony Ballroom 4502)	WE-A4.2A: Remote Sensing I		WE-A4.2P: Remote Sensing II

## Thursday, December 9

		<b>Morning</b>		<b>Afternoon</b>	
Virtual (Melati Ballroom 4002)	TH-A1.1A: Slotted and Guided Wave Antennas I		TH-A1.1P: Slotted and Guided Wave Antennas II		
Melati Ballroom 4104	TH-A1.2A: Microstrip Antennas and Arrays I		TH-A1.2P: Microstrip Antennas and Arrays II		
Peony Junior Ballroom 4411	TH-A1.3A: Wideband Phased Array Antennas II		TH-A1.3P: Reflector and Reflectarray Antennas I		
Melati Ballroom 4103	TH-UB.1A: Frequency-Domain Methods		TH-A1.4P: Multi-Band Antennas I		
Melati Ballroom 4102	TH-A5.1A: 3D Printed Antennas and Structures		TH-A5.1P: Printed and Chip Antennas		
Peony Ballroom 4402	TH-A3.1A: Optimization Methods in EM Designs I		TH-A3.1P: Optimization Methods in EM Designs II		
Peony Ballroom 4501AB	TH-SP.1A: Transforming Electromagnetics Education after Covid		TH-SP.1P: Electromagnetics Education	TH-SP.2P: International Standards Development and Applications	
Peony Junior Ballroom 4412	TH-UK.1A: Electromagnetics in Biology and Medicine I		TH-UK.1P: Electromagnetics in Biology and Medicine II		
Virtual (Melati Ballroom 4002)	TH-A5.2A: Software Defined/ Cognitive Radio	TH-A5.3A: Millimeter-Wave Waveguide and Cavity Antennas I		TH-A5.2P: Millimeter-Wave Waveguide and Cavity Antennas II	
Peony Junior Ballroom 4512	TH-SP.2A: Artificial Intelligence and Deep Learning: A New Era in Imaging and Inverse Scattering		TH-SP.3P: Machine Learning for Inverse Scattering and Imaging		
Peony Ballroom 4403	TH-SP.3A: Recent Advances in Generalized Sheet Transition Conditions (GSTCs): Theory, Capabilities, Realizations, and Applications		TH-A2.1P: Metasurfaces, FSS and EBG Materials III		
Peony Junior Ballroom 4511	TH-UB.2A: Time-Domain Methods I	TH-A3.2A: Time-Domain Methods II		TH-UB.1P: Antenna Theory, Design and Measurements	
Virtual (Peony Ballroom 4502)	TH-UB.3A: Propagation, Scattering, Imaging and Remote Sensing I		TH-UB.2P: Wireless Communications and Sensing Networks	TH-UC.1P: Radio Communication and Signal Processing Systems I	

## Friday, December 10

		<b>Morning</b>	<b>Afternoon</b>	
Virtual (Melati Ballroom 4002)	FR-A3.1A: Practical and High-Performance Computing	FR-A3.2A: Parallel and Special-Processor-Based Numerical Methods	FR-UA.1P: Electromagnetic Metrology and Antenna Applications	
Melati Ballroom 4104	FR-A1.1A: Microstrip Antennas and Circuits I		FR-A1.1P: Microstrip Antennas and Circuits II	
Peony Junior Ballroom 4411	FR-A1.2A: Reflector and Reflectarray Antennas II		FR-A1.2P: Reflector and Reflectarray Antennas III	
Melati Ballroom 4103	FR-A1.3A: Multi-Band Antennas II		FR-A1.3P: Multi-Band Antennas III	FR-A1.4P: Antenna Arrays and Circuits
Melati Ballroom 4102	FR-UB.1A: Microstrip Antennas and Printed Devices		FR-A5.1P: Mobile, PCS and Vehicular Antennas	
Peony Ballroom 4402	FR-UB.2A: Metamaterials and Metasurfaces		FR-UB.1P: Metamaterials and Wave-Guiding Structures	
Peony Ballroom 4501AB	FR-SP.1A: Quantum Technology Related to Electromagnetics		FR-A2.1P: Metamaterials and Periodic Structures	
Peony Junior Ballroom 4412	FR-SP.2A: Novel Methods and Algorithms for Microwave Biomedical Applications		FR-UF.1P: Microwave Remote Sensing	
Virtual (Melati Ballroom 4002)	FR-A5.1A: Millimeter-Wave, Terahertz and Optical Antennas I		FR-A5.2P: Millimeter-Wave, Terahertz and Optical Antennas II	
Peony Junior Ballroom 4512	FR-A4.1A: Inverse Scattering and Imaging I		FR-A4.1P: Inverse Scattering and Imaging II	
Peony Ballroom 4403	FR-A2.1A: Metamaterial Absorbers, RCS Reduction and Cloaking I		FR-A2.2P: Metamaterial Absorbers, RCS Reduction and Cloaking II	
Peony Junior Ballroom 4511	FR-A3.3A: Modeling, Optimization and Machine Learning I		FR-UB.2P: Modeling, Optimization and Machine Learning II	
Virtual (Peony Ballroom 4502)	FR-UB.3A: Propagation, Scattering, Imaging and Remote Sensing I		FR-UC.1P: Radio Communication and Signal Processing Systems II	

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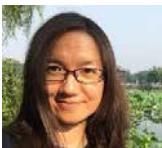


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## Short Courses

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### FULL DAY

#### **SC-6: Antennas for 5G, Wi-Fi 6 and Beyond—System Aspects and Design**

Speakers: John Sanford, University of California San Diego; Claes Beckman, KTH Royal Institute of Technology

Date and Time: Sunday, December 5, 08:20- 17:40 (12:00- 14:00 Lunch)

Mode: Virtual

Venue: Zoom

Abstract: This short course gives the participants an overview of the application, implementation, and design of base station antennas for 5G, Wi-Fi 6 and beyond. The course explains underlying theoretical and practical implementation aspects of base station antennas in both cellular communication networks and Wi-Fi, and discusses also their requirements and design. In particular the course is aimed at microwave-, RF- and antenna engineers working in the wireless area: However, it may also be useful for researchers looking for relevant research topics, and system engineers working on 5G and Wi-Fi 6 needing a deeper understanding of the antenna as a component of their system.

Course Outline:

- Introduction to BTS antennas
- Diversity, MIMO and massive MIMO
- Advanced Antenna Systems, AAS, for 5G, mmWave and fixed wireless access
- Antennas for Wi-Fi, small cells and mesh
- Lens antennas and their application in cellular and Wi-Fi

In the first part the fundamental parameters of a base station antenna are discussed in the context of radio network design. In particular we discuss parameters such as gain, radiation patterns, frequency bands and beam forming and put them in the context of cell planning, propagation and capacity.

Thereafter, we give an overview of the underlying theory of diversity, MIMO and massive MIMO antenna systems. In particular we look in detail at the implementation of multiple antenna systems and the various transmission modes into the 3GPP standard.

In the following parts we discuss the design of advanced antenna systems (AAS) for low-, mid- and millimeter wave bands as well as antenna designs for Fixed Wireless Access (FWA)

We then continue to discuss the design of antennas for Wi-Fi, small cells and mesh networks.

The final part of the course deals lens antennas of various kinds (both Luneburger and Butler type), their design and application in both cellular and Wi-Fi networks



## **HALF DAY, MORNING**

### **SC-3: Quantum Maxwell's Equations and Quantum Electromagnetics**

Speakers: Weng Cho Chew, Dong-Yeop Na, and Thomas E. Roth, Purdue University

Date and Time: Sunday, December 5, 08:20-12:00

Mode: Hybrid

Venue: Peony Junior Ballroom 4411

Abstract: We will give a brief introduction to quantum theory in general, and then introduce the quantization of electromagnetic field, and quantum Maxwell's equations. We will discuss how dispersion effect can be included into quantum Maxwell's equations. Then we will talk about quantum numerical mode decomposition, quantum FDTD. We will also discuss how qubits can be modeled, as well as the use of CEM methods in them.

### **SC-7: Recent Antenna Developments for Space, Deep-Space, and Ground Applications**

Speakers: Sudhakar Rao, Northrop Grumman Space Systems (NGSS), USA; Nacer Chahat, NASA/JPL

Date and Time: Sunday, December 5, 08:20-12:00

Mode: Virtual

Venue: Zoom

Abstract: This short course will cover latest antenna developments for satellite, deep-space and ground applications. It reviews the existing technologies and provides new technologies related to space, deep-space and ground antennas developed over the past 3 years. It includes high frequency antennas, GPS antennas, multi-band antennas and wide-coverage antennas. CubeSats are enabling space-based Earth and planetary science observations, making space science affordable, accessible, and rapidly deployable for institutions such as NASA as well as other space agencies, universities, and private space enterprises around the world. An overview of CubeSat antennas will be provided with a particular emphasize on deployable mesh reflector antennas and reflect-arrays.

Course Outline:

1. Satellite antennas & current limitations.
2. Latest developments in satellite antennas.
3. Deep-space communication antennas.
4. Deployable antennas
5. CubeSats
6. Recent developments related to ground antenna
7. System aspects, &
8. Qualification Tests

## **SC-10: Surface Electromagnetics in Antenna Engineering: From EBG to Metasurfaces and Beyond**

Speakers: Yahya Rahmat-Samii, University of California, Los Angeles; Fan Yang, Tsinghua University

Date and Time: Sunday, December 5, 08:20–12:00

Mode: Hybrid

Venue: Peony Junior Ballroom 4412

Abstract: From frequency selective surfaces (FSS) to electromagnetic band-gap (EBG) ground planes, from impedance boundaries to Huygens metasurfaces, novel electromagnetic surfaces have been emerging in both microwaves and optics. Many intriguing phenomena occur on these surfaces, and novel devices and applications have been proposed accordingly, which have created an exciting paradigm in electromagnetics, the so-called “Surface Electromagnetics”. This short course will review the development of various electromagnetic surfaces, as well as the state-of-the-art concepts and designs. Detailed presentations will be provided on the unique electromagnetic features of EBG ground planes and advanced metasurfaces. Furthermore, a wealth of antenna examples will be presented to illustrate promising applications of the surface electromagnetics in antenna engineering. The course covers representative materials from recent books by the lecturers, “Surface Electromagnetics: With Applications in Antenna, Microwave and Optical Engineering” (Cambridge University Press 2019) and “Electromagnetic Band Gap Structures in Antenna Engineering” (Cambridge University Press, 2009”.

Course Outline:

1. Introduction of Surface Electromagnetics
2. Properties of EBG Surface
3. EBG-based Antennas
4. Phase Limits of Transmission Surfaces
5. Reconfigurable Reflectarrays and Transmitarrays for Beam Scanning Applications
6. Surface EM in Optic and THz regimes

### **HALF DAY, AFTERNOON**

## **SC-2: Natural and Metamaterial Beam-steering Antennas**

Speaker: Hisamatsu Nakano, Hosei University

Date and Time: Sunday, December 5, 14:00–17:40

Mode: Hybrid

Venue: Peony Junior Ballroom 4411

Abstract: In conjunction with the development of conventional natural antennas, the emergence of metamaterials has enabled the development of innovative metamaterial antennas (metaantennas) and broadened the range of antenna applications. These natural and metaantennas can be applied to modern wireless communications between vehicles and base-stations, vehicles and satellites, ships and base-stations, and so forth. This short course presents recent progress in natural and metaantennas, with a focus on beam steering. The course is composed of three chapters. Chapter 1 starts with the definition of natural and metamaterial

antennas, followed by an overview of antenna analysis methods. Some formulations that are useful for antenna design are discussed. Chapter 2 presents five antennas that radiate a linearly polarized (LP) beam and have beam-steering capability. Firstly, beam steering for three natural antennas (four-leaf, disc-Ts, and BOR-based antennas) is discussed, where LP radiation is generated by a resonant current. Secondly, the discussion focuses on beam steering for two antennas (natural rhombic grid array and bent c-type metaline antennas), where the LP beam is generated by a traveling current i.e., a non-resonant current. Chapter 3 achieves beam steering for six circularly polarized (CP) antennas: (i) a natural loop grid array; (ii) a metaspiral, a four-metaline, a bent p-type metaline, and a multi-metalloop; and (iii) a patch-metaline. The currents on the antenna conductors in (i) and (ii) flow in a traveling wave fashion. In (iii), standing- and traveling-wave currents flow on the antenna conductors. Note that the antenna height of the metamaterial antennas presented in this short course is extremely small: on the order of  $1/100$  wavelength at the operating frequency.

Course Outline:

Chapter 1. Definition of antennas, antenna analysis methods, and some formulations.

Chapter 2. LP beam-steering antennas

2.1 Four-leaf antenna

2.2. Disc-Ts antenna

2.3 BOR-based antenna

2.4 Rhombic grid array antenna

2.5 Bent c-type metaline antenna

Chapter 3. CP beam-steering antenna

3.1 Loop grid array antenna

3.2 Metaspiral antenna

3.3 Four-metaline antenna

3.4 Bent p-type metaline antenna

3.5 Multi-metalloop antenna

3.6 Patch-metaline antenna

## Workshops

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### **WS-1: Recent Development of mm-Wave Antenna in MIMO Radar Systems**

Organizer: Ziqiang Tong, Rogers Corp.

Date and Time: Sunday, December 5, 14:00-17:40

Mode: Hybrid

Venue: Melati Junior Ballroom

Topic Description: The idea of the workshop is to invite worldwide research institutes, Universities, and companies to present their latest work on mmW antenna development. The topics in the workshop are all related to the new antenna development and its applications in MIMO Radar system. The topics may cover following area but not limited by those fields: new antenna proposal and its system implementation, new facilities of simulation tools and measurement tools, MIMO design in mmW Radar system, etc. The workshop plans to include 8 speeches.

### **WS-1-1: Recent Development of Beam-Scanning Antenna Technologies and Implementations for Automotive Radar Systems in Millimeter-Wave Band and Above**

Speaker: Prof. Kunio Sakakibara, Nagoya Institute of Technology

### **WS-1-2: Design Concepts for High Resolution mm-Wave MIMO Radar**

Speaker: André Dürr, Ulm University

### **WS-1-3: Development of a Novel Circular Polarized Horn Antenna for the Automotive Radar Frequency Band**

Speaker: Adam Weber, PSW automotive engineering GmbH

### **15:40-16:00: Break**

### **WS-1-5: Fan-Out Wafer-Level Packaged (FOWL) mmWave Antennas Featuring Wide-Angle Beam Scanning for Automotive Applications**

Speaker: Dr. Jae-Yeong Lee, Pohang University of Science and Technology

### **WS-1-6: Advances in Metallized Polymer mmW Waveguide Antenna Design**

Speaker: Dr. Francesco Merli, Huber & Suhner

### **WS-1-7: Hollow waveguide-based MIMO Antenna for Automotive Radar**

Speaker 1: Dr.-Ing. Thomas Bertuch, Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

Speaker 2: Dr. Andreas Löffler, Continental, Autonomous Mobility and Safety

### **WS-1-8: Compact Slot Antenna Array for Automotive Radar Applications**

Speaker: Dr. Niels Koch, Audi AG

## **WS-2: Artificial Intelligence Inspiring the Electromagnetic Wave**

Organizers: Er-Ping Li, Zhejiang University; Joung-ho Kim, KAIST

Date and Time: Sunday, December 5, 08:20-12:00

Mode: Hybrid

Venue: Melati Junior Ballroom

Topic Description: The workshop will present the latest development of AI technology in electromagnetic wave and electromagnetic coupling with neuron-science, such as new electromagnetic challenges in AI chips, Neuromorphic Chips, heterogeneous package integration. The workshop plans to include 4 speeches.

### **WS-2-1: Reinforcement Learning Based Semiconductor, and Package Designs for Signal Integrity and Power Integrity**

Speaker: Prof. Joung-ho Kim, IEEE Fellow, KAIST

### **WS-2-2: Machine Learning Approaches and Data Driven Methods for the Electromagnetic Modeling**

Speaker: Prof. Li-Jun Jiang, IEEE Fellow, University of Hong Kong

### **10:00-10:20: Break**

### **WS-2-3: Deep Learning for EMC**

Speaker: Prof. Jun Fan, IEEE Fellow, Missouri University of Science and Technology

### **WS-2-4: Electromagnetic Wave in Neuromorphic Chips**

Speaker: Prof. Er-Ping Li, IEEE Fellow, Zhejiang University

### **WS-3: WE-SP.1A: Workshop: Quantum Technology Related to Electromagnetics**

Organizers: W. C. Chew, Purdue University, USA; Amir Boag, Tel Aviv University, Israel;  
G. Hanson, University of Wisconsin, USA; Dong-Yeop Na, Purdue University, USA;  
Wei Sha, Zhejiang University, China

Date and Time: Wednesday, December 8, 08:20-12:00

Mode: Hybrid

Venue: Peony Junior Ballroom 4501AB

Topic Description: Quantum science and technology has the promise to dramatically improve the performance in various applications including radar and lidar systems, and the field of imaging in general. In fact, quantum communication systems are already being deployed. We hope that by running this workshop, we can organize talks that are accessible to both communities and help to advance the frontiers of knowledge to make our world a better world. The workshop plans to include 8 speeches.

#### **WE-SP.1A.1: Multimode Correlated Light for Quantum Imaging**

Haechan An, Ali Shakouri, Mahdi Hosseini, Purdue university, United States

#### **WE-SP.1A.2: Frequency Bin Photonic Entanglement**

Andrew Weiner, Purdue University, United States

#### **WE-SP.1A.3: Enhanced Quantum Optical Effects with Epsilon-Near-Zero Plasmonic Waveguides**

Ying Li, Nanjing University of Information Science and Technology, China; Christos Argyropoulos, University of Nebraska-Lincoln, United States

#### **WE-SP.1A.4: Theoretical Investigation of Current-Induced Light Emission In Scanning Tunneling Microscopy Molecular Junctions**

ChiYung YAM, Beijing Computational Science Research Center, China

#### **WE-SP.1A.5: Towards Optimal Single-Photon Sources and Applications**

Yu-Ming He, USTC, Hefei, China

#### **WE-SP.1A.6: Semiclassical Quantum Electromagnetics: From Numerical Models to Real Applications**

Guoda Xie, Anhui University, China; Wei SHA, Zhejiang University, China; Zhixiang Huang, Anhui University, China

#### **WE-SP.1A.7: Characteristic Mode-Based Quantization for Modeling of Lossless Scattering**

Gregory Slepyan, Ilay Levie, Tel Aviv University, Israel; Dmitri Mogilevtsev, Belarus National Academy of Sciences, Belarus; Amir Boag, Tel Aviv University, Israel

#### **WE-SP.1A.8: Molecular Lanthanide Complexes for Quantum Technologies**

Stergios Piligkos, U of Copenhagen, Denmark

## Special Sessions

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### **MO-SP.1A: High Sensitivity Phased Array Receivers for Location Services, 5G, Radio Astronomy, and Satellite Communications**

Karl F. Warnick, Brigham Young University, USA; David B. Davidson, Curtin University, Australia

### **MO-SP.2A: 5G and 6G Antenna Systems for Mobile Devices: Present Challenges and Future Opportunities**

Wonbin Hong, Pohang University of Science and Technology, South Korea; Rod Waterhouse, Octane Wireless, USA

### **MO-SP.1P: Antennas for Wireless Energy Harvesting and Power Transfer Applications**

Taimoor Khan, National Institute of Technology Silchar, India; Nasimuddin Nasimuddin, Institute for Infocomm Research, Singapore; Binod Kumar Kanaujia, Jawaharlal Nehru University, India

### **TU-SP.1A: Beam-Steerable Antenna Systems for Mobile Satellite Communications**

Karu P. Esselle, University of Technology Sydney, Australia; Dushmantha Thalakatuna, University of Technology Sydney, Australia; Ladislav Matekovits, Politecnico di Torino, Italy

### **TU-SP.4A: Towards a Unified View of Computational Electromagnetics (With a Retrospective at the Occasion of Prof. Hoefler's 80th Birthday)**

Zhizhang (David) Chen, Dalhousie University, Canada; Wolfgang J. R. Hoefler, University of Victoria, Canada; Chao-Fu Wang, National University of Singapore, Singapore

### **TU-SP.1P: Reconfigurable Antennas for Compact Devices**

Leonardo Lizzi, Université Côte d'Azur, CNRS, LEAT; Joseph Costantine, American University of Beirut

### **TU-SP.3P: Unconventional Design Approaches for Low Cost Antennas**

Nicola ANSELMINI, ELEDIA@UniTN (DISI-University of Trento), Italy; Paolo ROCCA, ELEDIA@UniTN (DISI-University of Trento), Italy; Robert MAILLOUX, ELEDIA@UniTN (DISI-University of Trento), Italy

### **WE-SP.2A: Future Technologies for Biomedical Applications**

Gammer H. Abbasi, University of Glasgow, UK; Asimina Kiourt, The Ohio State University, USA

### **WE-SP.1P: Innovative Trends in Antenna Tolerance Analysis and Robust Design**

Paolo ROCCA, University of Trento, Italy; Jin HUANG, Xidian University, China; Peng Li, Xidian University, China

**WE-SP.2P: Material Intelligence for Next Generation Wireless Systems**

Giacomo OLIVERI, University of Trento, Italy; Marco DI RENZO, CNRS & Paris-Saclay University, France; Tie Jun CUI, Southeast University, China

**TH-SP.1A: Transforming Electromagnetics Education after Covid**

Cynthia Furse, University of Utah, USA; Krishnasamy T. Selvan, SSN College of Engineering, India; Karl Warnick, Brigham Young University, USA

**TH-SP.2A: Artificial Intelligence and Deep Learning: A New Era in Imaging and Inverse Scattering**

Marco SALUCCI, University of Trento, Italy; Qing H. Liu, Duke University, USA; Xiuzhu YE, Beijing Institute of Technology, China

**TH-SP.3A: Recent Advances in Generalized Sheet Transition Conditions (GSTCs): Theory, Capabilities, Realizations, and Applications**

Jordan Budhu, University of Michigan, USA; Anthony Grbic, University of Michigan, USA

**TH-SP.2P: International Standards Development and Applications**

Vikass Monebhurrun, CentraleSupélec, France;

**FR-SP.1A: Quantum Technology Related to Electromagnetics**

W. C. Chew, Purdue University, USA; Amir Boag, Tel Aviv University, Israel; G. Hanson, University of Wisconsin, USA; Dong-Yeop Na, Purdue University, USA

**FR-SP.2A: Novel Methods and Algorithms for Microwave Biomedical Applications**

Xiong Wang, ShanghaiTech University, China; Maokun Li, Tsinghua University, China; Zhun Wei, Zhejiang University, China



## **Student Paper Competition**

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The annual IEEE AP-S Student Paper Competition recognizes outstanding papers written by students for any of the AP-S topics. In 2021, there were 189 submissions. From these, 11 papers were selected as Finalists and 36 as Honorable Mentions based on the scores by the reviewers. The Finalists will present their work to a panel of judges during a virtual session prior to the start of the Symposium and the winners will be announced at the Awards Ceremony.

### **FINALISTS**

#### **A Hybrid SIE-PDE Formulation Without Additional Boundary Conditions for Electromagnetic Analysis**

Aipeng Sun, Shunchuan Yang, Beihang University, China

#### **A Low-RCS and Low-ECC Transparent Meta-Radomes Based on a Conductive Nanocomposite**

Liang Zhu, Pai-Yen Chen, university of illinois at Chicago, United States

#### **A novel almost all-angle-insensitive FSS structure for high-performance radome**

Tianwu Li, Da Li, Er-ping Li, Zhejiang University, China

#### **A Space-Time Stochastic Green's Function Method for Statistical Analysis of Wave Physics in Ray-Chaotic Enclosures**

Shen Lin, Zhen Peng, University of Illinois at Urbana-Champaign, United States

#### **A Vasculature Anatomy Inspired Flexible Slot Antenna for Continuous Non-invasive Glucose Monitoring**

Jessica Hanna, Joseph Costantine, Rouwaida Kanj, Youssef Tawk, Ali Ramadan, Assaad Eid, American University of Beirut, Lebanon

#### **Achieving Hemispherical Beam Coverage for a 39 GHz Integrated Lens featuring Double-Elliptical Boundaries through sequential GO and multiple Scattering**

Youngno Youn, Wonbin Hong, Pohang University of Science and Technology, Korea (South)

#### **Inverse Design of Metasurface Polarization Convertor with Controllable Bandwidth**

Kai Qu, Ke Chen, Yijun Feng, Nanjing University, China

#### **Ku/Ka Wide-Band Dual-Band Dual-Polarized Shared-Aperture Phased Array Antenna with High Aperture Efficiency**

Yan Ran Ding, Yu Jian Cheng, University of Electronic Science and Technology of China, China

#### **Multiplicative-Regularized Bases-Expansion Subspace Optimization Method for Electrical Impedance Tomography**

Zheng Zong, Zhun Wei, Zhejiang University, China

## **Split-Field Domain Decomposition Algorithm with Fast Convergence for Electromagnetic Analysis**

Shuzhan Sun, Dan Jiao, Purdue University, United States

## **UHF Tags Array for Holographic Target Localization and Wireless Health Monitoring**

Aline Eid, Manos Tentzeris, Georgia Institute of Technology, United States; Jiang Zhu, Luzhou Xu, Google LLC, United States; Jimmy Hester, Atheraxon/Georgia Institute of Technology, United States

### **HONORABLE MENTION**

## **28 GHz Millimeter-Wave Digital Beamformer : Design and Experimental Evaluation**

Kefayet Ullah, Satheesh Bojja Venkatakrishnan, John L. Volakis, Florida International University, United States

## **A 230 GHz Orthomode Transducer with Simple Fabrication Steps**

Tanner Douglas, Adib Nashashibi, Kamal Sarabandi, University of Michigan, United States

## **A Computational Study of COVID-19 Detection using Colorimetric Plasmonic Sensors**

Somen Baidya, Graduate Research Assistant, United States; Ahmed M. Hassan, Associate Professor, Director of the Multiscale Multidisciplinary Electromagnetics Lab (MMEL), United States

## **A Dual Circularly Polarized Antenna Array With Compact Feeding Network**

Wenyu Zhao, Xiuping Li, Zihang Qi, Beijing University of Posts and Telecommunications, China

## **A Low-cost Sub-Terahertz Circularly Polarized Antenna for 6G Wireless Communications**

Basem Aqlan, Hamsakutty Vettikalladi, King Saud University, Saudi Arabia; Mohamed Himdi, Université of Rennes 1, France

## **A Multiband Quasi-Yagi Antenna for WiFi/Bluetooth/WiMAX/Zigbee Applications**

Goksel Turan, Hayrettin Odabasi, Eskisehir Osmangazi University, Turkey

## **A One-Stage $O(N \log N)$ Algorithm for Generating Nested Low-Rank Representation of Electrically Large Volume Integral Equations**

Yifan Wang, Dan Jiao, Purdue University, United States

## **A Planar Ultra-Wideband Dual Polarized Reflectarray**

Muhammad Hamza, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

### **A Reconfigurable Intelligent Surface Using a 2-Bit Programmable Metasurface for Communications**

John Hodge, Virginia Tech, United States; Thomas Spence, Northrop Grumman, United States; Amir Zaghloul, CCDC U.S. Army Research Lab and Virginia Tech, United States

### **A Reconfigurable Reflecting Metasurface with Sensing Capabilities**

Idban Alamzadeh, Mohammadreza F. Imani, Arizona State University, United States; George C. Alexandropoulos, National and Kapodistrian University of Athens, Greece; Nir Shlezinger, Ben-Gurion University of the Negev, Israel

### **A Scalable Deep Learning Model for Arbitrary Transmitter Configurations in Inverse Scattering**

Karthik Girija Ramesan, Prasanta Kumar Ghosh, Indian Institute of Science, India

### **A Wave Matrix Approach to Designing Azimuthally-Varying Cylindrical Metasurfaces**

Chun-Wen Lin, Anthony Grbic, University of Michigan, United States

### **A W-band, Microfabricated, Tiled Phased Array Realized by Bricked Tapered Slot Antenna Element**

Jian Xu Sun, Yu Jian Cheng, Yong Fan, University of Electronic Science and Technology of China, China

### **An Exponentially Convergent Quadrature Method for Evaluating Convolutional Integrals**

Li Zhang, Rayleigh R. Chang, Mei Song Tong, Tongji University, China

### **Antenna Array Time-Delay Loss Quantification for High Symbol Rate Satellite Communications**

Joshua Roper, Viasat, United States; Andrew Peterson, Georgia Institute of Technology, United States

### **Bypassing Rozanov's bound for short-time pulses**

Chen Firestein, Amir Shlivinski, Ben-Gurion University, Israel; Yakir Hadad, Tel-Aviv University, Israel

### **Electromagnetic Cloak Using Phase Gradient Metasurfaces**

Yufang Wang, Huaqiao University, China; Yuehe Ge, Fuzhou University, China; Zhizhang Chen, Dalhousie University, China

### **Extreme Beam-forming with Metagrating-assisted Planar Antennas**

Gengyu Xu, Sean Hum, George Eleftheriades, University of Toronto, Canada

### **Homogenization and Extreme Fresnel Drag in Spatiotemporally Modulated Wire Medium**

Michael Kreitzer, Yakir Hadad, Tel-Aviv University, Israel

**Implementation of DORT to a MIMO Radar with Planar Transmit and Receive Arrays**

Zhelin Cao, Kamal Sarabandi, University of Michigan, United States

**Improving the Efficiency of Parallel FFTs in Parallel Electromagnetic Solvers Based on the AIM**

Damian Marek, Piero Triverio, University of Toronto, Canada

**Low-Frequency Stable Discretization of the Electric Field Integral Equation based on Poincaré's Lemma**

Bernd Hofmann, Thomas F. Eibert, Technical University of Munich, Germany; Francesco P. Andriulli, Politecnico di Torino, Italy; Simon B. Adrian, Universität Rostock, Germany

**Metasurface-Pair Design for a Scan-angle Enhancement System**

Jaemin Kim, George Eleftheriades, University of Toronto, Canada

**Multichannel Metagrating Diffusers for Broad-Angle Radar Cross Section (RCS) Reduction**

Yarden Yashno, Ariel Epstein, Technion - Israel Institute of Technology, Israel

**Non-Conformal SS-SIE Formulation Without Treatments on Junctions for Composite Objects**

Zekun Zhu, Shunchuan Yang, Beihang University, China; Zhizhang (David) Chen, Fuzhou University, China

**Omnidirectional Multibeam Substrate Integrated Horn Array for Unmanned Aerial Vehicles**

Qingbi Liao, KTH Royal Institute of Technology, Sweden; Lei Wang, Heriot-Watt University, United Kingdom

**Radiation Pattern Roundness Improvement of Off-center Monopole Antenna Using Electromagnetic Band-gap (EBG) Structure**

Bo Zhang, Zhi Ning Chen, National University of Singapore, Singapore

**Real Time Correction of Multipath Error in Satellite Positioning using FPGA-Accelerated Ray Tracing**

Gaosong Lv, Huapeng Zhao, Jun Hu, University of Electronic Science and Technology of China, China

**Reconfigurable Metamaterial-Inspired PMC-PEC for Waveguide Miniaturisation**

Vikrant Singh, Mohsen Khalily, Amir Jafargholi, Rahim Tafazolli, University of Surrey, United Kingdom

**Remote Destruction of the Coronavirus by Dual-Polarized Wireless Power Transmission**

Konstantinos Kossenas, Maksim Kuznetsov, Symon Podilchak, University of Edinburgh, United Kingdom; Davide Comite, Sapienza University of Rome, Italy

**Respiration Monitoring Using Camera-Guided Frequency-Modulated Continuous-Wave Radar**

Arash Shokouhmand, Negar Tavassolian, Stevens Institute of Technology, United States;  
Amir Avnit, Behnood Gholami, Autonomous Healthcare, Inc., United States

**Robust Microwave Transport via Nontrivial Duality-Based Rhombic Unit Cells**

Robert Davis, Daniel Stevenpiper, University of California, San Diego, United States

**Shifted-Beam Array Coil for Highly Focal Transcranial Magnetic Stimulation**

Fangwei Chang, George Eleftheriades, University of Toronto, Canada

**Single Feed Dual Beam Antenna using Metamaterial Surfaces for Near-Field Phase Manipulation**

Aditya Dave, Rhonda Franklin, University of Minnesota, Twin Cities, United States

**Synthesis of Wide-Angle Difference Pattern with Low Side-lobe Level on Asymmetric Aperture of Hemispherical Conformal Array Antennas**

Hong Sheng Lin, Yu Jian Cheng, Hai Ning Yang, University of Electronic Science and Technology of China, China

**Towards Solution of Integral Equations in Electromagnetics on Quantum Computers**

Christopher Phillips, Vladimir Okhmatovski, University of Manitoba, Canada

## Student Design Contest

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The IEEE Antennas and Propagation Society (AP-S) Student Design Contest (SDC) is an annual contest on the design of a device or system involving principally antenna and propagation aspects. It culminates with a demonstration by finalists at the annual IEEE AP-S Symposium. The Contest is designed to engage and encourage study in the areas of electromagnetics, particularly antennas and propagation. Awards are given for the first, second, and third prize.

The goal of this year was to propose a setup that demonstrates the design of an array with beamforming capability for Direction of Arrival (DoA) determination in a practical application and provide educational material to explain it.

The IEEE AP-S SDC 2021 received 36 submissions for review. The results for the five finalist teams evaluated during the 2021 IEEE AP-S Student Design Contest are:

Dangerous Directivity Team, Brigham Young University, United States (First place)

*Members: Elias Guanuna, Keaton Shurilla, Whitney Kinnison, Batsaikhan Ariun-Erdene, Ben Francis*

*Mentor: Karl F. Warnick*

PSU Beam Team, Pennsylvania State University, United States (Second place)

*Members: Rebecca E. DeSipio, Ethan D. Tabler, Michael J. Shero, Bailey Campbell, N. Nicholas Mai*

*Mentor: Gregory H. Huff*

Do'A Beam Team, University of Aveiro - Instituto de Telecomunicações, Portugal (Third place)

*Members: Manuel dos Santos Neves, Amélia da Silva Ramos, Filipa Domingues Antunes, João André Margarido Maltez, Vasco Almeida Fernandes*

*Mentor: João Nuno Matos*

ETF-Belgrade Team, University of Belgrade, Serbia (Fourth place)

*Members: Olja Jakovljević, Vojislava Janković, Ana Čupurdija, Pavle Petrović*

*Mentor: Slobodan Savić*

Japantenna Team, Yokohama National University, Japan (Fifth place)

*Members: Jo Tamura, Yusuke Mitsui, Shouta Takato, Satoshi Sugaya*

*Mentor: Hiroyuki Arai*

## **High-School Student Experience**

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*Date and Time: Sunday, December 5, 08:20–17:40*

*Mode: Physical*

*Venue: Marina Bay Sands Expo and Convention Centre, Level 4*

The aim of this event is to introduce high school students to Science and Engineering, in particular, antennas and propagation. Students will be given the opportunity to interact with world renown researchers in the field of antennas and propagation. Check out some innovative, state of the art array antenna designs at the student design competition. Watch the top 6 teams from United States, Japan, Serbia and Portugal battle it out for the first place with their best designs! Find out more about upcoming technologies such as antennas for 5G, Wi-Fi 6 and beyond. Explore the recent antenna development for space and deep space. Understand how artificial intelligence is being used in the field of electromagnetics. Spend some time with us at Marina Bay Sands, interacting with our industrial sponsors from Nano Dimensions and TMY Technology, just to name a few. All participants will enjoy lunch and receive a cool gift sponsored by the Committee on Promoting Equality (COPE)!

## **Reviewers' Event / Meeting**

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The Editors in Chief (EiC) will be briefing on the AP Transactions, Letters, and/or Journal publication reports.

*Date and Time: Tuesday, December 7, 18:40–20:00*

*Mode: Virtual*

*Venue: Zoom*

*Cost: Free for registered conference participants*

### **ELECTROMAGNETICS: FROM CLASSICAL TO QUANTUM**

Weng Cho Chew

*Distinguished Professor*

*Elmore Family School of Electrical and Computer Engineering, Purdue University*

*Date and Time: Tuesday, December 7, 21:00-22:00*

*Mode: Virtual*

*Venue: Zoom*

*Cost: Free for registered conference participants*

Abstract: We will discuss the impact of electromagnetics from classical to quantum. Electromagnetics has impacted engineering technologies from nanometer length scale inside a computer chip to geological length scales for exploration. It has been used in communication from global as well as planetary length scales. Moreover, it has broad applications across the electromagnetic spectrum, from static to ultra-violet frequencies for sensing and metrology. We will give examples for these broad applications, from computer chip design to global wireless communications.

More recently, the quantum nature of electromagnetic fields heralds in its applications in quantum technology, such as quantum computing, quantum communications, quantum sensing and imaging. We will discuss these applications as well.

Biography: **W.C. Chew** received all his degrees from MIT. His research interests are in wave physics, specializing in fast algorithms for multiple scattering imaging and computational electromagnetics in the last 30 years. His recent research interest is in combining quantum theory with electromagnetics, and differential geometry with computational electromagnetics. After MIT, he joined Schlumberger-Doll Research in 1981. In 1985, he joined U Illinois Urbana-Champaign, was then the director of the Electromagnetics Lab from 1995-2007. During 2000-2005, he was the Founder Professor, 2005-2009 the YT Lo Chair Professor, and 2013-2017 the Fisher Distinguished Professor. During 2007-2011, he was the Dean of Engineering at The University of Hong Kong. He joined Purdue U in August 2017 as a Distinguished Professor. He has co-authored three books, many lecture notes, over 450 journal papers, and over 600 conference papers. He is a fellow of various societies, and an ISI highly cited author. In 2000, he received the IEEE Graduate Teaching Award, in 2008, he received the IEEE AP-S CT Tai Distinguished Educator Award, in 2013, elected to the National Academy of Engineering, and in 2015 received the ACES Computational Electromagnetics Award. He received the 2017 IEEE Electromagnetics Award. In 2018, he served as the IEEE AP-S President. He is a distinguished visiting professor at Tsinghua U, China, Hong Kong U, and National Taiwan U.



## **Awards Ceremony**

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*Date and Time: Wednesday, December 8, 12:05 - 13:00*

*Mode: Hybrid*

*Location:*

*Melati Ballroom 4104 (Main),*

*Peony Ballroom 4501AB,*

*Peony Ballroom 4403*

*Cost: Free for registered conference participants*

Please join the Antennas and Propagation Society, as we honor the distinguished accomplishments of the society's professional community. This year's 11 APS Field and Paper Awards will be presented to the recipients, as well as awards for Best Student paper and Student Design contest. The 2021 IEEE AP-S Fellows will also be recognized during this event. The event will be in hybrid mode, with both online and physical attendees. The Awards Ceremony is open to all conference registrants.

## Distinguished Industry Speaker Talk

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### Radar Applications for Autonomous Vehicles

*Gary Clayton*

*Head of Radar at Waymo*

*Date and Time: Thursday, December 9, 12:05 – 13:00*

*Mode: Hybrid*

*Venue: Melati Ballroom 4103*

*Sponsors:*

*IEEE AP-S Membership and Benefits Committee*

*IEEE AP-S Industry Initiatives and Listings Committee*

One of the biggest engineering hurdles of our time is improving the quality and safety of our mobility. Autonomous driving technology is a potential solution to this, but obstacles still exist in fully realizing this solution. Radar offers an attractive option to addressing these obstacles, since radar often fares better than other sensors in weather, uses relatively low power, and is generally affordable.

As radar moves from a driver assist role to being a key sensor for autonomous driving, many new challenges emerge beyond the typical size, weight, power, and cost constraints, pushing us towards the development of new radar technologies and capabilities. In this talk Dr. Gary Clayton, Head of Radar at Waymo, will speak on the history of Google's Self Driving Car Project (now Waymo), the challenges facing radars used for autonomous driving, and recent advances in automotive radar technology.

**Dr. Gary Clayton** is the head of Radar at Waymo, an autonomous driving technology company with the mission to make it safe and easy to get around. He leads a diverse, innovative, and collaborative group of Electrical, Mechanical, Software, Radio Frequency (RF), and Production engineers. As part of the larger Waymo Hardware Team, his group designs, builds, tests, and perfects the products which are the eyes and ears of Waymo's fully autonomous driving systems, and integrates those products into vehicle platforms.

Prior to Waymo, Dr. Clayton was a Raytheon Principal Engineering Fellow at Raytheon Space and Airborne Systems. In his 34 years of radar development at Hughes Aircraft and Raytheon, Dr. Clayton worked on system design and development of airborne and spaceborne radar systems and consulted on surface-based radar systems. Dr. Clayton is an expert in system design, adaptive signal processing, and electronic protection having developed imaging, tracking, and surveillance radars.

Dr. Clayton holds a Ph.D in Electrical, Electronics and Communications Engineering from the University of Southern California and earned his M.S. in Electrical and Electronics Engineering from the University of California Los Angeles.

## **Students and Young Professionals' Event**

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### **Entrepreneurship for Young Professionals in Antennas and Propagation – A Panel Discussion**

*Date and Time: Thursday, December 9, 19:00–21:30*

*Mode: Hybrid*

*Venue: Heliconia Ballroom*

*Cost: Complimentary for students and young professionals, but advance registration is required*

#### **Panelists**

*Dr. Jaume Anguera, Founder and CTO, Ignion*

*Dr. Kush Agarwal, Founder and CEO, WaveScan Technologies*

*Dr. Feng Ling, Founder and CEO, Xpeedic Technology*

*Dr. Pui Yi Lau (Anna), CTO, Laxcen*

*Dr. Shirook Ali, Founder and CEO, Ecosystem Informatics Inc*

#### **Panel Moderator**

*Prof. A. Alphones, Nanyang Technological University*

## **Women in Engineering Panel Discussion**

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*Date and Time: Friday, December 10, 12:05–12:50*

*Mode: Hybrid*

*Venue: Melati Ballroom 4104*

*Cost: Free for registered conference participant*

#### **Panelists**

*Prof. Mahta Moghaddam (the past president (2020), USA)*

*Asst. Prof. Deepti D. Krishna (India)*

*Assoc. Prof. Fauziahanim Seman (Malaysia)*

*Prof. Wenchuan Che (China)*

*Dr. Hla Nu Phyu (Singapore)*

#### **Panel Moderator**

*Assoc. Prof. Shaoying HUANG (Singapore)*

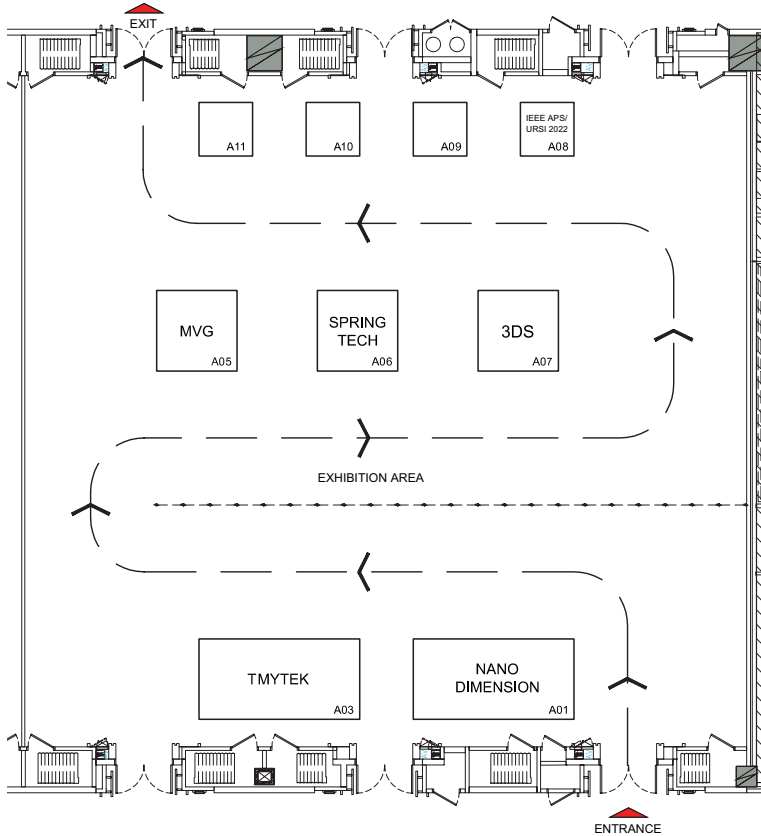
In this panel discussion, while we are still facing an unprecedented pandemic, let's discuss with the experienced researchers from all over the world about new challenges for our studies and research on top of the existing ones. What are our new and old challenges, and how can we cope with them effectively and in a healthy manner? What are the challenges that are specifically for women who are from the society of antenna and propagation? How different challenges are from different countries/regions?

This event is open to all conference participants, no pre-registration is required. The event will be hybrid which takes place both online and physically at Melati Ballroom 4104, Marina Bay Sands concurrently.

## Exhibitors & Sponsors

The Steering Committee of the 2021 IEEE AP-S International Symposium and USNC-URSI Radio Science Meeting would like to thank the following exhibitors for their participation and support.

### Orchid Ballroom 4202-4 and 4302-4






Booth	Exhibitor/Sponsor Name
(online)	Huawei Technologies
A01	Nano Dimension Ltd
A03	TMY Technology Inc.
A05	Microwave Vision Group
A06	Spring Technologies Pte Ltd
A07	Dassault Systèmes
A08	IEEE APS/URSI 2022


## EXHIBITION LOCATION AND HOURS

Exhibition is located in the Orchid Ballroom 4202-4 and 4302-4, on the 4th floor of the Marina Bay Sands, Singapore, and are open to all attendees according to the following schedule:

Tuesday, December 07 ..... 09:00 – 17:30  
 Wednesday, December 08 ..... 09:00 – 17:30  
 Thursday, December 09 ..... 09:00 – 17:30

 <b>HUAWEI</b>	<p><b>Huawei Technologies</b></p> <p>Founded in 1987, Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. We have approximately 197,000 employees and we operate in over 170 countries and regions, serving more than three billion people around the world.</p> <p>Huawei's mission is to bring digital to every person, home and organization for a fully connected, intelligent world. To this end, we will: drive ubiquitous connectivity and promote equal access to networks to lay the foundation for the intelligent world; provide the ultimate computing power to deliver ubiquitous cloud and intelligence; build powerful digital platforms to help all industries and organizations become more agile, efficient, and dynamic; redefine user experience with AI, offering consumers more personalized and intelligent experiences across all scenarios, including home, travel, office, entertainment, and fitness &amp; health.</p> <p><a href="http://www.huawei.com">www.huawei.com</a></p>
 	<p><b>Nano Dimension</b></p> <p>Nano Dimension's (Nasdaq: NNDM) vision is to transform the electronics and similar additive manufacturing sectors into an environmentally friendly &amp; economically efficient additive manufacturing Industry 4.0 solution, while enabling a one-production-step-conversion of digital designs into functioning devices - on demand, anytime, anywhere. Nano Dimension plans to execute on this vision by building an ecofriendly and intelligent distributed network of additively manufacturing self-learning &amp; self-improving systems, which are designed to deliver a superior ROI to their owners as well as to Nano Dimension shareholders and stakeholders.</p> <p>The DragonFly LDM® 3D printing systems serve cross-industry High Performance Electronic Devices (Hi-PEDs®) fabrication needs, by depositing proprietary conductive and dielectric materials simultaneously, while concurrently integrating in-situ capacitors, antennas, coils, transformers, and electromechanical components. The outcomes are Hi-PEDs® which are integral enablers of autonomous intelligent drones, cars, satellites, smartphones, and in vivo medical devices. These products enable iterative development, IP safety, fast time-to-market, and device performance gains. With DragonFly LDM®, a revolution happens at the click of a button, allowing customers to go from CAD to a functional device in a matter of hours instead of weeks; creating products with better performance; reducing the size and weight of electronic parts and devices; enabling innovation; and, critically important, protecting IP, all the while limiting environmental pollution and chemical waste.</p> <p><a href="http://www.nano-di.com">www.nano-di.com</a></p>

	<p><b>TMY Technology, Inc.</b></p> <p>TMY Technology, Inc. (TMYTEK) is an innovator and a game-changer that delivers the breakthroughs of millimeter-wave solutions in 5G/BSG and satellite communication applications to worldwide clients. As a leading technology developer, TMYTEK enables people's everyday life with better connectivity from our clients' products. By transforming the mmWave RF fronted with innovative devices, inventing ready-to-use beamforming development kit, implementing phased arrays with modern Antenna-in-Package (AiP) technology, and redefining the OTA testing methodology, TMYTEK empowers industrial inventions to market faster. Together with our global partners and allies, we make historical firsts and positively impact society. Find out more from <a href="http://www.tmytek.com">www.tmytek.com</a>.</p>
	<p><b>Microwave Vision Group (MVG)</b></p> <p>The Microwave Vision Group (MVG) is a premier supplier of antenna measurement and EMC testing solutions. Our systems allow users to visualize electromagnetic waves propagating in microwave frequencies and thus to evaluate the performance of antennas or devices under test. We are dedicated to the Telecommunications, Satellite, Aerospace &amp; Defense, Automotive, and EMC&amp;CE sectors as well as research institutes. MVG brings together the technical expertise, product portfolios and infrastructures of four industry leaders: SATIMO, ORBIT/FR, AEMI, Inc, &amp; Rainford EMC. The result is an unrivaled spectrum of key technologies and system building blocks for antenna measurement and EMC activities.</p> <p>The Group provides the broadest range of measurement techniques available on the market: near-field and far-field antenna measurement, antenna technology, EMC testing, EMP, RF safety and industrial inspection, all under one roof.</p> <p>Combining electronic probe arrays and precision electro-mechanical systems, our research and engineering departments are consistent in developing cutting edge technologies and in aiming to meet evolving measurement requirements, including 5G developments. MVG is the natural choice for clients seeking complete, fast, accurate and reliable testing and measurement solutions.</p> <p><a href="http://www.mvg-world.com">www.mvg-world.com</a></p>
	<p><b>Spring Technologies Pte Ltd</b></p> <p>Spring Technologies Pte Ltd was established on 18 February 2005 in Singapore. The core business is in providing Test &amp; Measurement (T&amp;M) solutions, especially in the RF and Microwave Frequency Range. Our team has many years of experience in the Wireless Communications and Test &amp; Measuring Equipment industry. We represent a wide range of T&amp;M equipment manufacturers and take pride in our capability to recommend &amp; integrate T&amp;M solutions for our clients' needs. Our key focus is on providing the customer the appropriate solution after in-depth customer discussion, so they get the right solution for their application at the right price/performance ratio.</p> <p>Some of the brands we represent and resell in SEA are :</p> <ul style="list-style-type: none"> <li>• Aaronia, Germany (Handheld Spectrum Analyzer and Antenna)</li> <li>• Anapico, Switzerland (RF and Microwave Signal Generators)</li> <li>• Ceyear, China (Signal Generator, Spectrum Analyser, VNA, Noise Figure Measurement)</li> <li>• Rigol Technologies Inc, China (General Instruments - Oscilloscope, Power Supply, etc)</li> <li>• Wireless Telecom Group (Boonton, Noisecom), USA (RF and Microwave Power Meter and Noise Generator)</li> <li>• ThinkRF (DownConverters)</li> </ul> <p>The customer sectors we serve are Defence, Education, R&amp;D, Production, Transport, and Enterprise.</p> <p>We also cater to instrument rental, repair, warranty, and calibration services for our customers.</p> <p><a href="http://www.springtechnologies.com.sg">www.springtechnologies.com.sg</a></p>

 <p>The 3DEXPERIENCE® Company</p>	<p><b>Dassault Systèmes</b></p> <p>Developed by Dassault Systèmes, the 3DEXPERIENCE Company, SIMULIA delivers realistic simulation applications enabling users to reveal the world we live in. One such application, CST Studio Suite, is a best-in-class software package for EM and multiphysics simulation used worldwide in leading technology and engineering companies.</p> <p>CST Studio Suite offers various tools for designing, analyzing, and optimizing products, from the general-purpose solvers like the Time Domain and Frequency Domain Solvers based on the Finite Integration Technique (FIT), to more specialized ones for applications such as electronics, electron devices, motor and cables. These tools are integrated into one single, easily understandable GUI. Moreover, CST Studio Suite can be integrated into collaborative workflows, with your team working on the same set of data concurrently on the cloud-based 3DEXPERIENCE platform.</p> <p>Thanks to our broad partner network and regional support hub in Singapore with our technical experts and consultants, we provide quick and high-quality support on demand. A collection of tutorials and resources are also available if you wish to set up or explore new applications.</p> <p>For more information about SIMULIA and CST Studio Suite, please feel free to reach out to Matthias MEIENHOFER at <a href="mailto:matthias.meienhofer@3ds.com">matthias.meienhofer@3ds.com</a>.</p> <p><a href="http://www.3ds.com">www.3ds.com</a></p>
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## Industry Talks (Sponsors)

### AME Microwave Devices: Design and Performance – From 1 GHz to 100 GHz, Fabricated by AME Technology

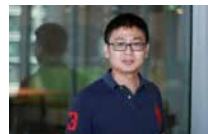
(Gold Sponsor Industry Talk, Nano Dimension Ltd)

Speaker: Yang Yang

Monday, December 06, 2021, 12:05 - 12:45

The race to develop next-generation wireless electronics is accelerating at a rapid pace. Thanks to additively manufactured electronics (AME) technology, fast-prototyping, low-entry-cost, and in-house short-run manufacturing empower millions of start-ups and companies with demanding confidentiality and accelerated innovation. We aim to build a new class of multi-beam packaged antennas and miniaturized circuit designs to advance the knowledge for next-generation (5G) mobile devices. Compact and low-cost 3D printed antennas and circuits will be delivered to circumvent the limitations of today's mobile antennas, which are usually bulky and not compatible with future ultrafast wireless communications. The proposed AME antennas and microwave circuits should be easily integrated into mobile devices linking billions of high-speed wireless systems in a dynamic environment. New antenna prototypes with multiple dynamic beams will be created for emerging intelligent and immersive technologies, e.g. unmanned vehicles, ultra-low latency virtual reality, smart cities, and seamless telepresence on the move.

**Dr. Yang Yang** is currently a Senior Lecturer and a group leader of Millimetre-Wave and Sub-Terahertz Circuits and Antennas. He is an IEEE Senior Member, Associate Editor of IEEE ACCESS (2018-2021), and Area Editor of Microwave Optical Technology Letters. Dr Yang received



the Ph.D. degree in electronic engineering (2013) from Monash University, Clayton Campus, Melbourne, Australia.

Dr Yang was involved in many international millimeter-wave and terahertz projects, including the Australian Research Council reconfigurable beam steering project, Nano Dimension (Israel) additively manufactured electronics (AME) microwave devices and antennas. He has published one book, two book chapters, and over 170 international peer-reviewed journal and conference papers in the areas of microwave and millimeter-wave circuits and antennas. Dr Yang's current research interests include millimeter-wave and sub-terahertz technologies in 5G, IoT and biomedical applications. Dr Yang is a winner of CST University Publication Award 2018, by CST, Dassault Systèmes. His students received many competitive international prizes, including the prestigious globally competitive award IEEE Microwave Theory and Technique Society Graduate Fellowship 2020, by IEEE MTT-S.

## **5G mmWave Development in IIoT and Satellite Applications and Research**

(Gold Sponsor Industry Talk, TMY Technology Inc.)

Speaker: Ethan Lin

Tuesday, December 07, 2021, 12:05 - 12:45

- 5G mmWave IIoT & Applications
- Beamforming Technology for Research
- 5G/B5G Beamforming Educational Kit - BBoard

How can 5G mmWave benefit IIoT & Satellite applications? The higher bandwidths improve sensor resolution and reduce latency. In terms of transmission speed and bandwidth, 5G mmWave is suitable for densely populated areas and/or scenarios with increased demand for stable network connectivity, such as Industrial IoT and Satellite Applications. Beamforming is the key technology in 5G mmWave; with the BBoard, a 5G NR educational kit, you can easily learn the beamforming principle.

**Ethan Lin** is a serial entrepreneur who founded three companies since 2007. Before TMYTEK, Ethan founded Scarlet Tech, a successful IoT company run until today. He worked for the smartphone maker HTC and cooperated with Microsoft and Qualcomm closely in the fields of software and wireless communication. In his first job, he built the world's largest infrared telescope (WIRCam) for CFHT in Hawaii. Ethan holds a Master's degree in Electronics Engineering on the topic of Quantum Dots IR detectors from National Chiao-Tung University, Taiwan. Ethan is the VP and Co-founder of TMYTEK, leading the pioneering mmWave products & solution technology to support 5G/B5G communication development worldwide.





## Recent Trends and Challenges of Base Station Antennas

(Platinum Sponsor Industry Talk, Huawei Technologies)

Speaker: Weihong Xiao

Wednesday, December 08, 2021, 12:05 - 12:50

This talk presents recent trends and challenges in the development of base station antennas for the 5G wireless systems with high spectrum efficiency, deployment efficiency, and energy efficiency. To improve the spectrum efficiency, upgrading xTxR is applied for sub 1GHz and massive MIMO is adopted for upper 1 GHz. For achieving fast 5G site deployment, we propose the concept of "Active + Passive" antenna modernization to use one passive antenna to incorporate 2/3/4G frequency bands and one active antenna to deploy 5G, such as C-band massive MIMO. The signal direct injection feeding (SDIF) and laser welding technologies are introduced in base station antennas for high energy efficiency. The challenges and solutions for developing the aforementioned high-efficiency base station antennas will be discussed.

**Weihong Xiao** received the Bachelor and Master degrees from the University of Electronic Science and Technology of China (UESTC), Chengdu, China, both in Electronic Engineering, in 2003 and 2006 respectively.
















Mr. Xiao has been with Huawei Technologies since 2006, where he is the CTO for Base Station Antenna. Under his leading of the antenna R&D, Huawei has become the Market Leader in base station antenna. The newly launched Huawei Blade AAU Pro has been widely recognized in the industry, packaging the iF Design Award, Red Dot Design Award, and Best Mobile Network Infrastructure Award. His research interests include the theory and design of antennas and arrays for base station, and the integration of antenna, filter and wireless algorithm for 5G mobile communications. He holds over 130 granted and pending US/WO/PCT/CN patents.

## Presentation Listing Explanation

### SESSION CODE LEGEND

Code	D	-	TT	.	N	M
Explanation	Day	-	Track	.	Ordinal	Time
Possible Values	MO TU WE TH FR	-	A1-A5: AP-S Tracks UA-UK: URSI Commissions SP: Joint Special Sessions	.	1-5	A: Morning P: Afternoon
Sample	MO	-	A5	.	2	A
	Monday	-	AP-S Track 5	.	2 <sup>nd</sup> Session	AM (Morning)

### SESSION TRACK ICON LEGEND

Icon	Code	Track
	A1	AP-S Track 1: Antennas
	A2	AP-S Track 2: Electromagnetics and Materials
	A3	AP-S Track 3: Computational and Numerical Techniques
	A4	AP-S Track 4: Propagation and Scattering
	A5	AP-S Track 5: Antenna Applications and Emerging Technologies
	UA	URSI Commission A: Electromagnetic Metrology
	UB	URSI Commission B: Fields and Waves
	UC	URSI Commission C: Radiocommunication Systems and Signal Processing
	UE	URSI Commission E: Electromagnetic Environment and Interference
	UF	URSI Commission F: Wave Propagation and Remote Sensing
	UG	URSI Commission G: Ionospheric Radio and Propagation
	UK	URSI Commission K: Electromagnetics in Biology and Medicine
	SP	AP-S/URSI Joint Special Sessions



## Antenna Theory I

Session Co-Chairs: Wen Wu, Nanjing University of Science and Technology; David R. Jackson, University of Houston

**MO-A1.1A.1** **08:20**

### Antenna Design for Improved Non-Linear Radar Performance

*Alex Bouvy, Nader Behdad, University of Wisconsin-Madison, United States; Gregory Mazzara, The Citadel, United States; Kelly Sherbondy, Kyle Gallagher, Army Research Lab, United States*

**MO-A1.1A.2** **08:40**

### A Concept of Transparent Antenna Array on Touch Screen Panel for Sub-6 GHz Cellular Devices

*Kosuke Fujita, Masaharu Takahashi, University of Chiba, Japan*

**MO-A1.1A.3** **09:00**

### Accurate Closed-Form Expressions for Maximum Radiated Power and Surface Wave Loss of Printed Antennas on a Thick Substrate

*Andrey Kobaykov, Corning Inc., United States*

**MO-A1.1A.4** **09:20**

### Sparse Cylindrical Arrays with Low Discrepancy Element Spacing Based on Van der Corput Sequence

*Travis Torres, Payam Nayeri, Randy Haupt, Colorado School of Mines, United States; Paolo Rocca, University of Trento, Italy*

**MO-A1.1A.5** **09:40**

### A Method to Widen the Range of Direction Finding by Time Modulated Array

*Yue Ma, Chen Miao, Yue Li, Wen Wu, Nanjing University of Science and Technology, China*

**Break** **10:00**

**MO-A1.1A.6** **10:20**

### Several Effective Methods on Reducing Cross-Polarization of a Patch Antenna

*Jing-Yi Zhang, Jin-Dong Zhang, Wen Wu, Da-Gang Fang, Nanjing University of Science and Technology, China*

**MO-A1.1A.7** **10:40**

### Radiation Characteristics of 2-D Fabry-Perot Cavity Antennas with Uniform Superstrate

*Yanlin Hei, Min Wang, Jia-Yan Xu, Wen Wu, Nanjing University of Science and Technology, China*

**MO-A1.1A.8** **11:00**

### Depth Direction Sensitivity of Antenna Sensor Embedded in Ground for Landslides Prediction System

*Riku Takamatsu, Subaru Iwaki, Kouta Iwamoto, Masaya Sakamoto, Futoshi Kuroki, National Institute of Technology, Kure College, Japan*

**MO-A1.1A.9** **11:20**

### Long Range Dipole with Omnidirectional Pattern Based on Spoof Surface Plasmon Polaritons Structure

*Jing Zhang, Junping Geng, Kun Wang, Chaofan Ren, Jingzheng Lu, Silei Yang, Yangzhou Zhang, Da Su, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China*

**MO-A1.1A.10** **11:40**

### Optimum Gain Conditions for 1-D Unidirectional Leaky-Wave Antennas

*Walter Fuscaldo, National Research Council of Canada, Italy; Alessandro Galli, Sapienza University of Rome, Italy; David R. Jackson, University of Houston, United States*



## Wireless Power Transmission I

Session Co-Chairs: Omar Ramahi, University of Waterloo; Zhengqing Yun, University of Hawaii at Manoa

**MO-A5.1A.1** **08:20**

### Simulation of Rectenna Systems

*Melad Olaimat, Omar Ramahi, University of Waterloo, Canada*

**MO-A5.1A.2** **08:40**

### Wireless Power Charging of Smartphone up to 6 Feet From Transmitter Antenna at 2.4 GHz

*Pawan Gaire, Dieff Vital, MD Rayhan Khan, Shubhendu Bhardwaj, Florida International University, United States; Cherif Chibane, WiGL inc., United States*

**MO-A5.1A.3** **09:00**

### Optimal Embroidered Wearable WPT Systems With Liquid Metal Nanoparticles

*Juan Barreto, Abdul-Sattar Kaddour, Stavros Georgakopoulos, Florida International University, United States; Hyeon Seok An, Robert Sheperd, Cornell University, United States*

**MO-A5.1A.4** **09:20**

### Metasurface Lens Design for High-Gain WPT System

*Scott Clemens, Magdy Iskander, Zhengqing Yun, University of Hawaii at Manoa, United States; Hooman Kazemi, Raytheon Company, United States*

**MO-A5.1A.5** **09:40**

### A Simple and Reliable Approach to Stabilizing Output Voltage of A Wireless Power Transfer System for Active Implantable Medical Devices

*Cheng Peng, Jinyan Li, Zhongwei Zhao, University of Electronic Science and Technology of China, China; Zhizhang Chen, Dalhousie University, Canada*

**Break** **10:00**

**MO-A5.1A.6** **10:20**

### Time Reversal Based Multi-Point Focusing Wireless Power Transfer

*Zhouming Yang, Jinlong Bao, Deshuang Zhao, University of Electronic Science and Technology of China, China*

**MO-A5.1A.7** **10:40**

### Wireless Power Transfer on Human Arm for Future Body Area Network

*Yiyang Wang, Yuanzheng Xu, Bo Wang, Jinjun Mo, Guilin University Of Electronic Technology, China; Safeddin Safavi-Naeini, University of Waterloo, Canada*

**MO-A5.1A.8** **11:00**

### On The Evaluation Of Wireless Power Transfer Efficiency Between Two Antenna Apertures In The Fresnel Region Over Wide Bandwidth

*Daniele Inserra, Guangjun Wen, University of Electronic Science and Technology of China, China*

**MO-A5.1A.9** **11:20**

### An Adaptive Multi Branch Dual Band Rectifier for RF Energy Harvesting Efficiency Improvement

*M. Arif Hussain Ansari, Salahuddin Raju, Agency for Science, Technology and Research (A\*STAR), Singapore*

**MO-A5.1A.10** **11:40**

### Basic Study on Two-Dimensional Beam Propagation Characteristics in Parallel Plate Waveguide

*Kazuki Yukawa, Takayuki Matsumuro, Toshio Ishizaki, Ryukoku University, Japan; Yohei Ishikawa, Kyoto University, Japan*



## High Sensitivity Phased Array Receivers for Location Services, 5G, Radio Astronomy, and Satellite Communications

Session Co-Chairs: David Davidson, Curtin University; Grant Hampson, CSIRO

**MO-SP.1A.1** **08:20**

### Performance of the ALPACA L band Phased Array Feed on the Green Bank Telescope

*Karl Warnick, Mitch Burnett, Jake Kunzler, Brian Jeffs, Brigham Young University, United States; Amit Vishwas, Donald Campbell, Cornell University, United States*

**MO-SP.1A.2** **08:40**

### Real-time Signal Processing with FPGAs and GPUs for Wideband Interference-resilient Communications

*Mark Ruzindana, Mitchell C. Burnett, Jakob Kunzler, David Marsh, Kayla Lyman, Kyle Evans, Adam Whipple, Karl Warnick, Brian Jeffs, Brigham Young University, United States*

**MO-SP.1A.3** **09:00**

### Flexible and Scalable Additively Manufactured Antenna Array Tiles for Satellite and 5G Applications Using A Novel Rugged Microstrip-to-Microstrip Transition

*Kexin Hu, Xuanke He, Manos Tentzeris, Georgia Institute of Technology, United States*

**MO-SP.1A.4** **09:20**

### Wideband RFI Cancellation Using True Time Delays and a Hadamard Projection Operator

*Jakob Kunzler, Karl Warnick, Brigham Young University, United States; Mohammad Chahardori, Deukhyoun Heo, Washington State University, United States*

**MO-SP.1A.5** **09:40**

### The Blurring Array Receiver System

*Grant Hampson, Wan Cheng, David Humphrey, John Bunton, Paul Roberts, Keith Bengston, Ron Beresford, Yuqing Chen, Raji Chekkala, Giles Babich, CSIRO, Australia*

**Break** **10:00**

**MO-SP.1A.6** **10:20**

### Spectral smoothness of embedded element patterns in the SKA-LOW prototype station AAVS2: preliminary results

*David Davidson, Daniel Ung, Curtin University, Australia*

**MO-SP.1A.7** **10:40**

### PAF application on a large spherical reflector to survey 100 times faster than the FAST

*Chengjin Jin, Jun Wang, Bo Peng, Yan Zhu, National Astronomical Observatories Chinese Academy of Sciences, China; Stefan Heyminck, Max-Planck-Institut für Radioastronomie, Germany*

**MO-SP.1A.8** **11:00**

### Current Status and Plans for the eGMRT Focal Plane Array Beamformer

*Kaushal Buch, Bela Dixit, Ajithkumar B., Jayaram Chengalur, Giant Metrewave Radio Telescope, NCRA-TIFR, India*

**MO-SP.1A.9** **11:20**

### Experimental verification of anomalous spectral features of SKALA4.1 antenna

*Georgios Kyriakou, National Institute for Astrophysics, Italy; Ravi Subrahmanyam, Commonwealth Scientific and Industrial Research Organisation, Australia; Pietro Bolli, National Institute for Astrophysics, Italy; David Davidson, International Centre for Radioastronomy Research, Curtin University, Australia*

**MO-SP.1A.10** **11:40**

### Towards A New Figure of Merit for Reflector Antenna Based Imaging

*Mariet Venter, Dirk de Villiers, Stellenbosch University, South Africa*



Monday, December 6  
MO-A1.2A

08:20 - 12:00  
Melati Ballroom 4103

## Broadband Antennas I

Session Co-Chairs: Mohammad Ababil Hossain, University of California, Davis; Jae-Yeong Lee, Pohang University of Science and Technology (POSTECH)

**MO-A1.2A.1** **08:20**

### A Compact Low-Cost and Lightweight 3-D Printed Horn Antenna for UWB System

*Mohammad Ababil Hossain, Samuel Wagner, Stephen Pancrazio, Anh-Vu Pham, University of California, Davis, United States*

**MO-A1.2A.2** **08:40**

### Wideband Circular Patch Antenna Excited in the Broadside TM<sub>12</sub> Mode

*Sai Radavaram, Saininad Naik, Maria Pour, University of Alabama in Huntsville, United States*

**MO-A1.2A.3** **09:00**

### A Wideband Stacked Patch-Patch Antenna with Hybrid Perturbations for Circular Polarization

*Muhammad Mubashshir Hossain, Syed Salman Kabir, Saeed Latif, Edmund Spencer, University of South Alabama, United States; Mohammad Qudrat-E-Maula, Global Skyware, United States*

**MO-A1.2A.4** **09:20**

### Wideband Compact Stripline Antenna for 5GB/6G applications

*Mohamed Ali, Shoukry Shams, Abdelrazik Sebak, Concordia University, Canada; Mahmoud Elsaadany, Ecole de Technologie Supérieure, Canada; Ghyslain Gagnon, École de technologie supérieure, Canada*

**MO-A1.2A.5** **09:40**

### Wideband, X-band Series-Fed Patch Array

*Matthew Bray, Johns Hopkins Applied Physics Laboratory, United States*

**Break** **10:00**

**MO-A1.2A.6** **10:20**

### Broadband Antenna-on-Display Applicable for WiFi

*Yerim Oh, Jae-Yeong Lee, Dongseop Lee, Wonbin Hong, pohang university of science and technology, Korea (South); Dongpil Park, Dongwoo Fine-Chem, Korea (South)*

**MO-A1.2A.7** **10:40**

### A Metasurface Antenna with the Characteristic of Broadband and Stable High Gain

*Deqiang Yang, Mi Wan, Sihao Liu, University of Electronic Science and Technology of China, China*

**MO-A1.2A.8** **11:00**

### An FSS-loaded PUMA Array with 16.5:1 bandwidth

*Hongmei Li, Danqi Lian, Jiaran Qi, Harbin Institute of Technology, China*

**MO-A1.2A.9** **11:20**

### Compact and Wideband Terahertz Lens Integrated Bow-tie Antenna for detector

*Bing Wang, Mingxun Li, Xin Lv, Beijing Institute of Technology, China*

**MO-A1.2A.10** **11:40**

### A Compact Differential quasi-Yagi Antenna With Broadband and Uniplanar Characteristics

*Zhihao Zhu, Yaowei Hou, Shanghai Jiao Tong University, China; Yueping Zhang, Nanyang Technological University, China*



## Reconfigurable Antennas and Arrays I

Session Co-Chairs: Yuandan Dong, University of Electronic Science and Technology of China; Maria Pour, University of Alabama in Huntsville

**MO-A1.3A.1** **08:20**

### A Reconfigurable Radiation Pattern Microstrip Patch Antenna with High Mode Purity

*Zabed Iqbal, Tanzeela H. Mitha, Maria Pour, University of Alabama in Huntsville, United States*

**MO-A1.3A.2** **08:40**

### Reconfigurable Cylindrical MEFSS for 360 Azimuthal Beam Steering

*Nicolas Faria, Sean Victor Hum, University of Toronto, Canada*

**MO-A1.3A.3** **09:00**

### Frequency Tunability of a Low Profile, Yagi Antenna

*John Verboom, Sungkyun Lim, Georgia Southern University, United States*

**MO-A1.3A.4** **09:20**

### Miniaturized Reconfigurable SIW-Based Leaky-Wave Antenna Loaded with Inclined Slot

*Nima Javanbakht, Rony Amaya, Barry Syrett, Carleton University, Canada; Jafar Shaker, Communication Research Center, Canada*

**MO-A1.3A.5** **09:40**

### Liquid-Metal-Tuned Patch Element for Flexible and Reconfigurable Reflectarrays/Intelligent Surfaces

*Kevin Xu, Jun Choi, University at Buffalo, The State University of New York, United States*

**Break** **10:00**

**MO-A1.3A.6** **10:20**

### A Compact Reconfigurable Antenna for Borehole Radar

*Jisheng Tong, Qing Zhao, University of Electronic Science and Technology of China, China; Yongxin Guo, National University of Singapore, Singapore*

**MO-A1.3A.7** **10:40**

### Miniaturized Meta-Resonator Based Pattern Reconfigurable Antenna for Sub 6 GHz Application

*Zhan Wang, Yuandan Dong, University of Electronic Science and Technology of China, China*

**MO-A1.3A.8** **11:00**

### Indoor WiFi Channel Measurements with Printed Endfire Beam-Steering Pixel Antennas

*Chi Zhang, Charles Ng, Chi-Yuk Chiu, Ross Murch, Hong Kong University of Science and Technology, Hong Kong SAR of China*

**MO-A1.3A.9** **11:20**

### Dual-Polarized Reconfigurable Antenna Using Annular Slots for 2.45 GHz ISM Band Applications

*Na-Rae Kwon, Sang-Min Nam, Wang-Sang Lee, Gyeongsang National University, Korea (South)*

**MO-A1.3A.10** **11:40**

### Design of a radiation-type low-profile programmable antenna

*Shaopeng Pan, Lin Qi, Wanting Shen, Gaosheng Li, Hunan University, China*



Monday, December 6  
MO-A2.1A

08:20 - 12:00  
Peony Ballroom 4402

## Metasurfaces in Beam Steering and Beam Forming I

Session Co-Chairs: Sean Hum, University of Toronto; Amir Zaghlool, CCDC U.S. Army Research Lab and Virginia Tech

**MO-A2.1A.1** **08:20**

### Metasurface-Pair Design for a Scan-angle Enhancement System

*Jaemin Kim, George Eleftheriades, University of Toronto, Canada*

**MO-A2.1A.2** **08:40**

### Frequency-Beam-Scanning Nonreciprocal Transmissive Polychromatic Metasurface

*Sajjad Taravat, George V. Eleftheriades, University of Toronto, Canada*

**MO-A2.1A.3** **09:00**

### Extreme Beam-forming with Metagrating-assisted Planar Antennas

*Genyuu Xu, Sean Hum, George Eleftheriades, University of Toronto, Canada*

**MO-A2.1A.4** **09:20**

### A Reconfigurable Intelligent Surface Using a 2-Bit Programmable Metasurface for Communications

*John Hodge, Virginia Tech, United States; Thomas Spence, Northrop Grumman, United States; Amir Zaghlool, CCDC U.S. Army Research Lab and Virginia Tech, United States*

**MO-A2.1A.5** **09:40**

### Investigating Dielectric Covers to Reduce Unwanted Lobes in Near-Field Meta-Steering Systems

*Khushboo Singh, Muhammad Usman Afzal, Karu P. Esselle, University of Technology Sydney, Australia; Ali Lalbakhsh, Macquarie University, Australia*

**Break** **10:00**

**MO-A2.1A.6** **10:20**

### Wideband 1-Bit Dynamical Beam Steering Transmitarray

*Fuheng Zhang, Fudan University and Shanghai Radio Equipment Research Institute, China; Hao Gu, Shanghai Radio Equipment Research Institute, China; Kaihua Zhang, Shanghai Academy of Spaceflight Technology, China; Guo-Min Yang, Ya-Qiu Jin, Fudan University, China*

**MO-A2.1A.7** **10:40**

### A Reconfigurable Reflecting Metasurface with Sensing Capabilities

*Idban Alamzadeh, Mohammadreza F. Imani, Arizona State University, United States; George C. Alexandropoulos, National and Kapodistrian University of Athens, Greece; Nir Shlezinger, Ben-Gurion University of the Negev, Israel*

**MO-A2.1A.8** **11:00**

### Boundary-Source Coherent Beamforming Using Metasurface

*Si Yu Miao, Feng Han Lin, ShanghaiTech University, China*

**MO-A2.1A.9** **11:20**

### Multi-Layered Flat Meta-Lenses for Conical Beam Scanning via Optimization of Geometrical Optics

*Anastasios Papanthanasopoulos, Yahya Rahmat-Samii, University of California, Los Angeles, Greece*

**MO-A2.1A.10** **11:40**

### Fixed Frequency Beam Scanning 5G Antenna Array with Switchable Multiple Beams and Wide Beam

*Hao Xiang Li, Yong Jin Zhou, Shanghai University, China*





## 5G and 6G Antenna Systems for Mobile Devices: Present Challenges and Future Opportunities

Session Co-Chairs: Wonbin Hong, Pohang University of Science and Technology (POSTECH); Huan-Chu Huang, Etheta Communication Technology Co., Ltd.

**MO-SP.2A.1** **08:20**

### Hybrid Active-Passive Beamforming for Scalable sub-Terahertz Antenna Array

*Kai-Qi Huang, Madhavan Swaminathan, Georgia Institute of Technology, United States*

**MO-SP.2A.2** **08:40**

### A Reconfigurable Intelligent Surface for 5G Wireless Communication Applications

*Bharath Kashyap, Panagiotis Theofanopoulos, Aditya Shekhawat, Anuj Modi, Anand Sengar, Sanjay Kumar, Arkajyoti Chang, Tawfik Osman, Ahmed Alkhateeb, Georgios Trichopoulos, Arizona State University, United States*

**MO-SP.2A.3** **09:00**

### Power Efficient RF Self-Interference Cancellation System for Simultaneous Transmit and Receive

*Md Nurul Anwar Tarek, Marisol Roman, Elias A. Alwan, Florida International University, United States*

**MO-SP.2A.4** **09:20**

### Flexible Quasi-Yagi-Uda antenna for 5G communication

*Behzad Ashrafi Nia, Franco De Flaviis, Soheil Saadat, University of California, Irvine, United States*

**MO-SP.2A.5** **09:40**

### Fan-Out Wafer-Level Package mm-Wave/Sub-THz LWA with Wide-Angle Scanning Capability

*Jae-Yeong Lee, Yeim Oh, Suho Chang, Sungmin Cho, Ho-Jin Song, Wonbin Hong, Pohang University of Science and Technology, Korea (South)*

**Break** **10:00**

**MO-SP.2A.6** **10:20**

### Innovative mm-Wave AiP-based Designs to Handsets: AiPiA and AiPaA

*Huan-Chu Huang, Etheta Communication Technology Co., Ltd., China*

**MO-SP.2A.7** **10:40**

### Impact of Phase Shifter Design on Beam Squinting in Phased Array

*Ryan Ong, Salahuddin Raju, Muthusamy Kumarasamy Raja, IME/A\*STAR, Singapore*

**MO-SP.2A.8** **11:00**

### Millimeter-Wave 5G Antenna-on-Display Topology Featuring Wideband and Dual-Polarization for Cellular Devices

*Bumhyun Kim, Junho Park, Wonbin Hong, Pohang University of Science and Technology, Korea (South)*

**MO-SP.2A.9** **11:20**

### Surface Equivalence Theory for 5G MIMO Metasurface Lens Antenna Design

*Amin Kianinejad, MEDS Technologies Pte Ltd, Singapore; Zhi Ning Chen, National University of Singapore, Singapore*

**MO-SP.2A.10** **11:40**

### High Gain Waveguide Tilted Slot Antenna for Millimeter Wave application

*Hatem O. Hanooshi, Mohamad Kamal Rahim, Noor Asniwa Murad, Yaqhdan Mahmood Hussein, Universiti Teknologi Malaysia, Malaysia*



## Biomedical Applications I

Session Co-Chairs: Negar Tavassolian, Stevens Institute of Technology; Ran Guo, University of Houston

- MO-A5.2A.1** **08:20**  
Microwave Planar Sensor Antenna for Glucose Sensing in Aqueous Solutions  
*Mohammad Abdolrazzagh, George Eleftheriades, Roman Genov, University of Toronto, Canada*
- MO-A5.2A.2** **08:40**  
A Regenerative RF Sensing System for Detection of Weak Electromagnetic Radiation from Biofilms  
*Menglou Rao, Kamal Sarabandi, University of Michigan, United States*
- MO-A5.2A.3** **09:00**  
Respiration Monitoring Using Camera-Guided Frequency-Modulated Continuous-Wave Radar  
*Arash Shokouhmand, Negar Tavassolian, Stevens Institute of Technology, United States; Amir Avniti, Behnood Gholami, Autonomous Healthcare, Inc., United States*
- MO-A5.2A.4** **09:20**  
Monitoring COVID-19 Patients Using CardioPulmonary Stethoscope RF Technology  
*Pratiksha Shukla, Magdy Iskander, Scott Clemens, Zhengqing Yun, University of Hawaii at Manoa, United States*
- MO-A5.2A.5** **09:40**  
Low Cost IR-UWB Radar for Multisubject Non-Contact Vital Sign Detection  
*Abdel-Kareem Moadi, Marvin Joshi, Ozlem Kilic, Aly Fathy, University of Tennessee, Knoxville, United States*
- Break** **10:00**
- MO-A5.2A.6** **10:20**  
Wearables for Joint Effusion Detection: An Analysis for Magnitude-/Phase-Only vs. Combined Readings  
*Connor Jenkins, Vigyanshu Mishra, Asimina Kiourtj, The Ohio State University, United States*
- MO-A5.2A.7** **10:40**  
Shifted-Beam Array Coil for Highly Focal Transcranial Magnetic Stimulation  
*Fangwei Chang, George Eleftheriades, University of Toronto, Canada*
- MO-A5.2A.8** **11:00**  
Landmark Effects on RF-induced Heating for Patients with Artificial Shoulder at 1.5T MRI  
*Ran Guo, Jianfeng Zheng, Ji Chen, University of Houston, United States; Wolfgang Kainz, US Food and Drug Administration, United States*
- MO-A5.2A.9** **11:20**  
Impacts of Patient Postures on the RF-induced Heating for An External Fixation Device  
*Xiaolin Yang, Jianfeng Zheng, Ji Chen, University of Houston, United States; Wolfgang Kainz, US Food and Drug Administration, United States*
- MO-A5.2A.10** **11:40**  
Simplified Human Body Models with Reduced Types of Tissues for MRI at 1.5T  
*Meiqi Xia, Ran Guo, Jianfeng Zheng, Ji Chen, University of Houston, United States; Devashish Shrivastava, Wolfgang Kainz, US Food and Drug Administration, United States*



**Monday, December 6**  
**MO-A1.4A**

**08:20 - 12:00**

**Virtual (Chairs/Speakers to go to Melati Ballroom 4002)**

## **Magneto-Electric Dipole and Microstrip Antennas I**

Session Co-Chairs: Andrew Chrysler, Idaho State University; Aditya Singh, Queen's University

**MO-A1.4A.1** **08:20**

### **Planar 40-port Slot Antenna for Healthcare applications**

*Parisa Lotfi Poshgol, Saber Soltrani, Yuhao Wu, Douglas H. Werner, Pennsylvania State University, United States; Nima Bayat-Makou, University of Toronto, Canada*

**MO-A1.4A.2** **08:40**

### **Effect of diagonal slot dimensions on Axial Ratio and S11 at 26 GHz Design Frequency**

*Brandon Starks, Andrew Chrysler, Idaho State University, United States*

**MO-A1.4A.3** **09:00**

### **Design of a Patch Antenna Using Materials of Clothing: a Study Under Simulations**

*Eduardo Rodriguez, Edwin Jabonero, Maicol Cardenas, Cafam University Foundation, Colombia*

**MO-A1.4A.4** **09:20**

### **A Miniaturized Magneto-Electric Dipole Antenna for Array Applications**

*Utkarsh Deva, Alois Freundorfer, Queen's University, Canada; Gaozhi (George) Xiao, National Research Council of Canada, Canada; Yazan Al-Alem, Yahia Antar, Royal Military College, Canada*

**MO-A1.4A.5** **09:40**

### **Wideband CPW-PS Feed for Millimeter Wave Magneto-Electric Dipole Antenna**

*Aditya Singh, Carlos E. Saavedra, Queen's university, Canada*

**Break** **10:00**

**MO-A1.4A.6** **10:20**

### **Millimeter-Wave PRGW ME Dipole Antenna with Surface Mounted Conical Horn for 5G/6G**

*Mohamed Ali, Tayeb A. Denidni, Universite du Quebec, Canada; Osama M. Haraz, Assiut University, Egypt*

**MO-A1.4A.7** **10:40**

### **Substrate Integrated Coaxial Line Fed Magneto-Electric Dipole Antenna for 5G**

*Aditya Singh, Carlos E. Saavedra, Queen's university, Canada*

**MO-A1.4A.8** **11:00**

### **Low RCS Transmitarray Using Phase Controllable Resonator**

*Xuan Wang, Ronghong Jin, Shanghai Jiao Tong University, China; Peiyuan Qin, Can Ding, University of Technology Sydney, Australia*

**MO-A1.4A.9** **11:20**

### **Dual-mode Bandpass Filter based on Circular Fractal Patch Resonator for WLAN Applications**

*Xiaoping Li, Xin Cao, Qiangming Cai, Yuyu Zhu, Yihong Qi, Jun Fan, Southwest University of Science and Technology, China*

**MO-A1.4A.10** **11:40**

### **Design of W-band Multi-OAM-mode Antenna with High Purity**

*Hongliang Wu, Xianling Liang, Weihao Qi, Yunfan Zhang, Junping Geng, Ronghong Jin, Shanghai Jiao Tong University, China*



## RFID Antennas and Systems I

Session Co-Chairs: Yong-Hong Lee, Universiti Tunku Abdul Rahman; Neda Nourshamsi, Michigan State University

**MO-A5.3A.1** **08:20**

### RFID Tag Analysis Using an Equivalent Circuit

*Pavel Nikitin, John Kim, KVS Rao, Impinj, United States*

**MO-A5.3A.2** **08:40**

### A Narrowband Harmonic Tag Using a Microstrip Ring Antenna

*Cory Hilton, Neda Nourshamsi, Jeffery Nanzer, Michigan State University, United States*

**MO-A5.3A.3** **09:00**

### 24GHz RFID for Orientation Detection and Tracking Applications in Human Activity Recognition and Motion

#### Capture

*Ajibayo Adeyeye, Charles Lynch, Manos Tentzeris, Georgia Institute of Technology, United States; Jimmy Hester, Atheraxon, United States*

**MO-A5.3A.4** **09:20**

### A Shared NFC Antenna Using Metal Frame of Smartphone

*HyoungHwan Roh, YoungTae Kim, Samsung Electronics, Korea (South)*

**MO-A5.3A.5** **09:40**

### A Meander Line UHF RFID Reader Antenna with Uniform Near-field Distribution

*Rui Xu, Zhongxiang Shen, Nanyang Technological University, Singapore*

**Break** **10:00**

**MO-A5.3A.6** **10:20**

### Small 3D-Dipole Antenna for RFID Tag Mounted on a Full Container of Water

*Chin-Cheng Chang, Hua-Ming Chen, Nguyen Minh Tan, National Kaohsiung University of Science and Technology, Taiwan; Chien-Hung Chen, R.O.C. Air Force Academy, Taiwan*

**MO-A5.3A.7** **10:40**

### Double U-slotted Antenna for RFID Tags Mountable on Metallic Surfaces using rectangular-loop feed

*Ziwen Yang, Sitao Chen, Xiaolin Yang, University of Electronic Science and Technology of China, China*

**MO-A5.3A.8** **11:00**

### Capacitors-loaded Dipolar Patch Antenna for UHF Tag Miniaturization

*Shao-Ming Chiang, Eng-Hock Lim, Pei-Song Chee, Yong-Hong Lee, Universiti Tunku Abdul Rahman, Malaysia; Fwee-Leong Bong, Tunku Abdul Rahman University College, Malaysia*

**MO-A5.3A.9** **11:20**

### Statistical Analysis of Electric Field Distribution in Metal Cabinet with Built-in RFID Antennas

*Guohong Du, Shun Tang, Yuan Zhao, Xiaofeng Sun, Chengdu University of Information Technology, China*

**MO-A5.3A.10** **11:40**

### Coplanar-fed Planar Inverted-L Antennas (PILAs) for Miniature On-Metal RFID Tag Design

*Jun-Ian Tan, Yong-Hong Lee, Eng-Hock Lim, Universiti Tunku Abdul Rahman, Malaysia*



Monday, December 6  
MO-A2.2A

08:20 - 12:00  
Peony Ballroom 4403

## Metasurfaces I

Session Co-Chairs: Halim Boutayeb, University of Quebec in Outaouais; Do-Hoon Kwon, University of Massachusetts Amherst

**MO-A2.2A.1** **08:20**

### Effect of Bending on Metasurface Antenna and Microstrip Patch Antenna Array

*Melad Olaimat, Youcef Chaouche, Omar Ramahi, University of Waterloo, Canada; Mohamed El Badawe, Soundskirt Inc., Canada; Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada*

**MO-A2.2A.2** **08:40**

### Non-Uniform Gratings that Produce Preselected Anomalous Reflections

*Thorikild Hansen, Seknion Inc., United States*

**MO-A2.2A.3** **09:00**

### New Design Technique for mm-Wave Reflecting Electromagnetic Surfaces With Varying Phase Shifts

*Bilel Mnassi, Halim Boutayeb, Larbi Talbi, University of Quebec in Outaouais, Canada*

**MO-A2.2A.4** **09:20**

### Efficient 2-D Plane Wave-to-Surface Wave Couplers

*Hakjune Lee, Do-Hoon Kwon, University of Massachusetts Amherst, United States*

**MO-A2.2A.5** **09:40**

### Millimeter-Wave Quarter-Wave Plate for Diffusion Bonded Slot Array Antennas

*Mohamed Emara, Shulabh Gupta, Carleton University, Canada; Takashi Tomura, Jiro Hirokawa, Tokyo Institute of Technology, Japan*

**Break** **10:00**

**MO-A2.2A.6** **10:20**

### Zero Thickness Sheet Model of Dispersive & Nonlinear Metasurfaces

*João Guilherme Nizer Rahmeier, Tom Smy, Shulabh Gupta, Carleton University, Canada; Jeremy Upham, Robert W. Boyd, University of Ottawa, Canada*

**MO-A2.2A.7** **10:40**

### Multipoles THz Metamaterial Biosensor for Low-Density Biomarker Detection

*Milad Entezami, Seyed Ali Hosseini Farahabadi, Hadi Amarloo, Safieddin Safavi Naeini, University of Waterloo, Canada*

**MO-A2.2A.8** **11:00**

### Mathematical Multiplexing Operation of Complex Amplitude Metasurfaces

*Ji Liu, Jurui Qi, Xiong Wang, ShanghaiTech University, China*

**MO-A2.2A.9** **11:20**

### A Fast Calibration Method for Digital Metasurface with Periodic Phase Modulation

*Gang Ni, Chong He, Junping Geng, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China*

**MO-A2.2A.10** **11:40**

### Dimer Dielectric Huygens' Metasurface: Realizing Perfect Anomalous Reflection at 60 GHz

*Abhishek Sharma, Alex M. H. Wong, City University of Hong Kong, Hong Kong SAR of China*



Monday, December 6  
MO-A3.3A

08:20 - 12:00  
Peony Junior Ballroom 4511

## Integral Equation Methods I

Session Co-Chairs: Vladimir Okhmatovski, University of Manitoba; Abdulkadir C. Yucel, Nanyang Technological University

**MO-A3.3A.1** **08:20**

Adaptive Refinement for Scattered Field Quantities of Interest for the Coupled EFIE-MFIE

*Jake Harmon, Branislav Notaras, Colorado State University, United States*

**MO-A3.3A.2** **08:40**

On Evaluation of Incident Fields from Near Sources in Method of Moments Layered Media Solvers

*Shucheng Zheng, Vladimir Okhmatovski, University of Manitoba, Canada*

**MO-A3.3A.3** **09:00**

Strata: An Open-Source C++ Library for Computing Green's Functions for Layered Media

*Shashwat Sharma, Piero Triverio, University of Toronto, Canada*

**MO-A3.3A.4** **09:20**

Implementation of Discrete Exterior Calculus in Solving the A-Phi Formulation

*Boyuan Zhang, Dan Jiao, Weng Cho Chew, Purdue University, United States*

**MO-A3.3A.5** **09:40**

Improving the Efficiency of Parallel FFTs in Parallel Electromagnetic Solvers Based on the AIM

*Damian Marek, Piero Triverio, University of Toronto, Canada*

**Break** **10:00**

**MO-A3.3A.6** **10:20**

Green's Function for Pedagogical Development II: Inhomogeneous Boundary Conditions

*Mahmoud Alashi, Z. John Shen, Thomas Wong, Illinois Institute of Technology, United States*

**MO-A3.3A.7** **10:40**

FFT-Accelerated and Tucker-Enhanced Impedance Extraction for Voxelized Structures

*Mingyu Wang, Abdulkadir C. Yucel, Nanyang Technological University, Singapore*

**MO-A3.3A.8** **11:00**

Error Analysis of Isosceles Triangular Interpolation for Non-uniform Grid

*Wen Luo, Jinbo Liu, Zengrui Li, Communication University of China, China; Jiming Song, Iowa State University, United States*

**MO-A3.3A.9** **11:20**

A Singular Cancellation Method Inspired by Differential Geometry for Evaluating Nearly Singular Integrals

*Yi Zhou, Rayleigh R. Chang, Mei Song Tong, Tongji University, China*

**MO-A3.3A.10** **11:40**

An Exponentially Convergent Quadrature Method for Evaluating Convolutional Integrals

*Li Zhang, Rayleigh R. Chang, Mei Song Tong, Tongji University, China*



**Monday, December 6**  
**MO-A4.1A**

**08:20 - 12:00**

**Virtual (Chairs/Speakers to go to Peony Ballroom 4502)**

## **Propagation and Wireless Communications I**

Session Co-Chairs: Costas Sarris, University of Toronto; Zaifeng Yang, Institute of High Performance Computing

**MO-A4.1A.1** **08:20**

### **Analysis of Empirical Propagation Models in Suburban Areas at 800 MHz and 1.8 GHz**

*Laercio Mendonca, Federal University of Rio Grande do Norte, Brazil; Bruno Cavalcanti, IFPB - Federal Institute of Education, Science and Technology of Paraíba, Brazil*

**MO-A4.1A.2** **08:40**

### **Physics-Informed Machine Learning Models for Indoor Wi-Fi Access Point Placement**

*Dongfang Cui, Guoli Yang, Shichen Ji, Shuyang Luo, Aristeidis Seretis, Costas Sarris, University of Toronto, Canada*

**MO-A4.1A.3** **09:00**

### **Deterministic-Based 5G mmWave Propagation Characterization in Urban Environments**

*Leyre Azpilicueta, Fidel Alejandro Rodríguez-Carbo, Mikel Celaya-Echarri, Tecnológico de Monterrey, Mexico; Peio Lopez-Iturri, Public University of Navarre, Spain; David G. Michelson, Francisco Falcone, University of British Columbia, Canada*

**MO-A4.1A.4** **09:20**

### **Prediction of 28 GHz Millimeter-wave Indoor Propagation Characteristics in a Residential House**

*Sango Nagamoto, Manabu Omiya, Hokkaido University, Japan*

**MO-A4.1A.5** **09:40**

### **Deep Learning Based Blind Deconvolution for Geophysical Data Processing**

*Xuqing Wu, Yuchen Jin, Chenpei Huang, Miao Pan, Jiefu Chen, University of Houston, United States*

**Break** **10:00**

**MO-A4.1A.6** **10:20**

### **Machine-Learning-Assisted Modeling of Millimeter-Wave Channels**

*Peize Zhang, Cheng Yi, Haiming Wang, Southeast University, China*

**MO-A4.1A.7** **10:40**

### **Measurements of 3.5 GHz OAM Misaligned Channels in Indoor Corridor Scenarios**

*Yang Wang, Panpan Shi, Xi Liao, Tao Hu, Chongqing University of Posts and Telecommunications, China; Jiliang Zhang, Alan Tennant, University of Sheffield, United Kingdom*

**MO-A4.1A.8** **11:00**

### **Projection-assisted Indoor Attenuation Parameter Compression based on Curve Fitting**

*Meng Gao, Xiaolong Yang, Mu Zhou, Chongqing University of Posts and Telecommunications, China*

**MO-A4.1A.9** **11:20**

### **A high-speed railway channel measurement scheme based on 5G signal**

*Yabo Wang, Jianwen Ding, Jia Yu, Dan Fei, Beijing Jiaotong University, China; Zhiping Chen, Zhongxing Telecom Equipment, China*

**MO-A4.1A.10** **11:40**

### **Intermediary Objective Based Optimization Method for Field Focusing through an Inhomogeneous Medium**

*Shang Guo, Deshuang Zhao, University of Electronic Science and Technology of China, China*



Monday, December 6  
MO-A1.1P

14:00 - 17:40  
Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Antenna Theory II

Session Co-Chairs: Tommaso Isernia, Università Mediterranea di Reggio Calabria; BRATIN GHOSH, Indian Institute of Technology Kharagpur

**MO-A1.1P.1** **14:00**

### Rotationally Symmetric Antennas Using Characteristic Mode Analysis

*Yongxin Chen, Xiuping Li, Beijing University of Posts and Telecommunications, China*

**MO-A1.1P.2** **14:20**

### Guided and Leaky Mode Radiation Characteristics of Solid Dielectric Pyramidal Horn Antenna

*Shreya Menon, Deepthi Krishna, C. K. Aanandan, Cochin University of Science and Technology, India; Surya Pathak, Institute for Plasma Research, India*

**MO-A1.1P.3** **14:40**

### Low Cross-Polarized Patch Antenna With Lossy Material

*Jing-Yi Zhang, Jin-Dong Zhang, Wen Wu, Da-Gang Fang, Nanjing University of Science and Technology, China*

**MO-A1.1P.4** **15:00**

### Compact Cavity-backed Magneto-Electric Dipole Array Filtenna Using Hybrid Coupled-resonators

*Behrooz Rezaee, Hossein Sarbandi Farahani, Wolfgang Bösch, Graz University of Technology, Austria*

**MO-A1.1P.5** **15:20**

### Gain Enhancement of Patch Antenna Array Using a Metamaterial Superstrate

*Priyanka Deb Sinha, Bratin Ghosh, Indian Institute of Technology Kharagpur, India; Deepa B. G., Defence Research and Development Laboratory, India*

**Break** **15:40**

**MO-A1.1P.6** **16:00**

### Circularly Polarized Antenna with Isoflux pattern for Space IoT applications

*Manh Thao Nguyen, Le Huy Trinh, University of Information Technology, Viet Nam; Fabien Ferrero, Université Côte d'Azur, France*

**MO-A1.1P.7** **16:20**

### Pre-phased Planar Array with 1-bit Amplitude Control for Single-beam Scanning

*Jiexi Yin, Zhi Ning Chen, National University of Singapore, Singapore*

**MO-A1.1P.8** **16:40**

### Correlation Analysis of MIMO Base Station Antenna Arrays With Different Column Spacings

*Jiayue Jiang, Luyi Zhao, Xidian University, China*

**MO-A1.1P.9** **17:00**

### Advances in Antenna Diagnostic Techniques through Post-Processing of Antenna Measurements

*Fernando Rodríguez Varela, Celia Fontá Romero, Belen Galocha Iragüen, Manuel Sierra Castañer, Universidad Politécnica de Madrid, Spain; José Antonio López Pérez, Centro astronómico Yebes, Spain*

**MO-A1.1P.10** **17:20**

### A New Approach to Phase Retrieval and its Application to Reflector Antennas Diagnostics

*Roberta Palmeri, IREA-CNR, Napoli, Italy, Italy; Giada Maria Battaglia, Andrea Francesco Morabito, Tommaso Isernia, Università Mediterranea di Reggio Calabria, Italy*





Monday, December 6  
MO-A5.1P

14:00 - 15:40  
Melati Ballroom 4104

## Wireless Power Transmission II

Session Co-Chairs: Haruichi Kanaya, Kyushu University; Agostino Monorchio, University of Pisa / RaSS Laboratory CNIT

**MO-A5.1P.1** 14:00

### Design of a High Gain and Miniaturized Inter-digital CPW Antenna for Energy Harvesting

*Mohamed Mansour, Torigoe Shota, Haruichi Kanaya, Kyushu University, Japan*

**MO-A5.1P.2** 14:20

### Wireless Charging of Ground-based Sensors from a UAV-carried Transmitter

*David Chatzichristodoulou, RF and Microwave Solutions LTD, Cyprus; Abdul Quddious, KIOS Research and Innovation Center of Excellence, Cyprus; Loukia Vassiliou, Agricultural Research Institute, Nicosia, Cyprus; Photos Vryanides, Symeon Nikolaou, Frederick Research Center, Nicosia, Cyprus*

**MO-A5.1P.3** 14:40

### Analytical Analysis and Simulation of Structures of Wireless Power Transfer System

*Andrey Azarov, Igor Shirokov, Sevastopol State University, Russia*

**MO-A5.1P.4** 15:00

### Wireless Power Transfer to a Visual Prosthesis: 100 mW at 6.78 MHz

*Tom van Nunen, Rob Mestrom, Hubregt Visser, Eindhoven University of Technology, Netherlands*

**MO-A5.1P.5** 15:20

### A Homogenized Magnetic Metasurface for Misalignment Robustness Enhancement in Wireless Power Transfer

*Daniilo Brizi, Agostino Monorchio, University of Pisa/CNIT, Italy; Valeria Lazzoni, University of Pisa, Italy*



Monday, December 6  
MO-SP.1P Special Session

16:00 - 17:40  
Melati Ballroom 4104

## Antennas for Wireless Energy Harvesting and Power Transfer Applications

Session Co-Chairs: Nasimuddin Nasimuddin, Institute for Infocomm Research, A-STAR; Sun Hong, Soongsil University

**MO-SP.1P.1** 16:00

### Magnetic Coupling WPT Efficiency Improvement by Inserting Relay Coil with Optimized Load Impedance

*Tamami Maruyama, Masashi Nakatsugawa, Tai Kimura, National Institute of Technology, Hakodate College, Japan*

**MO-SP.1P.2** 16:20

### Rotman Lens-based High Gain Retrodirective Beamformer for Wireless Power Transfer at Ka-band

*Ha Young Hong, Hong Soo Park, Kanghyeok Lee, Sun Hong, Soongsil University, Korea (South)*

**MO-SP.1P.3** 16:40

### A Performance Metric for Mode Decision of Linear Array-Based WPT System via Beamforming and Time-Reversal

*Hong Soo Park, Sun Hong, Soongsil University, Korea (South)*

**MO-SP.1P.4** 17:00

### Dual Band Slot Antenna with Suppressed Higher Order Harmonics for Wireless Power Transmission

*Neeta Singh, Vikrant Kaim, Binod Kumar Kanaujia, Jawaharlal Nehru University, India*

**MO-SP.1P.5** 17:20

### Remote Destruction of the Coronavirus by Dual-Polarized Wireless Power Transmission

*Konstantinos Kossenas, Maksim Kuznetsov, Symon Podilchak, University of Edinburgh, United Kingdom; Davide Comite, Sapienza University of Rome, Italy*



## Antenna Arrays

Session Co-Chairs: Jian Lu, National University of Singapore; Zhongxiang Shen, Nanyang Technological University

**MO-UB.1P.1** **14:00**

### Beam Steering Resolution for Large Antenna Array

*Xinyi Tang, Xianming Qing, N. Nasimuddin, Yijun Zhou, Bin Luo, Wenjiang Wang, Francois Chin, Institute for Infocomm Research, Singapore*

**MO-UB.1P.2** **14:20**

### Differentially Fed Linear Antenna Array with Wideband Common-mode Absorption

*Peng Zhou, Hongxin Zhao, Shunli Li, Xiaoxing Yin, Southeast University, China*

**MO-UB.1P.3** **14:40**

### Analysis of Limitation of Beam Steering in Large Scale Array Antenna For 5G Base Station and its economical Solution

*Juneseok Lee, Dohyuk Ha, Youngju Lee, Samsung Electronics, Korea (South)*

**MO-UB.1P.4** **15:00**

### Progressive Phaseshifter Concept for Beam-Scanned Waveguide Array

*Jian Lu, Peng Khiang Tan, Theng Huat Gan, National University of Singapore, Singapore*

**MO-UB.1P.5** **15:20**

### Data-Driven Beamforming Model for Digital Beamforming Applications Using Unsupervised Learning

*Xiao Xiao, Yilong Lu, Nanyang Technological University, Singapore*

**Break** **15:40**

**MO-UB.1P.6** **16:00**

### DOA tracking based on multi-Bernoulli filter for planar array

*Zhao Jun, Gui Renzhou, Tongji University, China; Dong Xudong, Nanjing University of Aeronautics and Astronautics, China*

**MO-UB.1P.7** **16:20**

### Compact and Broadband LPDA with Curved Bow-Tie Elements for TVWS Band

*Rajbala Solanki, Indian Institute of Technology Bombay, India*

**MO-UB.1P.8** **16:40**

### A Compact Design Using a Sequential Rotation Technique to Reduce Surface Wave in Microstrip Patch Antenna

*Mohammad Fairouz, The Higher Institute of Telecommunication and Navigation, Kuwait*

**MO-UB.1P.9** **17:00**

### A Wideband Corporate Feed Network for Antenna Arrays

*Natasha Hall, Johann Odendaal, Johan Joubert, University of Pretoria, South Africa*

**MO-UB.1P.10** **17:20**

### Multiple Modes OAM Reflectarray in Ka-band

*Michele Beccaria, Paola Pirinoli, Politecnico di Torino, Italy*



## Broadband Antennas II

Session Co-Chairs: Soumava Mukherjee, IIT Jodhpur; Wei E. I. LIU, National University of Singapore

**MO-A1.2P.1** **14:00**

### Optimal Pulse Transmission Criterion for Ultra-wideband Wireless Transmission System

*Hongtai Chen, Yue Su, Haoyan Ma, Shunli Li, Hongxin Zhao, Xiaoxing Yin, Southeast University, China*

**MO-A1.2P.2** **14:20**

### Design of a Compact Inkjet-Printed Wideband (4.89- 18 GHz) Antenna on a flexible PET Substrate

*Abdullah Madni, Subhan Zakir, Muhammad Awais, Wasif Tanveer Khan, Lahore University of Management Sciences (LUMS), Pakistan*

**MO-A1.2P.3** **14:40**

### Beam Steerable HF Inverted V Dipole Antenna

*Rajesh Shukla, Idury Satya Krishna, Naman Baghel, Sourav Ghosh, Soumava Mukherjee, Sandeep Kumar Yadav, IIT Jodhpur, India*

**MO-A1.2P.4** **15:00**

### Differentially-fed Two-element Laminated Resonator Antenna Array With Low Cross Polarization and Broad Bandwidth

*Yaowei Hou, Yueping Zhang, Junfa Mao, Shanghai Jiao Tong University, China*

**MO-A1.2P.5** **15:20**

### Broadband L-Shaped Probe Fed Suspended Metasurface Antenna

*Wei E. I. Liu, Zhi Ning Chen, National University of Singapore, Singapore; Xiaotian Shi, The 54th Research Institute of China Electronic Technology Group Cooperation, China; Xianming Qing, Institute for Infocomm Research, Singapore*

**Break** **15:40**

**MO-A1.2P.6** **16:00**

### Performance Enhancement of A Compact Archimedean Spiral Antenna for 2-18 GHz

*Aitra Roy, Vinoy K. J., Indian Institute of Science, India; Noham Martin, Cedric Quendo, Université de Bretagne Occidentale, France; Stéphane Mallégo, Thales DMS, France*

**MO-A1.2P.7** **16:20**

### Radiative Performance of a Vivaldi Antenna Equipped with Petal-Shaped and Massive Lens

*Renato Cicchetti, Valentina Cicchetti, Orlandino Testa, University of Rome, Italy; Lars Foged, Microwave Vision Italy s.r.l., Italy; Antonio Faraone, Motorola Solutions, Inc., United States*

**MO-A1.2P.8** **16:40**

### Connected Array Design for Mobile Communications

*Riccardo Ozzola, Zhuang Chen, Andrea Neto, Daniele Cavallo, Technical University of Delft, Netherlands; Ulrik Imberg, Huawei Sweden AB, Sweden*

**MO-A1.2P.9** **17:00**

### A Low-Profile Broadband Nonuniform Metasurface Antenna for 5G Terminal Applications

*Long Qian, Xiaodong Chen, Queen Mary University of London, United Kingdom; HanYang Wang, Hai Zhou, Huawei Technologies (UK) CO., LTD, United Kingdom*

**MO-A1.2P.10** **17:20**

### Compact Antenna for Optimized Platform Installations

*Domenico Gaetano, Christian Canestri, Alessandro Calcaterra, Cosmo Mitrano, Pietro Bia, Antonio Manna, Elettronica SpA, Italy*



Monday, December 6  
MO-A1.3P

14:00 - 17:40  
Melati Ballroom 4102

## Reconfigurable Antennas and Arrays II

Session Co-Chairs: Igor Shirokov, Sevastopol State University; Theng Huat Gan, National University of Singapore

**MO-A1.3P.1** **14:00**

### A Multi-functional Polarization Reconfigurable Metasurface for C-band Applications

*Hamza Abbas Kiani, Noshawan Shoaib, National University of Sciences and Technology, Pakistan; Abdul Quddious, University of Cyprus, Cyprus; Photos Vryanides, Symeon Nikolaou, Frederick University, Cyprus*

**MO-A1.3P.2** **14:20**

### An IC-Enabled Metasurface Producing OAM and Pencil Beams

*Kypros M. Kossifos, Julius Georgiou, University of Cyprus, Cyprus; Marco A. Antoniadis, Ryerson University, Canada*

**MO-A1.3P.3** **14:40**

### Active RX-TX Antenna

*Elena Shirokova, Igor Shirokov, Sevastopol State University, Russia*

**MO-A1.3P.4** **15:00**

### Multiple scan state using mechanically reconfigurable parasite antennas

*Valentin Sokolow, Christophe Craeye, Paul Fisette, UCLouvain, Belgium*

**MO-A1.3P.5** **15:20**

### Pencil to Flat-Top Beampattern Transform and Its Application in Gaussian Array Design

*Goran Molnar, Dorian Ljubenko, Ericsson Nikola Tesla, Inc., Croatia (Hrvatska)*

**Break** **15:40**

**MO-A1.3P.6** **16:00**

### Synthesis of Pencil Beams Optimum in L1-Sense

*Katarina Vodvarka, Mladen Vucic, University of Zagreb Faculty of Electrical Engineering and Computing, Croatia (Hrvatska); Goran Molnar, Ericsson Nikola Tesla, Inc., Croatia (Hrvatska)*

**MO-A1.3P.7** **16:20**

### Printed radome for reconfigurable antenna radiation pattern in 5G applications

*Thi-Hong-Lê Dam, Camille Delfaut, Tan-Phu Vuong, Grenoble INP, France; Grégory Houzet, Thierry Lacrevoz, Université Savoie Mont Blanc, France; Alejandro Niembro-Martin, Schneider Electric, France; Quoc-Bao Duong, Nadège Reverdy-Bruas, Université Grenoble Alpes, France*

**MO-A1.3P.8** **16:40**

### Stacked-Patch MIMO Antenna for Dual-Plane Beamsteering

*Abel Zandamela, Nicola Marchetti, Adam Narbudowicz, Trinity College Dublin, Ireland*

**MO-A1.3P.9** **17:00**

### Reconfigurable Metamaterial-Inspired PMC-PEC for Waveguide Miniaturisation

*Vikrant Singh, Mohsen Khalily, Amir Jafarholi, Rahim Tafazolli, University of Surrey, United Kingdom*

**MO-A1.3P.10** **17:20**

### Reconfigurable Antenna Using Liquid Metal Vias

*Shaker Alkaraki, James Kelly, Queen Mary University of London, United Kingdom; Zhengpeng Wang, Beihang University, China*



Monday, December 6  
MO-A2.1P

14:00 - 17:40  
Peony Ballroom 4402

## Metasurfaces in Beam Steering and Beam Forming II

Session Co-Chairs: Qi Wu, Southeast University; Pedro Hernandez-Martinez, Nanyang Technological University

**MO-A2.1P.1** **14:00**

### Low-loss and low profile metamaterial lens antenna for 5G millimeter wave

*Lifei Jia, Jinling Zhang, Beijing University of Posts and Telecommunications, China; Xiangzhi Zhu, Zhengzhou University, China; Zhanqi Zheng, Datang Mobile Equipment Co, China*

**MO-A2.1P.2** **14:20**

### Bidirectional Folded Transmitarray Antenna Using Full-Space Chiral Metasurfaces

*Weixu Yang, Ke Chen, Yijun Feng, Nanjing University, China*

**MO-A2.1P.3** **14:40**

### Single-layer Prephased 1-bit Metasurface Using True-time Delay for Symmetric Beam Suppression

*Xiaohua Long, Qi Wu, Haiming Wang, Wei Hong, Southeast University, China*

**MO-A2.1P.4** **15:00**

### Design of a Reflective Metasurface for Near-Field Focusing

*Guohong Du, Dongdong Wang, Xiaofeng Sun, Yuan Zhao, Chengdu University of Information Technology, China*

**MO-A2.1P.5** **15:20**

### A Compact Beamsteering Metalens Array Antenna with Circularly Polarized Phased Array

*Ruolei Xu, Zhi Ning Chen, National University of Singapore, Singapore*

**Break** **15:40**

**MO-A2.1P.6** **16:00**

### Tailoring Airy Beam from a Two-Dimensional Dynamic Metasurface

*Rui Feng, Hailin Zhang, Xidian University, China; Badreddine Ratni, Shah Nawaz Burokur, Université Paris Nanterre, France; Jianjia Yi, Xi'an Jiaotong University, China; André de Lustrac, Université Paris-Saclay, France*

**MO-A2.1P.7** **16:20**

### Multibeam 2D Lens Antenna Based on Metasurface Technology

*Alex Davidov, Reuven Shavit, Ben-Gurion University of the Negev, Israel*

**MO-A2.1P.8** **16:40**

### Design, Simulation, and Measurement of Microwave Beam-Generating Structures With Near-Zero-Index Characteristics

*Ozgur Eris, Ozgur Ergul, Middle East Technical University, Turkey*

**MO-A2.1P.9** **17:00**

### Enhancing the Beam Scanning Capability of Phased Arrays Using Quadratic-Gradient Metasurface Dome

*Alessio Monti, Mirko Barbuto, Niccolò Cusano University, Italy; Claudio Massagrande, Milan Research Center - Huawei Technologies, Italy; Stefano Vellucci, Angelica Viola Marini, Davide Ramaccia, Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy*

**MO-A2.1P.10** **17:20**

### 2.75-Bit Reflecting Unit Cell Design for Reconfigurable Intelligent Surfaces

*James Rains, Jalil ur Rehman Kazim, Lei Zhang, Qammer Abbasi, Muhammad Imran, University of Glasgow, United Kingdom; Anvar Tukmanov, British Telecommunications PLC, United Kingdom*



## 5G and 6G Antenna Systems for Mobile Devices: Relevant Technologies

Session Co-Chairs: Wonbin Hong, Pohang University of Science and Technology (POSTECH); Yunjia Zeng, Institute for Infocomm Research

### MO-SP.2P.1

14:00

#### A Liquid Crystal Beam Scanning Antenna Based on Even and Odd Modes

*Jun Shu, Shanghai Jiao Tong University, China; Yueping Zhang, Nanyang Technological University, Singapore*

### MO-SP.2P.2

14:20

#### Multi-Port Rectangular Horn Antenna with Dielectric Resonator for 5G Application

*Purevtsersen Bayarsaikhan, Ryuji Kuse, Takeshi Fukusako, Kumamoto University, Japan; Kazuma Tomimoto, Masayuki Miyashita, Ryo Yamaguchi, Softbank Corporation, Japan*

### MO-SP.2P.3

14:40

#### Wideband and Wide Beam-Scanning Phased Array Antenna Design for 5G Applications

*Haoran Zhang, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia*

### MO-SP.2P.4

15:00

#### A wave physics approach to electronically steerable antennas

*Geoffroy Lerosey, Jean-Baptiste Gros, Mikhail Odit, Vladislav Popov, Greenerwave, France*

### MO-SP.2P.5

15:20

#### Integration of a 28 GHz Beamforming Module into a Handset Device Using LDS-MID Technology

*Steffen Seewald, Dirk Manteuffel, Leibniz University Hannover, Germany*

### Break

15:40

### MO-SP.2P.6

16:00

#### Design of a 5G End-Fire Meta-Surface Antenna Array for Mobile User Equipment Using SIW Technology

*Sebastian Coenen, Gabriele Federico, Bart Smolders, University of Technology Eindhoven, Netherlands*

### MO-SP.2P.7

16:20

#### Antenna Designs for Mobile Handsets With Consideration of 3GPP Requirements in FR2

*Kun Zhao, Zhinong Ying, Sony Research Center Lund, Sweden; Shuai Zhang, Gert Pedersen, Aalborg University, Denmark*

### MO-SP.2P.8

16:40

#### A Wide-Angle Scanning Array Using a Multi-Mode Antenna for mm-Wave Communications

*Gabriele Federico, Bart Smolders, Guilherme Theis, Eindhoven University of Technology, Netherlands; Diego Caratelli, The Antenna Company, Netherlands*

### MO-SP.2P.9

17:00

#### A novel Non-orthogonal Frequency Division Multiplexing scheme for interference avoidance in SM-STBC Systems.

*Fadila Berrahma, H Bousbia-Salah, National Polytechnical School, Algeria; Khalida Ghanem, Center for Development of Advanced Technologies, Algeria; Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada*

### MO-SP.2P.10

17:20

#### Dual U-Slot Patch Antenna for 5G Applications

*Chaker Saleh, Laghouat university, Algeria; Eqab Almajali, University of Sharjah, United Arab Emirates; Saqer Alja'afreh, Mutah University, Jordan; Jawad Yousof, Abu Dhabi University, United Arab Emirates*



Monday, December 6  
MO-A5.2P

14:00 - 17:40  
Peony Junior Ballroom 4412

## Biomedical Applications II

Session Co-Chairs: Melusine Pigeon, Tyndall National Institute; Danilo Brizi, University of Pisa / RaSS National Laboratory, CNIT

**MO-A5.2P.1** **14:00**

### A Microwave Tomography System For Ischemic Stroke Based on Distorted Born Iterative Method

*Yahui Ding, Yifan Chen, Jun Hu, University of Electronic Science and Technology of China, China; Zheng Gong, University of Waikato, China*

**MO-A5.2P.2** **14:20**

### A Metasurface Design for Enhancing In-Body Signal Transmission in Biomedical Microwave Imaging

*Elisa Giampietri, Danilo Brizi, Agostino Monorchio, University of Pisa / RaSS Laboratory CNIT, Italy; Maria Conte, Free Space SRL, Italy*

**MO-A5.2P.3** **14:40**

### Design of a Homogenized Magnetic Metasurface for the RF Magnetic Field Enhancement in 1.5 T MRI

*Danilo Brizi, Agostino Monorchio, University of Pisa/CNIT, Italy; Elisa Di Napoli, University of Pisa, Italy*

**MO-A5.2P.4** **15:00**

### Electromagnetically characterized gelatinous-based phantoms for breast microwave imaging

*Giulia Monacelli, University of Pisa /UBT- Umbria Bioengineering Technologies, Italy; Eliana Canicatti, University of Pisa/RaSS National Laboratory CNIT, Italy; Alessandro Vispa, Lorenzo Sani, UBT- Umbria Bioengineering Technologies, Italy; Gianluigi Tiberi, London South Bank University/UBT- Umbria Bioengineering Technologies, Italy; Agostino Monorchio, University of Pisa/RaSS National Laboratory, CNIT, Italy*

**MO-A5.2P.5** **15:20**

### SAR Evaluation from High-intensity and Broadband Sources for Different Human Body Models

*Eliana Canicatti, Elisa Giampietri, Danilo Brizi, Nunzia Fontana, Agostino Monorchio, University of Pisa / RaSS National Laboratory, CNIT, Italy*

**Break** **15:40**

**MO-A5.2P.6** **16:00**

### 3D printed torso phantom for UHF WIMD measurements

*Melusine Pigeon, Brendan O'Flynn, John Barton, Tyndall National Institute, Ireland; Patricia O'Sullivan, MUT, Ireland*

**MO-A5.2P.7** **16:20**

### Folded Terahertz Antenna based on MoS<sub>2</sub> and Gold for Biomedical Imaging

*Abdoalbaset Abohmra, University of glasgow, United Kingdom; Jalil Kazim, Hasan Abbas, Muhammad Imran, Qammer Abbasi, University of Glasgow, United Kingdom; Akram Alomainy, Queen Mary University of London, United Kingdom*

**MO-A5.2P.8** **16:40**

### Receive Signal Strength- Based Human Activity Recognition

*Wassila Dib, Khalida Ghanem, Center for Development of Advanced Technologies, Algeria; Amina Ababou, University of Sciences and Technologies Houari Boumediene, Algeria; Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada; Björn Eskofier, Friedrich-Alexander University Erlangen-Nuernberg, Germany*

**MO-A5.2P.9** **17:00**

### A Feasibility Study of a Low-frequency Wearable Device for Contactless Monitoring of Blood Glucose Level

*Sabrina Rotundo, University of Pisa, Italy; Danilo Brizi, Agostino Monorchio, University of Pisa\CNIT, Italy*

**MO-A5.2P.10** **17:20**

### A Low Frequency Device for Non-invasive Detection of Pulmonary Malignancies

*Sabrina Rotundo, Danilo Brizi, Agostino Monorchio, University of Pisa, Italy*



Monday, December 6

14:00 - 15:40

MO-A1.4P

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Magneto-Electric Dipole and Microstrip Antennas II

Session Co-Chairs: Rajbala Solanki, Indian Institute of Technology Bombay; Lei Wang, Heriot-Watt University

**MO-A1.4P.1**

**14:00**

A 2×2 Dual-Polarized Magneto-Electric Dipole Antenna Array at 28 GHz

*Yinxue Zhao, Xiao-Wei Zhu, Wenliang Song, Southeast University, China*

**MO-A1.4P.2**

**14:20**

Broadband Direct Coupled Stacked Microstrip Antenna for TVWS Band

*Rajbala Solanki, Bindu K. K., Indian Institute of Technology Bombay, India*

**MO-A1.4P.3**

**14:40**

Omnidirectional Multibeam Substrate Integrated Horn Array for Unmanned Aerial Vehicles

*Qingbi Liao, KTH Royal Institute of Technology, Sweden; Lei Wang, Heriot-Watt University, United Kingdom*

**MO-A1.4P.4**

**15:00**

Smart Use of Vehicle's Existing Plastic Substrates for GPS Antenna Integration in Automotive Applications

*Sally Alsayah, Fabien Ferrero, Robert Staraj, UCA CNRS LEAT, France; Ignacio Gimeno, Renault Software Labs, France*

**MO-A1.4P.5**

**15:20**

Compact Circularly Polarized Aperture Fed Patch Antenna for LEO Satellite Constelations

*Amélia Ramos, Tiago Varum, João N. Matos, Instituto de Telecomunicações and Universidade de Aveiro, Portugal*



Monday, December 6

16:00 - 17:40

MO-UB.2P

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Millimeter-Wave and Terahertz Antennas

Session Co-Chairs: Eva Rajo-Iglesias, University Carlos III of Madrid; Takashi Tomura, Tokyo Institute of Technology

**MO-UB.2P.1**

**16:00**

Digitally Coded Metasurface Lens Antenna for Millimeter Wave Applications

*Priyanka Das, University Of Engineering and Management, Kolkata, India; Amit Kumar Singh, Indian Institute Of Technology Jammu, India*

**MO-UB.2P.2**

**16:20**

Gain evaluation of millimeter-wave-band plate-laminated-waveguide slot arrays by measured anisotropic conductivity

*Takashi Tomura, Jiro Hirokawa, Tokyo Institute of Technology, Japan*

**MO-UB.2P.3**

**16:40**

A Terahertz All-dielectric EBG Resonator Antenna

*Kai Yao, Stephen Hanham, University of Birmingham, United Kingdom*

**MO-UB.2P.4**

**17:00**

Arrays of low profile horns fed with groove gap waveguide technology

*Natsika Memeletzoglou, Eva Rajo-Iglesias, University Carlos III of Madrid, Spain; Malcolm Ng Mou Keh, National Chiao Tung University, Taiwan*

**MO-UB.2P.5**

**17:20**

3D-printed graded index half-Maxwell lens with integrated DRA feeding

*José-Manuel Poyanco, Eva Rajo-Iglesias, University Carlos III of Madrid, Spain; Francisco Pizarro, Pontificia Universidad Católica de Valparaíso, Chile*





## RFID Antennas and Systems II

Session Co-Chairs: Mei Song Tong, Tongji University; Rui Xu, Nanyang Technological University

**MO-A5.3P.1** **14:00**

### A Chipless Ultra-Wideband RFID Tag Based on Cylindrical Dielectric Resonator

*Li Zhang, Meng Meng Li, Mei Song Tong, Tongji University, China*

**MO-A5.3P.2** **14:20**

### A Miniaturized HF/UHF Dual-Band RFID Tag Antenna

*Hossein Sarbandi Farahani, Behrooz Rezaee, Michael Gadringer, Wolfgang Bösch, Graz University of Technology, Austria; Lukas Zöschner, Stefan Johannes Maier, Franz Amtmann, NXP Semiconductors Austria GmbH & Co KG, Austria*

**MO-A5.3P.3** **14:40**

### Design and Analysis of Paper-based Arabic RFID Letters for IoT Applications

*Jawad Yousaf, Mahmoud El najjar, Ahmed Amer, Abu Dhabi University, United Arab Emirates; Eqab Almajali, University of Sharjah, United Arab Emirates; Manzoor Elahi, Amir Altaf, Sungkyunkwan University, Korea (South); Saqer Aljafreh, Mutah University, Jordan*

**MO-A5.3P.4** **15:00**

### Challenges in Development of Bended Passive UHF RFID Moisture Sensors on a Sponge Cloth

*S M Musfequr Rahman, Zahangir Khan, Adnan Mehmood, Xiaochen Chen, Johanna Virkki, Tampere University, Finland*

**MO-A5.3P.5** **15:20**

### Chipless RFID Tag Detection with a Single Measurement in Presence of Multipath

*Fatima Villa-Gonzalez, Ainhoa Rezola, Ailyn Estevez, Javier Díaz, Daniel Valderas, Universidad de Navarra, Spain*

**Break** **15:40**

**MO-A5.3P.6** **16:00**

### Performance Analysis of Single-Lane Multi-Tag Vehicle Identification Scenarios with UHF RFID

*Alexander R. Unterhuber, Stoyan Iliev, Kathrein Solutions GmbH, Germany; Erwin Biebl, Technical University of Munich, Germany*

**MO-A5.3P.7** **16:20**

### Interconnect-free DRA-SAW RFID Sensing System for High Temperature Monitoring

*Tony Makdissy, Omar Elmazria, Sami Hage-Ali, Université de Lorraine, CNRS, IJL, France*

**MO-A5.3P.8** **16:40**

### Passive RFID-based Intelligent Gloves for Alternative and Assistive Communication – A Preliminary Study

*Adnan Mehmood, Zahangir Khan, Alekski Vianto, Tiina Ihalainen, Johanna Virkki, Tampere University, Finland*

**MO-A5.3P.9** **17:00**

### Platform Tolerant UHF RFID Tag Design using Multi-resonant Surface for Supply Chain Visibility

*Abu bakar Sharif, Jaspreet Kaur, Hasan Abbas, Qammer Abbasi, Muhammad Ali Imran, University of Glasgow, United Kingdom; Kamran Arshad, Khaled Assaleh, Ajman University, United Arab Emirates*

**MO-A5.3P.10** **17:20**

### Complex-Impedance Dipole Antennas as RFID-Enabled Ice Monitors

*Mahmoud Wagih, Junjie Shi, University of Southampton, United Kingdom*



Monday, December 6  
MO-A2.2P

14:00 - 17:40  
Peony Ballroom 4403

## Metasurfaces II

Session Co-Chairs: Ariel Epstein, Technion - Israel Institute of Technology; Stefano Vellucci, Roma Tre University

**MO-A2.2P.1** 14:00

### Transmission Properties Analysis of Huygens' Metasurface

*Fanglin Ren, Qun Lou, Zhi Ning Chen, National University of Singapore, Singapore*

**MO-A2.2P.2** 14:20

### Design Method of Broadband Flat Metasurface Lenses by Using an One-Dimensional Distributed Transmission-Line Model

*Tsutomu Nagayama, Seiji Fukushima, Toshio Watanabe, Kagoshima University, Japan*

**MO-A2.2P.3** 14:40

### Time-Modulation as a Vehicle for Bypassing the Gain-Bandwidth bound of Small LTI Antennas

*Yakir Hadad, Tel-Aviv University, Israel; Amir Shlivinski, Ben-Gurion University, Israel*

**MO-A2.2P.4** 15:00

### Multichannel Metagrating Diffusers for Broad-Angle Radar Cross Section (RCS) Reduction

*Yarden Yashno, Ariel Epstein, Technion - Israel Institute of Technology, Israel*

**MO-A2.2P.5** 15:20

### Arbitrary Pulse Shaping using Nonuniform Spacetime Modulation

*Amir Bahrami, Christophe Caloz, Katholieke Universiteit Leuven, Belgium*

**Break** 15:40

**MO-A2.2P.6** 16:00

### Wave Manipulation through Advanced Smart Skins for Shaped Beam Synthesis

*Giacomo Oliveri, Marco Salucci, Francesco Zardi, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*

**MO-A2.2P.7** 16:20

### Compact Waveguide Surface End-launcher Suitable for Wearable Body Area Network Terminals

*Maria El Bacha, Fabien Ferrero, Leonardo Lizzi, Université Côte d'Azur, CNRS, LEAT, France*

**MO-A2.2P.8** 16:40

### Perfect Anomalous Reflection: Spatially Dispersive Boundary Conditions

*Cristina Yepes, Marco Faenzi, Stefano Maci, Enrica Martini, University of Siena, Italy; Sergei Tretyakov, Aalto University, Finland*

**MO-A2.2P.9** 17:00

### Design of a Metasurface for a Circularly Polarized Antenna by Using Characteristic Mode Theory

*Simone Genovesi, University of Pisa, Italy; Francesco Alessio Dicandia, IDS Ingegneria dei Sistemi SpA, Italy*

**MO-A2.2P.10** 17:20

### Coating Metasurfaces Enabling Antenna Frequency Reconfigurability for Cognitive Radio System

*Stefano Vellucci, Alessandro Toscano, Filiberto Bilatti, Roma Tre University, Italy; Alessio Monti, Mirko Barbuto, Niccolò Cusano University, Italy*



Monday, December 6  
MO-A3.1P

14:00 - 17:40  
Peony Junior Ballroom 4511

## Integral Equation Methods II

Session Co-Chairs: Shunchuan Yang, Beihang University; Dirk Manteuffel, Leibniz University Hannover

**MO-A3.1P.1** **14:00**

Radiated Near Field Prediction based on Equivalent Source Reconstruction Method with Truncated Singular Value Decomposition

*Chang Liu, Huapeng Zhao, Jun Hu, University of Electronic Science and Technology of China, China*

**MO-A3.1P.2** **14:20**

Mesh Sharing Based Fast Parameter Sweep for EM Simulation Accelerated by H-matrix

*Yu Zhao, Song Zhang, Long Li, Xidian University, China; Fuyao Hou, Xidian University, China*

**MO-A3.1P.3** **14:40**

A Hybrid SIE-PDE Formulation Without Additional Boundary Conditions for Electromagnetic Analysis

*Aipeng Sun, Shunchuan Yang, Beihang University, China*

**MO-A3.1P.4** **15:00**

The Dyadic Green's Function for the Rectangular Dielectric Cavity

*Guizhen Lu, Meng Wang, Communication University of China, China*

**MO-A3.1P.5** **15:20**

Combined Potential-Field Formulation for Densely Discretized Conductors

*Gokhan Karaova, Ozgur Eris, Ozgur Ergul, Middle East Technical University, Turkey*

**Break** **15:40**

**MO-A3.1P.6** **16:00**

Acceleration of the Surface Test Integral Using Vertex Functions

*Javier Rivero, Francesca Vipiana, Politecnico di Torino, Italy; Donald Wilton, University of Houston, United States; William Johnson, Consultant, United States*

**MO-A3.1P.7** **16:20**

On the Low-Frequency Scaling of Vector Potential Integral Equation Solutions

*Rui Chen, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia*

**MO-A3.1P.8** **16:40**

Low-Frequency Stable Discretization of the Electric Field Integral Equation based on Poincaré's Lemma

*Bernd Hofmann, Thomas F. Eibert, Technical University of Munich, Germany; Francesco P. Andriulli, Politecnico di Torino, Italy; Simon B. Adrian, Universität Rostock, Germany*

**MO-A3.1P.9** **17:00**

Green's Function Implementation for Characteristic Modes in Various Environments

*Axel Hoffmann, Dirk Manteuffel, Leibniz University Hannover, Germany*

**MO-A3.1P.10** **17:20**

DG-JMCFIE Formulation for Composite Multimaterial Objects

*Victor F Martin, David Larios, Jose M Taboada, Luis Landesa, University of Extremadura, Spain; Fernando Obelleiro, University of Vigo, Spain*



Monday, December 6  
MO-A4.1P

14:00 - 17:40

Virtual (Chairs/Speakers to go to Peony Ballroom 4502)

## Propagation and Wireless Communications II

Session Co-Chairs: Peiqin Liu, National University of Singapore; Richard X. K. Gao, Institute of High Performance Computing

**MO-A4.1P.1** **14:00**

### UAV Positioning Based on L-Shaped Antenna Array

*Zhi-Chao Han, Wei Nie, Mu Zhou, Chongqing University of Posts and Telecommunications, China*

**MO-A4.1P.2** **14:20**

### Omnidirectional Direction Finding Based on Time-modulated Array

*Liu Yang, Jingfeng Chen, Han Liu, Chong He, Ronghong Jin, Shanghai Jiao Tong University, China*

**MO-A4.1P.3** **14:40**

### Channel Characterization of Horizontal Beam Switching in Urban Overtaking Scenario

*Shitong Cui, Yiming Fang, Xiaohan Chen, Beijing Jiaotong University, China*

**MO-A4.1P.4** **15:00**

### Direction Finding for BPSK with In-band Interference Based on Amplitude Comparison Method

*Han Liu, Jingfeng Chen, Ziheng Ding, Gang Ni, Chong He, Ronghong Jin, Shanghai Jiao Tong University, China*

**MO-A4.1P.5** **15:20**

### Measurement and Analysis on Radio Coverage of 5G based Train Wireless Communication Network

*Xiaokang Zhang, Siyu Lin, Beijing Jiaotong University, China*

**Break** **15:40**

**MO-A4.1P.6** **16:00**

### Measurement and Analysis of 5G Radio Coverage with Inner End Door on Electric Multiple Units

*Chengxiao Yu, Siyu Lin, Beijing Jiaotong University, China*

**MO-A4.1P.7** **16:20**

### Measurement and Analysis of Radio Coverage in Tunnel Boring Machine

*Zhiwen Long, Chengxiao Yu, Xiaokang Zhang, Li Zhu, Hongwei Wang, Siyu Lin, Beijing Jiaotong University, China*

**MO-A4.1P.8** **16:40**

### Horn Antenna Misalignments at 100, 300, 400, and 500 GHz in Close Proximity Communications

*Fawad Sheikh, Yamen Zantah, Nidal Zarifeh, Thomas Kaiser, University Duisburg-Essen, Germany; Muath Al-Hasan, Al Ain University, United Arab Emirates; Ismail Mabrouk, Durham University, United Kingdom*

**MO-A4.1P.9** **17:00**

### Effect of Circular Polarization in a UHF LP-WAN communication

*Lionel Tombakdjian, Fabien Ferrero, Université Côte d'Azur, France; Le Huy Trinh, University of Information Technology, Viet Nam*

**MO-A4.1P.10** **17:20**

### Deterministic Wireless Propagation Model Assisted Indoor Positioning

*Conor Wilson, Xingqi Zhang, University College Dublin, Ireland; Hans-Dieter Lang, OST - Eastern Switzerland University of Applied Sciences, Switzerland; Yunbo Li, Southeast University, China; Costas Sarris, University of Toronto, Canada*



## Antenna Feeds and Matching Circuits I

Session Co-Chairs: Ikmo Park, Ajou University; Xianming Qing, Institute for Infocomm Research

**TU-A1.1A.1** **08:20**

### A 230 GHz Orthomode Transducer with Simple Fabrication Steps

*Tanner Douglas, Adib Nashashibi, Kamal Sarabandi, University of Michigan, United States*

**TU-A1.1A.2** **08:40**

### Dual-port Stacked Annular Ring Microstrip Patch Antenna with Vertical Pins for Isolation Enhancement

*Daniele Inserra, Guangjun Wen, University of Electronic Science and Technology of China, China*

**TU-A1.1A.3** **09:00**

### KA-Band Y-Junction Substrate Integrated Gap Waveguide Ferrite Circulator

*Syed M. Sifat, Shoukry I. Shams, Ahmed A. Kishk, Concordia University, Canada*

**TU-A1.1A.4** **09:20**

### Broadband Millimeter-Wave Feed Structure for Log-Periodic Toothed Antenna

*Hayden Banting, Carlos Saavedra, Queen's University, Canada*

**TU-A1.1A.5** **09:40**

### Embedded Split Ring Resonator Tunable Notch Band Filter in Transmission Lines

*Farhad Farzami, Seiran Khaledian, Alex Stutts, Besma Smida, Danilo Erricolo, University of Illinois Chicago, United States*

**Break** **10:00**

**TU-A1.1A.6** **10:20**

### Tightly Coupled Dipole Array with In-Line Guanella Transformer and Balun

*Conrad Andrews, Dejan Filipovic, University of Colorado Boulder, United States; Riley Pack, Alan Brannon, CACI, United States*

**TU-A1.1A.7** **10:40**

### Multi-Band Array Using a Multiplexed Antenna Feed Composed of CRLH Transmission Line-Based Dual Band Isolation Circuits

*Jeremy Furgal, Jay Lee, Syracuse University, United States; Hanseung Lee, HRL Laboratories, United States; Jun Choi, University at Buffalo, The State University of New York, United States*

**TU-A1.1A.8** **11:00**

### Low-Profile Feeding Structure for Exciting Metal Casing as an Antenna

*Takumi Nishime, Hiroshi Hashiguchi, Naobumi Michishita, Hisashi Morishita, National Defense Academy, Japan*

**TU-A1.1A.9** **11:20**

### A Broadband Multilayer Magic-T Using Coupled Microstrip-Slotlines for Monopulse Antenna Systems

*Xiang Zhao, Hongxin Zhao, Shunli Li, Xiaoxing Yin, Southeast University, China*

**TU-A1.1A.10** **11:40**

### A Broadband High-Efficiency Electromagnetic Wave Mode Excitation for Terahertz Waveguide Using Tightly Coupled Stub-lines

*Bin Yuan, Peng Wu, Zhongjun Yu, Chinese Academy of Sciences, China*



## Electrically Small Antennas I

Session Co-Chairs: Sungkyun Lim, Georgia Southern University; Zhengqing Yun, University of Hawaii at Manoa

**TU-A1.2A.1** **08:20**

**Design of an Electrically Small, Low-profile, Parasitic Array for Wireless Electrocardiograph System**  
*Mason Moore, John Verboom, Sungkyun Lim, Georgia Southern University, United States*

**TU-A1.2A.2** **08:40**

**On the Performance of Tree-Based Antennas for SLF-VLF Signal Reception**  
*DaHan Liao, Frank Combs, Milton Ericson, Ryan Kerekes, Stephen Killough, Kyle Reed, Oak Ridge National Laboratory, United States*

**TU-A1.2A.3** **09:00**

**An Electrically Smaller Ultra-Wideband Monopole Antenna for Ground Penetrating Radar Application**  
*Mohammad Ababil Hossain, Samuel Wagner, Stephen Pancrazio, Anh-Vu Pham, University of California, Davis, United States*

**TU-A1.2A.4** **09:20**

**Antenna Miniaturization Using High-Permittivity and Magneto-Dielectric Substrates in VHF-UHF Bands: A Comparative Study**  
*Milad Mirzaee, Yanghyo Kim, Stevens Institute of Technology, United States*

**TU-A1.2A.5** **09:40**

**The Permanent Magnet Based Reluctance Modulated VLF Transmitter: An Equivalent Circuit Analysis**  
*Ali Hosseini-Fahraji, Majid Manteghi, Virginia Polytechnic Institute and State University, United States*

**Break** **10:00**

**TU-A1.2A.6** **10:20**

**Automated Synthesis of Non-Foster Impedance Matching Circuits**  
*Qianyi Li, Ting-Yen Shih, University of Idaho, United States*

**TU-A1.2A.7** **10:40**

**A Low-Profile Three-Port Antenna for Compact Polarization and Pattern Diversity Systems**  
*Jihun Choi, Fikadu Dagefu, US Army Research Lab, United States*

**TU-A1.2A.8** **11:00**

**Analysis of a fractal small antenna using shorting post and the social spider optimization algorithm**  
*Eduardo Souza, Adaildo Assunção, Laercio Mendonca, Federal University of Rio Grande do Norte, Brazil*

**TU-A1.2A.9** **11:20**

**Acoustically Driven VLF Antennas with High Data Rates**  
*Shiwei Tian, Tianxiang Nan, Tsinghua University, China*

**TU-A1.2A.10** **11:40**

**Low frequency transmission of mechanical antenna across the interface of air-water**  
*Silei Yang, Junping Geng, Han Zhou, Kun Wang, Chaofan Ren, Jingzheng Lu, Weinan Gao, Da Su, Yangzhou Zhang, Jing Zhang, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China*



## Phased Array Antennas I

Session Co-Chairs: Maria Pour, University of Alabama in Huntsville; Swaroop Sahoo, Indian Institute of Technology Palakkad

**TU-A1.3A.1** **08:20**

**On the Gain Loss of Wide-Angle Scanning Phased Arrays with Narrow- and Wide-beam Element Patterns**

*Matthew Adams, Maria Pour, University of Alabama in Huntsville, United States*

**TU-A1.3A.2** **08:40**

**360° Beam Steering with Circular Polarization Based on the Superposition of Circular TE<sub>n1</sub> Modes**

*Fatemeh Akbar, Behzad Yektakhah, University of Michigan, United States*

**TU-A1.3A.3** **09:00**

**Quasi-Optical Beamforming using Horizontal Dielectric Wedges**

*Pratik Ghate, Jonathan Bredow, University of Texas at Arlington, United States*

**TU-A1.3A.4** **09:20**

**A Circular Polarized Ku-Band Phased Array using a Triangular Lattice**

*Raif Farkouh, Jia Chi Chieh, Naval Information Warfare Center Pacific, United States*

**TU-A1.3A.5** **09:40**

**A Low-Profile Tapered Slot Antenna Array with Two-Decade (20:1) Bandwidth**

*Peter Moschetti, Roger Hasse, Joshua Gustafson, Thomas Hand, Joseph Torres, Lockheed Martin Space, United States*

**Break** **10:00**

**TU-A1.3A.6** **10:20**

**Ku-Band Dual Linear Polarized Flat Panel Phased Array Antenna with Very Low Cross Polarization**

*Connor Laffey, Satish Sharma, San Diego State University, United States; Tim Gilmore, Dell Kronewitter, Fuse Integration Inc, United States*

**TU-A1.3A.7** **10:40**

**Design of a Circularly-Polarized Tightly-Coupled Microstrip Patch Array**

*Dong-Chan Son, Aman Samaiyar, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder, United States*

**TU-A1.3A.8** **11:00**

**Deployable Miura-Ori Tightly Coupled Dipole Array for Small Satellites**

*Maxence Carvalho, John L. Volakis, Florida International University, United States*

**TU-A1.3A.9** **11:20**

**Single-Feed Multi-beam Transmitarray Antenna Design Using Parallel Particle Swarm Optimization**

*Xuankai Zhao, Bo Li, Nanjing University of Posts and Telecommunications, China; Lei Zhu, University of Macau, China*

**TU-A1.3A.10** **11:40**

**Analysis of Optimized Subarray Configuration for Cross Polarization Reduction for Phased Array Antennas used in Weather Radar**

*Steffy Benny, Swaroop Sahoo, Indian Institute of Technology Palakkad, India*



## Ultra-Wideband Antennas and Systems I

Session Co-Chairs: Jingchen Wang, Xi'an Jiaotong-Liverpool University (XJTU); Mahrukh Khan, The College of New Jersey

**TU-A5.1A.1** **08:20**

**Synthetic Ultra-Wideband Phased-Array Transceiver for Millimeter-Wave Imaging Applications With On-Chip Antennas**

*Amir Mirbeik-Sabzevari, Negar Tavassolian, Stevens Institute of Technology, United States; Laleh Najafzadeh, Rutgers University, United States*

**TU-A5.1A.2** **08:40**

**Ultra-Wideband RF Self Interference Cancellation Filter for STAR Radios**

*Md Rakibur Rahman, Satheesh Bojja Venkatakrishnan, John Valakis, Florida International University, United States*

**TU-A5.1A.3** **09:00**

**Digital Pre-Distortion to Correct UWB Pulses in a Bore-sight Test**

*Stephen Pancrazio, Phat Nguyen, Sam Wagner, Ababil Hossain, Anh-Vu Pham, University of California, Davis, United States*

**TU-A5.1A.4** **09:20**

**Utilizing a Tunable Non-Foster Circuit for Wideband Matching of a Resistively Loaded Dipole Antenna**

*Dojana Salama, Jay Lee, Syracuse University, United States; Harvey Schuman, SRC Inc, United States*

**TU-A5.1A.5** **09:40**

**Characterization of a Highly Efficient Waveguide Front-End Direct-Conversion Receiver for 60-GHz Wireless Systems**

*Mansoor Dashti Ardakani, Serioja Ovidiu Tatu, INRS University, Canada; Reza Karimian, Shahrokh Ahmadi, Mona Zaghloul, George Washington University, United States; Javad Pourahmadazar, Concordia University, Canada*

**Break** **10:00**

**TU-A5.1A.6** **10:20**

**Application of Characteristic Modes on High Gain UWB Platform Integrated Monopole Antenna**

*Mahrukh Khan, The College of New Jersey, United States; Anthony Caruso, University of Missouri-Kansas City, United States*

**TU-A5.1A.7** **10:40**

**A Compact UWB Antipodal Vivaldi Antenna with Enhanced Radiation Performance**

*Xiaogang Li, Kun Wang, Ziheng Li, Ronghong Jin, Shanghai Jiao Tong University, China*

**TU-A5.1A.8** **11:00**

**Experimental Research on Planar Ultra-wideband Modular Antenna Array**

*Ling Zhu, Min Wang, Jia-Yan Xu, Wen Wu, Nanjing University of Science and Technology, China*

**TU-A5.1A.9** **11:20**

**A Wide-band Inner-wall Conformal Antenna for Wireless Capsule Endoscopy**

*Yongmin Luo, Jingchen Wang, Rui Pei, Mark Leach, Zhao Wang, Eng Gee Lim, Junliang Li, Xi'an Jiaotong-Liverpool University (XJTU), China*

**TU-A5.1A.10** **11:40**

**Enhancement of MIMO-UWB Communications in Underground Mine Environments**

*Rym Labdaoui, Fatiha Youcef Ettoumi, University of Sciences and Technologies Houari Boumediene, Algeria; Khalida Ghanem, Center for Development of Advanced Technologies, Algeria; Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada; Larbi Talbi, Université du Québec en Outaouais, Canada; Ismail Ben Mabrouk, Durham University, United Kingdom*





## Reconfigurable Antennas and Arrays III

Session Co-Chairs: Dimitrios Tzarouchis, University of Pennsylvania; Wenyao Zhai, Huawei Technologies Canada

**TU-A1.4A.1** **08:20**

### Radiation Calculation of Wedge-shaped Leaky-Wave Antenna

*Zhenjiang Zhao, Tayeb Denidni, Institut National de la Recherche Scientifique, Canada*

**TU-A1.4A.2** **08:40**

### 360-degree beam steering antenna based on substrate integrated frequency selective structure

*Xin Feng, Foyez Hyjazie, Wenyao Zhai, David Wessel, Wen Tong, Huawei Technologies Canada, Canada; Halim Boutayeb, University of Quebec, Canada*

**TU-A1.4A.3** **09:00**

### Fully Collapsible Lightweight Dipole Antennas

*Austin Fikes, Oren Mizrahi, Alan Truong, Sergio Pellegrino, Ali Hajimiri, California Institute of Technology, United States; Fabian Wiesemüller, Imperial College London, United States*

**TU-A1.4A.4** **09:20**

### High-Power-Capable, Ultra-Wideband, 1-Bit, Reflectarray Unit Cells Using Polarization-Rotation Reflection Modes

*Meng Gao, Mohammad Mahdi Honari, John Booske, Nader Behdad, University of Wisconsin-Madison, United States*

**TU-A1.4A.5** **09:40**

### A Reconfigurable Metadevice for Solving Equations and Inverting Matrices at RF Frequencies

*Dimitrios Tzarouchis, Brian Edwards, Nader Engheta, University of Pennsylvania, United States; Mario Junior Mencagli, University of North Carolina at Charlotte, United States*

**Break** **10:00**

**TU-A1.4A.6** **10:20**

### V02-Based Reconfigurable Meanderline Polarizer at Ka-band

*Mark Lust, Nima Ghalichechian, The Ohio State University, United States*

**TU-A1.4A.7** **10:40**

### V02 based Ultra-Reconfigurable Ka-Band Reflectarrays for Next-Generation Communication and Radar Systems

*Randy Matos, Abdul Sattar Kaddour, Stavros Georgakopoulos, Nezhil Pala, Florida International University, United States*

**TU-A1.4A.8** **11:00**

### A Novel Liquid-Metal Antenna with Polarization and Continuous-Frequency Reconfigurability

*Yi Zhou, Mei Song Tong, Tongji University, China*

**TU-A1.4A.9** **11:20**

### A Planar Wide-angle Scanning Array Using Pattern-Reconfigurable Antenna

*Theng Huat Gan, Peng Kiang Tan, Ankang Liu, Jian Lu, Sek Meng Sow, National University of Singapore, Singapore*



## Beam-Steerable Antenna Systems for Mobile Satellite Communications

Session Co-Chairs: Matekovits Ladislau, Politecnico di Torino; Karu P. Esselle, University of Technology Sydney

**TU-SP.1A.1** **08:20**

Antenna Array Time-Delay Loss Quantification for High Symbol Rate Satellite Communications  
*Joshua Roper, Viasat, United States; Andrew Peterson, Georgia Institute of Technology, United States*

**TU-SP.1A.2** **08:40**

A 3-State Broadband Circularly-Polarized Unit Cell Enabling Steerable Reflectarrays for CubeSats  
*Junbo Wang, Yahya Rahmat-Samii, University of California, Los Angeles, United States*

**TU-SP.1A.3** **09:00**

Sparse-fed GRIN Lens Antennas for Low-cost and Low-power Millimeter-wave Beamscanning  
*Wei Wang, Matthew Roddy, Nicolas Garcia, Nicholas Estes, Jonathan Chisum, University of Notre Dame, United States*

**TU-SP.1A.4** **09:20**

Switched Beam Steering Antenna System at Ka-band  
*N. Nasimuddin, Yijun Zhou, Xianming Qing, Institute for Infocomm Research (ASTAR), Singapore*

**TU-SP.1A.5** **09:40**

A Novel Wideband E-plane Crossover and Its Application on Multi-beam Antenna Array  
*Yan Wang, Xiaohe Cheng, Yuan Yao, Jusheng Yu, Beijing University of Posts and Telecommunications, China; Xiaodong Chen, School of Electronic Engineering and Computer Science Queen Mary University of London, United Kingdom*

**Break** **10:00**

**TU-SP.1A.6** **10:20**

A High-Performance Absorbent Frequency-Selective Radome Unit for Low-RCS Ka-Band Transmit and Receive Satellite Communication Antennas  
*Zhiyu Xing, Feng Yang, Jianhua Yang, Huanhuan Peng, University of Electronic Science and Technology of China, China*

**TU-SP.1A.7** **10:40**

Broadband and Wide Angular Stable Inductive Grid-Based Linear to Circular Transmission Type Polarizer for Satellite Communication Applications  
*Mohammad Abdul Shukoor, Soumik Dey, Sukomal Dey, Indian Institute of Technology Palakkad, India*

**TU-SP.1A.8** **11:00**

A Phase-controlled Beam-Steered 2×2 Patch Antenna Array With a Partially Reflecting Surface  
*Bratin Ghosh, Mahesh Singh, Indian Institute of Technology, Kharagpur, India*

**TU-SP.1A.9** **11:20**

A Metal-Only Partially Reflective Surface For Metallic Resonant-Cavity Antennas  
*Foez Ahmed, Muhammad U. Afzal, Karu P. Esselle, University of Technology Sydney, Australia*

**TU-SP.1A.10** **11:40**

Wideband Radial-Line Slot Array Antenna Technology for Near-Field Meta-Steering Systems  
*Muhammad Usman Afzal, Dushmantha Thalakatuna, University of Technology Sydney, Australia; Karu Esselle, University Technology Sydney, Australia; Nishat Kali, Macquarie University, Australia*



**Tuesday, December 7**  
**TU-SP.2A**

**08:20 - 10:00**  
**Peony Ballroom 4501AB**

## **5G and 6G Antenna Systems for Mobile Devices: Innovative Approaches**

Session Co-Chairs: Chow-Yen-Desmond Sim, Feng Chia University; Wonbin Hong, Pohang University of Science and Technology (POSTECH)

**TU-SP.2A.1** **08:20**

### **Substrate Integrated Waveguide Antenna at Millimeter Wave Frequency**

*Yaqdhan Mahmood, Noor Asniza Murad, H. O. Hanoosh, Universiti Teknologi Malaysia, Malaysia; Mohamad Kamal A Rahim, Mohamad Kamal A Rahim, Malaysia*

**TU-SP.2A.2** **08:40**

### **Sub-THz Metasurfacing Antenna-in-Package/Antenna-on-Package for 6G Communications**

*Seongwoog Oh, Jungsoek Oh, Seoul National University, Korea (South)*

**TU-SP.2A.3** **09:00**

### **A Novel Dual-Polarized 5G Base Station Filtering Antenna**

*Xiaobing Gao, Yejun He, Li Zhang, Shenzhen University, China; Zhi Zeng, Mobi Antennas Technologies(Shenzhen) Co., Ltd., China*

**TU-SP.2A.4** **09:20**

### **A Monolithic, Spherical Beamsteering Strategy based on Heterogeneous Antenna-on-Surfaces (AoS) for Beyond 5G Mobile Devices**

*Junho Park, Wonbin Hong, Pohang University of Science and Technology, Korea (South)*

**TU-SP.2A.5** **09:40**

### **A Compact Dual-Band Dual-Antenna Building Block for 5G Mobile Communication Application**

*Zi-Yu Pang, Shenzhen University, China; Guan-Long Huang, Foshan University, China; Chow-Yen-Desmond Sim, Feng Chia University, China*



**Tuesday, December 7**  
**TU-SP.3A**

**10:20 - 12:00**  
**Peony Ballroom 4501AB**

## **Low Cost Antenna Design and Analysis**

Session Co-Chairs: Nicola Anselmi, University of Trento; Paolo Rocca, University of Trento

**TU-SP.3A.1** **10:20**

### **Technique for Efficiency Evaluation of Vertical Monopoles over Imperfect Earth**

*Benjamin Dawson III, Hatfield & Dawson Consulting Engineers, LLC, United States*

**TU-SP.3A.2** **10:40**

### **High Gain Antenna Using Dielectric Slabs and Electromagnetic Band Gap Feeding Structure**

*Yazan Al-Alem, Yahia Antar, The Royal Military College of Canada, Canada; Syed Sifat, Ahmed Kishk, Concordia University, Canada*

**TU-SP.3A.3** **11:00**

### **Scanning Reflectarray with Embedded Structural Grid for Deployable Applications**

*William Moulder, Andrew MacCabe, Sungeun Jeon, Landen Bowen, Daniel Stromberg, Lincoln Laboratory, Massachusetts Institute of Technology, United States*

**TU-SP.3A.4** **11:20**

### **Experimental Realization of Bespoke Multi-Band GRIN Lens Using Multi-Objective Optimization**

*Jingwei Xu, Eric Whiting, Sawyer Campbell, Pingjuan Werner, Douglas Werner, Pennsylvania State University, United States; Jeremy Bossard, John Barrett, Joshua Withrow, Lockheed Martin, United States*

**TU-SP.3A.5** **11:40**

### **Low-Profile, Low-Cost Ultrawideband VHF/UHF Antennas for Communications and Remote Sensing**

*Md Rakibul Islam, Vignesh Manohar, Sathesh Venkatakrisnan, John Volakis, Florida International University, United States*



## Biomedical Applications III

Session Co-Chairs: Magda El-Shenawee, University of Arkansas; Abas Sabouni, Wilkes University

**TU-A5.2A.1** **08:20**

### Terahertz Imaging of ENU Injected Sprague Dawley Rat Breast Cancer Tumors

*Nagma Vohra, Magda ElShenawee, University of Arkansas, United States; Keith Bailey, University of Illinois, United States*

**TU-A5.2A.2** **08:40**

### Fork-shape Wideband Monopoles for Microwave Imaging

*Shengkai Gao, Elise Fear, University of Calgary, Canada*

**TU-A5.2A.3** **09:00**

### A Metasurface for Biomedical Imaging Applications

*Dawood Alsaedi, Omar Ramahi, University of Waterloo, Canada; Mohamed El Badawe, Soundskirt Inc., Canada*

**TU-A5.2A.4** **09:20**

### Microwave Head Imaging System for Detection of Blood Clots inside the Brain

*Farhana Parveen, Parveen Wahid, University of Central Florida, United States*

**TU-A5.2A.5** **09:40**

### Impact of Microwave Pulse Characteristics on Thermoacoustic Signals Generated during Pulsed Microwave Ablation

*Audrey Evans, Chu Ma, Susan Hagness, University of Wisconsin-Madison, United States*

**Break** **10:00**

**TU-A5.2A.6** **10:20**

### Computerized Tomography with Microwaves

*Seyed Mirjahanmardi, Ryerson University, Canada; Omar Ramahi, University of Waterloo, Canada*

**TU-A5.2A.7** **10:40**

### Wearable Magnetoinductive Waveguide WBANs: Tolerance to Loop Failures

*Vigyanshu Mishra, Asimina Kiourti, The Ohio State University, United States*

**TU-A5.2A.8** **11:00**

### Selection of Suitable Inorganic/Organic Substrate for In-Body Antenna Implants: Impact on Antenna Characteristics in Deep Tissue Environment

*Debarati Ganguly, Yahia Antar, Royal Military College of Canada, Canada; Prapti Ganguly, AKCIT, University of Calcutta, India; Jawad Siddiqui, University of Calcutta, India; Debdeep Sarkar, Indian Institute of Science, India; Chinmoy Saha, Indian Institute of Space Science and Technology, India*

**TU-A5.2A.9** **11:20**

### Small Antenna Design for Drug Delivery in Human Body

*Rachel Maniskas, Mahsa Khamechi, Abas Sabouni, Wilkes University, United States*

**TU-A5.2A.10** **11:40**

### Safety Metrics Investigation of an Electrically Coupled Patch Antenna for sub-6 GHz Portable Devices serving 5G/6G systems

*Abdullah Mahtouz, Assiut University, Egypt; Shoukry Shams, Concordia University, Canada; Mahmoud Elsaadany, Ghyslain Gagnon, Ecole Technologie Supérieure, Canada*



Tuesday, December 7

TU-UB.1A

08:20 - 10:00

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Electromagnetic Interaction and Coupling

Session Co-Chairs: Saeed Khan, Kansas State University; Enxiao Liu, Institute of High Performance Computing

**TU-UB.1A.1**

**08:20**

**Efficient Wireless Power Transfer (WPT) and Field Containment Through Chiral Ordering of a Four-Tier WPT System**

*Saeed Khan, Chad Bailey, Kansas State University, United States*

**TU-UB.1A.2**

**08:40**

**Wireless Charging Shielding Structure with Periodic Slots in UAVs for Weigh Reduction**

*Zuming Wang, Xin Cao, Yuying Zhu, Yuyu Zhu, Qiangming Cai, Jun Fan, School of Information Engineering, Southwest University of Science and Technology, China*

**TU-UB.1A.3**

**09:00**

**Planar WGM Resonator with High Dielectric-Constant Ceramic Slab for Sensing Applications**

*Afsaneh Hojati Firozabadi, Ala Eldin Omer, Suren Gigoyan, Safieddin Safavi-Naeini, University of Waterloo, Canada*

**TU-UB.1A.4**

**09:20**

**Adjacent Element Coupling Consideration in Periodic Dipole Antenna (LPDA) Array**

*Saeed Khan, Kansas State University, United States*

**TU-UB.1A.5**

**09:40**

**Frequency Dependence of Electromagnetic Coupling in Mars Soil Simulants**

*Shantti Garman, Yasuo Kuga, Oliver Ruo, Salma Hassanain, University of Washington, United States*



Tuesday, December 7

TU-UE.1A

10:20 - 12:00

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Electromagnetic Environment and Interference

Session Co-Chairs: Er-Ping Li, Zhejiang University; Enxiao Liu, Institute of High Performance Computing

**TU-UE.1A.1**

**10:20**

**Electromagnetic Impact of Parasitic Effects on the STDP Characteristics in Neuromorphic Memristor Crossbar Arrays**

*Tuomin Tao, Hanzhi Ma, Quankun Chen, Shurun Tan, Er-Ping Li, Zhejiang University, China; En-Xiao Liu, A\*STAR Institute of High Performance Computing, Singapore*

**TU-UE.1A.2**

**10:40**

**Using Square Cross Structure for Far-End Crosstalk Reduction on Microstrip Signal Lines in DDR5**

*Qiang-Ming Cai, Xiao-Bo Yu, Liang Zhang, Chao Zhang, Lin Zhu, Xin Cao, Jun Fan, Southwest University of Science and Technology, China; Yinglei Ren, Xiaoning Ye, Intel Corporation, China*

**TU-UE.1A.3**

**11:00**

**Far-End Crosstalk Mitigation for Transmission Lines in DDR5 Using Glass-Weave Coating Structure**

*Xiao-Bo Yu, Qiang-Ming Cai, Liang Zhang, Chao Zhang, Lin Zhu, Xin Cao, Jun Fan, Southwest University of Science and Technology, China; Yinglei Ren, Xiaoning Ye, Intel Corporation, China*

**TU-UE.1A.4**

**11:20**

**Three-Dimensional Analysis of Propagation Characteristics in an Urban Environment Using Large-scaled FDTD simulation**

*Hikage Takashi, Kazuki Yoshida, Manabu Yamamoto, Manabu Omiya, Hokkaido University, Japan; Nobuaki Kuno, Minoru Inomata, Wataru Yamada, NTT Corporation, Japan*

**TU-UE.1A.5**

**11:40**

**Evaluation of Interference Path Loss Characteristics in Sub-6 GHz/5G Frequency Bands for Small Aircraft Using Large-scale FDTD Analysis**

*Ai Sato, Takashi Hikage, Manabu Omiya, Hokkaido University, Japan; Shunichi Futatsumori, Naruto Yonemoto, National Institute of Maritime, Port and Aviation Technology, Japan*



## Electromagnetic Theory, Material Properties and Measurements I

Session Co-Chairs: Nirod Das, Tandon School of Engineering, New York University; Amin Kianinejad, arQana Technologies

**TU-A2.1A.1** **08:20**

**On the Importance of the Love's Condition for Inverse Equivalent-Source Metasurface Design**

*Mario Phaneuf, Tianke Qiu, Puyan Mojabi, University of Manitoba, Canada*

**TU-A2.1A.2** **08:40**

**Uniaxial Anisotropic Metamaterial Radome for 79 GHz Automotive Radars**

*Nima Bayat-Makou, George V. Eleftheriades, University of Toronto, Canada*

**TU-A2.1A.3** **09:00**

**Propagation Phase Aberration Characterization of Automotive Radar Covers**

*Adib Nashashibi, Kamal Sarabandi, University of Michigan, United States; Stephen Decker, General Motors, United States*

**TU-A2.1A.4** **09:20**

**An Automated Experiment for Parametric Investigation of Voltage Stacking Behavior**

*Benjamin Bissen, Thomas Ory, Mohamed Z. M. Hamdalla, Ahmed M. Hassan, Anthony N. Caruso, University of Missouri Kansas City, United States*

**TU-A2.1A.5** **09:40**

**Real-Time Dielectric Sensing of Liquids using Waveguide Supercoupling**

*Aditya Varma Muppala, Adam Kaleo Roberts, Adib Nashashibi, Kamal Sarabandi, University of Michigan, Ann Arbor, United States*

**Break** **10:00**

**TU-A2.1A.6** **10:20**

**CPW Resonators for Dielectric Characterization of Sheets at 77 GHz**

*Abdelhamid Nasr, Kamal Sarabandi, University of Michigan, United States*

**TU-A2.1A.7** **10:40**

**A Broadband S/SSTR-VNA for Energized Circuits**

*Evan Benoit, Cynthia Furse, University of Utah, United States*

**TU-A2.1A.8** **11:00**

**New Approach on Generating Electromagnetic Waves for Transcranial Magnetic Stimulation**

*Ali Hosseini-Fahraji, Majid Manteghi, Virginia Polytechnic Institute and State University, United States*

**TU-A2.1A.9** **11:20**

**Probe-based Gain Measurement of On-chip Millimeter-wave Antennas**

*Menglou Rao, Kamal Sarabandi, University of Michigan, United States*

**TU-A2.1A.10** **11:40**

**Deriving Maxwell's Equations from First Principles of Relativistic Charge Invariance and Space-Time Relations**

*Nirod Das, Tandon School of Engineering, New York University, United States*



Tuesday, December 7  
TU-A2.2A

08:20 - 12:00  
Peony Ballroom 4403

## Metasurface Applications I

Session Co-Chairs: Selvan Krishnasamy T, Sri Sivasubramaniya Nadar College of Engineering; Alexandre Serres, Federal University of Campina Grande

**TU-A2.2A.1** **08:20**

**Toward an End-to-End Metasurface Design Procedure for Power Pattern Synthesis**

*Max Kelly, Trevor Brown, Puyan Mojabi, University of Manitoba, Canada*

**TU-A2.2A.2** **08:40**

**Robust Microwave Transport via Nontrivial Duality-Based Rhombic Unit Cells**

*Robert Davis, Daniel Sievenpiper, University of California, San Diego, United States*

**TU-A2.2A.3** **09:00**

**Single Feed Dual Beam Antenna using Metamaterial Surfaces for Near-Field Phase Manipulation**

*Aditya Dave, Rhonda Franklin, University of Minnesota, Twin Cities, United States*

**TU-A2.2A.4** **09:20**

**HIS Based Low-Profile Double-Negative Metastructure for Millimeter-Wave Applications**

*Mad Jubaer Alam, M.M. Reazul Haque Tanmoy, Saeed I. Latif, University of South Alabama, United States*

**TU-A2.2A.5** **09:40**

**Analysis of Angular Stability of FSS Based on Open Trapezoidal Rings Geometry**

*Juliete da Silva Souza, Alexandre Serres, Federal University of Campina Grande, Brazil; Alfredo Gomes Neto, Federal Institute of Paraíba, Brazil*

**Break** **10:00**

**TU-A2.2A.6** **10:20**

**Small-And Large-Scale Strain Sensing Using Frequency Selective Surfaces**

*Swathi Muthyala Ramesh, Kristen Donnell, Missouri University of Science and Technology, United States*

**TU-A2.2A.7** **10:40**

**C-shaped Waveguide for Spin-dependent Propagation**

*Sara Kandil, Daniel Sievenpiper, University of California, San Diego, United States*

**TU-A2.2A.8** **11:00**

**Compact Ferromagnetic WGM Resonator for Sensing Applications at Sub-Centimeter Wavelengths**

*Ala Eldin Omer, Afsaneh Hajjati-Firoozabad, Suren Gigoyan, George Shaker, Safieddin Safavi-Naeini, University of Waterloo, Canada*

**TU-A2.2A.9** **11:20**

**Toward improved prediction of RCS reduction bandwidth of checkerboard metasurfaces**

*Akila Murugesan, Selvan Krishnasamy T, Sri Sivasubramaniya Nadar College of Engineering, India*

**TU-A2.2A.10** **11:40**

**$\pm 45^\circ$  Dual-Polarization Multi-Beam Metasurface Lens Antenna**

*Yu Luo, Songjiang Zhao, Tianjin University, China; Zhi Ning Chen, National University of Singapore, Singapore*



## **Towards a Unified View of Computational Electromagnetics (With a Retrospective at the Occasion of Prof. Hoefler's 80th Birthday)**

Session Co-Chairs: Zhizhang David Chen, Dalhousie University; Wolfgang J. R. Hoefler, University of Victoria; Chao-Fu Wang, National University of Singapore

**TU-SP.4A.1** **08:20**

**Unification of Numerical Methods with the Method of Weighted Residuals and Meshless Method**  
*Zhizhang David Chen, Dalhousie University, Canada; Juan Li, Fuzhou University, China*

**TU-SP.4A.2** **08:40**

**Well-Conditioned Hierarchical Curl-Conforming Bases for Hybrid Meshes with Pyramids, Prisms, Bricks and Tetrahedrons**  
*Roberto D. Graglia, Politecnico di Torino, Italy*

**TU-SP.4A.3** **09:00**

**Unified Scattering Model for Modelling Electrically Large and Complex Object above Rough Surface**  
*Chao-Fu Wang, National University of Singapore, Singapore*

**TU-SP.4A.4** **09:20**

**Generalized Design Considerations of Leaky-Wave Antennas Based on Multi-Mode Resonator (MMR) Concept**  
*Dongze Zheng, Ke Wu, Polytechnique Montreal, Canada*

**TU-SP.4A.5** **09:40**

**Novel Method for Quantitative Image Reconstruction with Time-domain Signals Based on Scattered Power Mapping**  
*Romina Kazemivala, Natalia Nikolova, McMaster University, Canada*

**Break** **10:00**

**TU-SP.4A.6** **10:20**

**Three-Dimensional Electromagnetic Forward Scattering Problem Solver Based on Deep Learning**  
*Tiantian Yin, Chao-Fu Wang, Yulong Zhou, Xudong Chen, National University of Singapore, Singapore; Kuiwen Xu, Hangzhou Dianzi University, China; Yu Zhong, Institute of High Performance Computing, A\*STAR, Singapore*

**TU-SP.4A.7** **10:40**

**Fundamental Leapfrog ADI and CDI FDTD Methods**  
*Eng Leong Tan, Nanyang Technological University, Singapore*

**TU-SP.4A.8** **11:00**

**Unity and Diversity in Computational Electromagnetics – A Retrospective**  
*Wolfgang J. R. Hoefler, University of Victoria, Canada*





**Tuesday, December 7**  
**TU-A4.1A**

**08:20 - 12:00**

**Virtual (Chairs/Speakers to go to Peony Ballroom 4502)**

## **Propagation Modeling and Analysis I**

Session Co-Chairs: Costas Sarris, University of Toronto; Ding Yu Heh, Nanyang Technological University

**TU-A4.1A.1** **08:20**

### **Vector Parabolic Equation Modeling of sub-6 GHz 5G Propagation in Tunnels**

*Zhenming Huang, Costas Sarris, University of Toronto, Canada; Xingqi Zhang, University College Dublin, Ireland*

**TU-A4.1A.2** **08:40**

### **Flat-Earth Finite Difference - Guided Mode Model for Long Wavelength Propagation**

*Drew Overturf, Vitaliy Lomakin, University of California, San Diego, United States*

**TU-A4.1A.3** **09:00**

### **Ionospheric Equatorial Plasma Bubble effects on L1 single frequency code GPS positioning using precise ephemerides**

*Clodoaldo Júnior, Bruno Vani, Instituto Federal de Educação, Ciência e Tecnologia de São Paulo, Brazil; Alison Moraes, Instituto de Aeronáutica e Espaço, Brazil; Emanuel Costa, Centro de Estudos em Telecomunicações, Pontifícia Universidade Católica do Rio de Janeiro, Brazil; João Monico, Universidade Estadual Paulista Julio de Mesquita Filho, Brazil*

**TU-A4.1A.4** **09:20**

### **Indoor Propagation Loss Model for Simultaneous Wireless Information and Power Transfer Based in Multicommodity Flow Problems**

*Alexandre Oliveira, Glauco Fontgalland, UFECG, Brazil; Humberto D. Andrade, UFERSA, Brazil*

**TU-A4.1A.5** **09:40**

### **Wideband Indoor Channel characterization of Massive MIMO System at 3.5 GHz**

*Saif Eddine Hadji, Mourad Nedil, Mohamed Lamine Seddiki, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada; Ismail Ben Mabrouk, Durham university, United Kingdom*

**Break** **10:00**

**TU-A4.1A.6** **10:20**

### **A Generative Adversarial Network Approach for Indoor Propagation Modeling with Ray-Tracing**

*Aristeidis Seretis, Costas D. Sarris, University of Toronto, Canada; Takahiro Hashimoto, Mitsubishi Electric Co., Japan*

**TU-A4.1A.7** **10:40**

### **Physics-Informed Convolutional Neural Network for Indoor Localization**

*Farah Ashqar, Rakan Khoury, Caroline Wood, Yi-Hsuan Yeh, Aristeidis Seretis, Costas D. Sarris, University of Toronto, Canada*

**TU-A4.1A.8** **11:00**

### **A Simple Gaussian Model for Ionospheric Scintillation in Singapore**

*Ding Yu Heh, Eng Leong Tan, Eng Kee Poh, Nanyang Technological University, Singapore*

**TU-A4.1A.9** **11:20**

### **Finite-State Markov Modeling for the Non-stationary Wideband Vehicular Channels**

*Hailun Wang, Siyu Lin, Beijing Jiaotong University, China*

**TU-A4.1A.10** **11:40**

### **Finite State Markov Frequency Domain Channel Model for Vehicular Communications**

*Jiaying Song, Chinese Institute of Electronics, China; Huimin Zhang, Siyu Lin, Beijing Jiaotong University, China*



## Antenna Feeds and Matching Circuits II

Session Co-Chairs: Hao Peng, University of Electronic Science and Technology of China; Murat Emre Ermutlu, Nokia

**TU-A1.1P.1** **14:00**

**Step Substrate Integrated Waveguide Equalizer Based on Microwave Discrete Resistors for Feeding Network**

*Hao Peng, Shunhua Huang, Yu Liu, Shaowei Hu, Tao Yang, University of Electronic Science and Technology of China, China*

**TU-A1.1P.2** **14:20**

**Circular Horn Antenna with Ring and Coaxial Grooves for Dual Band**

*Atsuki Takada, Shinichi Ito, Hiroyuki Deguchi, Mikio Tsuji, Doshisha University, Japan*

**TU-A1.1P.3** **14:40**

**mm-Wave Phased Arrays Consisting of GCPW Feeding Networks with HIS in Mobile Terminals**

*Jae-Yeong Lee, Bumhyun Kim, Dongseop Lee, Wonbin Hong, Pohang University of Science and Technology, Korea (South); Jaehyun Choi, LG Innotek, Korea (South)*

**TU-A1.1P.4** **15:00**

**Low Insertion and Large Dynamic Range Substrate Integrated Waveguide Equalizer on Ceramic for Feeding Network**

*Yu Liu, Shunhua Huang, Hao Peng, Tao Yang, University of Electronic Science and Technology of China, China*

**TU-A1.1P.5** **15:20**

**Stabilizing Impedance Matching for Differentially Fed Base Station Antenna**

*JinWen Guo, Qing-Xin Chu, South China University of Technology, China*

**Break** **15:40**

**TU-A1.1P.6** **16:00**

**A Novel Coaxial Balun for High Power Electromagnetic Applications**

*Felix Vega, Adamo Banelli, Abdul Rouf Baba, Ahmed Alebri, Chaouki Kasmir, Technology Innovation Institute, United Arab Emirates*

**TU-A1.1P.7** **16:20**

**A Wideband Stripline-to-Stripline Transition for K/Ka-Bands**

*Amélia Ramos, Tiago Varum, João N. Matos, Instituto de Telecomunicações and Universidade de Aveiro, Portugal*

**TU-A1.1P.8** **16:40**

**Compact Antenna with Enhanced Filtering Capabilities by Using a Novel Structure**

*Murat Emre Ermutlu, Efstratios Doumanis, Nokia, Finland*

**TU-A1.1P.9** **17:00**

**Dual Band Topside Waveguide-to-Stripline Transition in Multilayer Substrate**

*Emilio Amieri, Francesco Greco, Luigi Boccia, Carmine Mustacchio, Giandomenico Amendola, University of Calabria, Italy*

**TU-A1.1P.10** **17:20**

**A wideband miniaturized 3 dB hybrid coupler for passive beam switching application**

*Jalil Ur Rehman Kazim, Hassan Abbas, Masood Ur Rehman, Muhammad Ali Imran, Qammer H Abbasi, University of Glasgow, United Kingdom*



## Electrically Small Antennas II

Session Co-Chairs: Smail Tedjini, Univ. Grenoble Alpes, Grenoble INP; Yijun Zhou, Institute for Infocomm Research

### TU-A1.2P.1

14:00

#### A Compact Wideband Flexible Circularly Polarized Implantable Antenna for Biotelemetry Applications

Sarosh Ahmad, Government College University, Faisalabad, Pakistan; Asma Khabba, Cadi Ayyad University Marrakesh, Morocco; Adnan Ghaffar, Xue Jun Li, Auckland University of Technology Auckland, New Zealand

### TU-A1.2P.2

14:20

#### A Highly Miniaturized 3D Antenna in Package for UHF RFID Application

Zulma Lopez Reyes, Zubair Akhter, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia

### TU-A1.2P.3

14:40

#### Coil Antenna Embedded in Ground to Monitor Water Content in Soil for Landslides Prediction System

Subaru Iwaki, Kota Iwamoto, Masaya Sakamoto, Futoshi Kuroki, National Institute of Technology, Kure College, Japan; Yuto Uchida, University of Electro-Communications, Japan

### TU-A1.2P.4

15:00

#### A 3D Dual-band Electrically Small Monopole Antenna for Internet of Sea Applications

Hanguang Liao, Rana Muhammad Bilal, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia

### TU-A1.2P.5

15:20

#### Can We Improve on the Dipole Antenna for Space-based Low Frequency Radio Astronomy?

Cornelis Versteeg, Mark Bentum, Hamid Pourshaghghi, Eindhoven University of Technology, Netherlands

### Break

15:40

### TU-A1.2P.6

16:00

#### PIFA antenna for smart watch application in the 2.4GHz Band

Abdelhakim Adli, Maria Cabedo-Fabrés, Miguel Ferrando Bataller, Universitat Politècnica de València, Spain

### TU-A1.2P.7

16:20

#### Miniaturized 3D Multi-Segment Wire Antenna for 5G

Fateh Benmahmoud, Military Polytechnique School, Algeria; Smail Tedjini, Univ. Grenoble Alpes, Grenoble INP, France

### TU-A1.2P.8

16:40

#### Dual-Band Dually-Polarized Compact Folded-Shorted Patch Array for Small Satellites

Bandar Alshammari, Khalid Alrshud, Maksim Kuznetsov, Yuepei Li, Symon. K Podilchak, Institution of Digital Communication, The University of Edinburgh, United Kingdom

### TU-A1.2P.9

17:00

#### Bandwidth investigation of UHF antenna fully integrated into 2U CubeSat body

Adam Narbudowicz, Trinity College Dublin, Ireland; Robert Borowiec, Wroclaw University of Science and Technology, Poland; Suramate Chalermwisutkul, King Mongkut's University of Technology North Bangkok, Thailand

### TU-A1.2P.10

17:20

#### A Dual-Band Microstrip Patch Antenna for 5G Mobile Communications

Gurkan Kalinay, Erzurum Technical University, Turkey; Fatih Kaburcuk, Sivas Cumhuriyet University, Turkey; Yiming Chen, Atef Z. Elsherbeni, Colorado School of Mines, United States; Veysel Demir, Northern Illinois University, United States



## Phased Array Antennas II

Session Co-Chairs: Hiroyuki Arai, Yokohama National University; Makoto Sano, Toshiba Corporation

**TU-A1.3P.1** **14:00**

### Dual-polarized Circular Horn Antenna Integrated in Multilayer PCB

*Yasushi Iitsuka, Kazuo Saitoh, Waka Manufacturing Co., Ltd., Japan*

**TU-A1.3P.2** **14:20**

### A Notch-Band UWB Tightly Coupled Antenna Array

*Xin Quan, Zhenxin Cao, Zihao Xu, Mengjiang Sun, Southeast University, China*

**TU-A1.3P.3** **14:40**

### Reflector Backed Dipole Antenna Array Employing Side Reflectors for Null Depth Improvement

*Jo Tamura, Hiroyuki Arai, Yokohama National University, Japan*

**TU-A1.3P.4** **15:00**

### Broadband E-plane Wide-angle Scanning Phased Array Base on V-shaped Structure Above Cavity

*Han Zhou, Junping Geng, Chaofan Ren, Kun Wang, Silei Yang, Jingzheng Lu, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China*

**TU-A1.3P.5** **15:20**

### Correction of the Excitation Coefficients of Ku-band Phased Arrays With a Rotatable Polarization Plane

*Makoto Sano, Koh Hashimoto, Makoto Higaki, Kentaro Wada, Toshiba Corporation, Japan*

**Break** **15:40**

**TU-A1.3P.6** **16:00**

### Distributed Amplitude Weighting and System Noise Figure in Active Phased Array

*Virendra Kumar, Rahul Agrawal, Upendra Shankar Pandey, Beenamole K.S, DRDO, India; Ravi Kumar Gangwar, IIT(ISM), India*

**TU-A1.3P.7** **16:20**

### Wide-angle Scanning Metasurface-Enhanced Array for Next-Generation Communications

*Giacomo Oliveri, Marco Salucci, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy; Renato Lombardi, Roberto Flamini, Christian Mazzucco, Stefano Verzura, Huawei Technologies, Segrate, Italy*

**TU-A1.3P.8** **16:40**

### Beamforming Comparison of a Multi-Mode Array with a Dipole Array of the Same Aperture Size

*Leonardo Mörlein, Nikolai Peitzmeier, Dirk Manteuffel, Leibniz University Hannover, Germany*

**TU-A1.3P.9** **17:00**

### Gradient Metasurface Dome for Phased arrays able Reducing the Grating Lobes within Single-side Scanning region

*Alessio Monti, Mirko Barbuto, Niccolò Cusano university, Italy; Davide Ramaccia, Angelica Viola Marini, Stefano Vellucci, Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy*

**TU-A1.3P.10** **17:20**

### EIRP Enhancement of Multi-Facet Phased Antenna Arrays for Full-Azimuth Radio Coverage

*Stanislav Ogurtsov, Diego Caratelli, Zhe Song, The Antenna Company, Netherlands*



Tuesday, December 7  
TU-A1.4P

14:00 - 17:40  
Melati Ballroom 4103

## Ultra-Wideband Antennas and Systems II

Session Co-Chairs: Yejun He, Shenzhen University; Chong He, Shanghai Jiao Tong University

**TU-A1.4P.1** **14:00**

### A Compact Monopole Antenna For UWB Upper Band Application

*Youngtae Kim, Hyounghwan Roh, Samsung Electronics Co., Ltd., Korea (South)*

**TU-A1.4P.2** **14:20**

### Ultra Wide Band Antenna for True Wireless Stereo Earphones

*Tae Hyun Woo, Young Joong Yoon, Yonsei University, Korea (South); Hyungrak Kim, Daelim University College, Korea (South)*

**TU-A1.4P.3** **14:40**

### Highly Efficient Ultra-Wideband Planar Folded Dipole Antenna for Mobile Applications

*Sheng-Sen You, Shenzhen University, China; Guan-Long Huang, Foshan University, China*

**TU-A1.4P.4** **15:00**

### A 3-9 GHz UWB High-Gain Conformal End-Fire Vivaldi Antenna Array

*Yaling Chen, Yejun He, Wenting Li, Long Zhang, Sai-Wai Wong, Shenzhen University, China; Amir Boag, Tel-Aviv University, Israel*

**TU-A1.4P.5** **15:20**

### A Miniaturized Surpershape UWB Microstrip Patch Antenna Design

*Ismail Shittu, Mousa Hussein, United Arab Emirates University, United Arab Emirates; Orhman Al Aidaros, Carleton University, Canada*

**Break** **15:40**

**TU-A1.4P.6** **16:00**

### UWB Antipodal Antenna With Parasitic Patch and Elliptical Cylindrical Dielectric For Concealed Object Detection with Microwave Imaging

*Athul O Asok, Sukomal Dey, IIT Palakkad, India*

**TU-A1.4P.7** **16:20**

### An Ultra-Wideband and High-Efficiency Single-Sideband Time-Modulator With 2-bit Phase Shifter

*Ruihua Chen, Chong He, Junping Geng, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China*

**TU-A1.4P.8** **16:40**

### Machine Learning Based Fully Digital UWB Antenna for Direction Finding Systems

*Antonio Manna, Rosa Altilio, Marco Bartocci, Pietro Bia, Christian Canestri, Domenico Gaetano, Riccardo Ardoino, Elettronica SpA, Italy*

**TU-A1.4P.9** **17:00**

### Broadband mmWave Filters using Dielectric Waveguide Bends

*Christoph Baer, Ruhr University Bochum, Germany*

**TU-A1.4P.10** **17:20**

### UWB Supershaped Dielectric Lens for Beam Control

*Christian Canestri, Alessandro Calcaterra, Domenico Gaetano, Cosma Mitrano, Pietro Bia, Antonio Manna, Elettronica S.p.A., Italy*



## Reconfigurable Antennas for Compact Devices

Session Co-Chairs: Joseph Costantine, American University of Beirut; Junho Park, Pohang University of Science and Technology (POSTECH)

### TU-SP.1P.1

14:00

#### Pop-Up Card Inspired, 3D-Printed Corner Reflector Antenna—A Novel Deployable Antenna

*Madeline Holda, Yepu Cui, Syed Abdullah Nurooze, Manos Tentzeris, Georgia Institute of Technology, United States; Peter Dahmen, Grafikdesign, Germany*

### TU-SP.1P.2

14:20

#### Polarization Reconfigurable Circular Patch

*Marios Patriotis, Firas N. Ayoub, Christos G. Christodoulou, University of New Mexico, United States; Sudharman K. Jayaweera, Bluecom Systems and Consulting LLC, United States*

### TU-SP.1P.3

14:40

#### Dual-Polarized End-fire and $\pm$ Broadside Millimeter-Wave Antenna Array

*Ahmed Omar, Junho Park, Wanbin Hong, Pohang University of Science and Technology, Korea (South); Beakjun Seong, Jongwoo Lee, Kreemo Inc., Korea (South)*

### TU-SP.1P.4

15:00

#### Design of Electrically Small, Frequency-Agile, Beam-Switchable Huygens Dipole Antenna

*Zhentian Wu, Ming-Chun Tang, College of Microelectronics and Communication Engineering, China; Richard W. Ziolkowski, Global Big Data Technologies Centre, Australia*

### TU-SP.1P.5

15:20

#### A Compact Wideband Frequency Reconfigurable Antenna for Cognitive Radio Applications

*Meini Wang, Min Tang, Junfa Mao, Shanghai Jiao Tong University, China*

### Break

15:40

### TU-SP.1P.6

16:00

#### Design and Testing of a SIW-Reconfigurable Antenna With Improved performance

*Anil Kumar Nayak, Amalendu Patnaik, IIT Roorkee, India*

### TU-SP.1P.7

16:20

#### Integrated Multi-Standard MIMO Antennas for 5G n-RNA Applications

*Rifaqat Hussain, King Fahd University of Petroleum and Minerals, Saudi Arabia; Ali Raza, UET Lahore, Faisalabad Campus, Pakistan; Muhammad Umar Khan, RIMMS, National University of Sciences and Technology (NUST), Pakistan; Mohamed Abou-Khousa, Khalifa University of Science and Technology, United Arab Emirates; Mohammad Sharawi, Polytechnique Montr'éal, Canada*

### TU-SP.1P.8

16:40

#### A Miniaturized Reconfigurable Antenna using Quantum Genetic Algorithm Optimization

*Rosette Bichara, Fatima Asadallah, Mariette Awad, Joseph Costantine, American University of Beirut, Lebanon*

### TU-SP.1P.9

17:00

#### Compact Antenna Approaching the Lower Q-factor Theoretical Bound Suitable for IoT Applications

*Luca Santamaria, Tran Quang Khai Nguyen, Fabien Ferrero, Robert Staraj, Leonardo Lizzi, Université Côte d'Azur, CNRS, LEAT, France*

### TU-SP.1P.10

17:20

#### Multiport broadband 5G MIMO antenna with very high isolation

*Anibal Llanga-Vargas, Marta Cabedo-Fabrés, Miguel Ferrando-Bataller, Universitat Politècnica de València, Spain; Carlos Ramiro Peñafiel-Ojeda, Universidad Nacional de Chimborazo, Ecuador*



Tuesday, December 7  
TU-SP.2P

14:00 - 17:20  
Peony Ballroom 4402

## Beam-Steerable Antenna Systems for Communications

Session Co-Chairs: Karu P. Esselle, University of Technology Sydney; Emilio Arneri, university of calabria

### TU-SP.2P.1

14:00

#### A Modular Microstrip Phased-array Antenna for Low-Cost, Beam-Steerable Application

*Lu Yin, Peng Yang, ZaiPing Nie, University of Electronic Science and Technology of China, China*

### TU-SP.2P.2

14:20

#### Beam-Steering 2-D Leaky-Wave Antenna Using Sparse Array Feeding by CRLH-Metasurface Network

*Ahmad Almutawa, Abdulaziz Haddab, PAAET, Kuwait*

### TU-SP.2P.3

14:40

#### High Gain Low Profile CTS Antenna Array for Satcom Applications

*Adham Mahmoud, Michele Del Mastro, Thomas Patelon, Ronan Sauleau, Mauro Ettore, IETR, France*

### TU-SP.2P.4

15:00

#### Continuous Transverse Stub Array Fed by Stripline Ports

*Emilio Arneri, Francesco Greco, Luigi Boccia, Giandomenico Amendola, University of Calabria, Italy*

### TU-SP.2P.5

15:20

#### Gradient Metasurface Dome implements a Matrix Beamforming Network for 2D Antenna Arrays

*Luca Stefanini, Davide Ramaccia, Filiberto Bilotti, Alessandro Toscano, Roma Tre University, Italy*

### Break

15:40

### TU-SP.2P.6

16:00

#### Antenna Technologies and Challenges for User Terminals of LEO Satellite Communication Systems

*Sara Mugnaini, James Liu, OneWeb, United Kingdom*

### TU-SP.2P.7

16:20

#### Flat Panel Interlaced Shared Aperture Antenna Array for LEO Ka-band High Throughput Satellite Communication Applications

*Benjamin Falkner, Hengyi Zhou, Amit Mehta, Swansea University, United Kingdom; Alessandro Modigliana, Satellite Applications Catapult, United Kingdom*

### TU-SP.2P.8

16:40

#### Patch Antenna Array Design through Bottom-Up and Bayesian Optimizations

*Lida Kouhalvandi, Farzad Mir, Ladislav Matekovits, Politecnico di Torino, Italy*

### TU-SP.2P.9

17:00

#### Enhancing wave propagation via Contextual Beamforming

*Jaspreet Kaur, Qammer H Abbasi, Abu Bakar Sharif, Olaoluwa Popoola, Muhammad Ali Imran, Hasan T Abbas, University of Glasgow, United Kingdom*



## Unconventional Design Approaches for Low Cost Antennas

Session Co-Chairs: Paolo Rocca, University of Trento; Nicola Anselmi, University of Trento

**TU-SP.3P.1** **14:00**

### A Phase Compensation Technique for the Tradeoff Design of Irregular Phased Array

*Yankai Ma, Shiwen Yang, University of Electronic Science and Technology of China, China*

**TU-SP.3P.2** **14:20**

### A Novel Method for the Synthesis of High Directivity Wide-Angle Scanning Irregular Phased Arrays

*Feng Yang, Shiwen Yang, University of Electronic Science and Technology of China, China; Chao Sun, China Electronics Technology Group Corporation, China*

**TU-SP.3P.3** **14:40**

### Circularly Polarized Rampart Slotline Terminated With Patch for Low-Cost Applications

*Yang Cheng, Yuandan Dong, University of Electronic Science and Technology of China, China*

**TU-SP.3P.4** **15:00**

### A Low-Profile Omnidirectional Antenna for WAIC System Application

*Xiao-Yu Ma, Sai-Wai Wong, Shenzhen University, China; Guan-Long Huang, Foshan University, China*

**TU-SP.3P.5** **15:20**

### A Low-Cost Combination for Phased Array and ESPAR Antennas

*Shambhu Nath Jha, Thales Belgium, Belgium; Francis Keshmiri, Agile Antenna Services, France; Maxime Drouguet, Christophe Craeye, Université catholique de Louvain, Belgium*

**Break** **15:40**

**TU-SP.3P.6** **16:00**

### Irregularly Clustered Antenna Array: a prototype for mmW 5G Base Station

*Laura Resteghini, Roberto Flamini, Claudia Massagrande, Valentina Verri, Christian Mazzucco, Renato Lombardi, Huawei Technologies, Italy*

**TU-SP.3P.7** **16:20**

### Shaped Elevation Patterns for 5G Base Stations

*Antoine Roederer, Yanki Aslan, Alex Yarovoy, Delft University of Technology, Netherlands; Jan Puskely, TU Delft, Netherlands*

**TU-SP.3P.8** **16:40**

### Low-cost antenna architectures with control of the local environment for 5G and beyond 5G

*Daniele Pinchera, Marco Donald Migliore, University of Cassino and Southern Lazio, Italy*

**TU-SP.3P.9** **17:00**

### Capacity-Driven Optimization of Tiled Arrays for Multi-User MIMO Communication Base Stations

*Nicola Anselmi, Paolo Rocca, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy; Bruno Biscontini, Alejandro Murillo Barrera, Huawei Technologies Duesseldorf GmbH, Germany*

**TU-SP.3P.10** **17:20**

### Implantable Antenna Design Using Improved Grey Wolf Optimizer Algorithm

*Achilles Boursianis, Sotirios Goudos, Aristotle University of Thessaloniki, Greece; Maria Matthaïou, Stavros Koulouridis, University of Patras, Greece; Marco Salucci, University of Trento, Italy*





## Wearable and Implantable Antennas I

Session Co-Chairs: Agostino Monorchio, University of Pisa / RaSS Laboratory CNIT; Roy B. V. B. Simorangkir, Tyndall National Institute; Youssef Tawk, American University of Beirut

**TU-A5.1P.1** **14:00**

### A Vasculature Anatomy Inspired Flexible Slot Antenna for Continuous Non-invasive Glucose Monitoring

*Jessica Hanna, Joseph Costantine, Rouwaida Kani, Youssef Tawk, Ali Ramadan, Assaad Eid, American University of Beirut, Lebanon*

**TU-A5.1P.2** **14:20**

### A Tunable Wearable Band Reject Sensor for Enhanced Glucose Monitoring Sensitivity

*Moussa Bteich, Joseph Costantine, Rouwaida Kani, Youssef Tawk, Ali Ramadan, Assaad Eid, American University of Beirut, Lebanon*

**TU-A5.1P.3** **14:40**

### Application of Dielectric Resonator Antenna in Implantable Medical Devices

*Sumer Singh Singhal, Ladislav Matekovits, Politecnico di Torino, Italy; Ildiko Peter, University of Medicine, Pharmacy, Science and Technology, Romania; Binod Kumar Kanaujia, Jawaharlal Nehru University, India*

**TU-A5.1P.4** **15:00**

### Implantable Antenna Design for Surface-Wave Based In-Body to On-Body Communications

*Lukas Berkelmann, Dirk Manteuffel, Leibniz University Hannover, Germany*

**TU-A5.1P.5** **15:20**

### A circularly polarized patch antenna matched to liver surface with TX coupling medium

*Muhammad Saad Khan, Bernd Schweizer, Andreas Breusing, RheinMain University of Applied Sciences, Germany; Georg Rose, Otto Von Guericke University, Germany*

**Break** **15:40**

**TU-A5.1P.6** **16:00**

### Miniaturization of a Wideband Implantable Peano Antenna for Medical Applications

*Abdenasser Lamkaddem, Ahmed El Yousfi, Daniel Segovia-Vargas, Carlos III University of Madrid, Spain; Vicente González Posadas, Polytechnic University of Madrid, Spain*

**TU-A5.1P.7** **16:20**

### A Conformal and Wearable Metasurface for Non-invasive Skin Inflammation Monitoring

*Danilo Brizi, Agostino Monorchio, University of Pisa/CNIT, Italy; Francesco Marino, University of Pisa, Italy*

**TU-A5.1P.8** **16:40**

### Flexible Antenna on Polymer-Conductive Textile Composite for Epidermal Electronics

*Roy B. V. B. Simorangkir, Brendan O'Flynn, Dinesh R. Gawade, John L. Buckley, Tyndall National Institute, Ireland; Tim Hannon, Paul Donovan, Robert Newberry, Sanmina Corporation, United States*

**TU-A5.1P.9** **17:00**

### Screen Printing Reliable Wearable Microstrip Antennas on Rough Textile Substrates

*Mahmoud Wagih, Abiodun Komolafe, Russel Torah, Alex Weddell, University of Southampton, United Kingdom; Steve Beeby, University of Southampton, United Kingdom*

**TU-A5.1P.10** **17:20**

### The Challenges in Implementing Wearable Antennas for Large-Scale Health Monitoring

*Sagar Suresh Kumar, Kia Dashtipour, Qammer H Abbasi, Muhammad Ali Imran, Wasim Ahmad, University of Glasgow, United Kingdom*



## Millimeter-Wave Antennas I

Session Co-Chairs: Mohamad Kamal A Rahim, Universiti Teknologi Malaysia; Eva Antonino-Daviu, Universitat Politècnica de València

### TU-A5.2P.1

14:00

#### A Novel Broadband Partially Reflective Surface Superstrate for mm-Wave Printed Antennas

*Lamine Mohamed Abdelghani, Institut national de recherches Scientifiques, Canada; Abdelhalim Chaabane, Université 8 Mai 1945 Guelma, Algeria; Hussein Attia, King Fahd University of Petroleum and Minerals, Saudi Arabia*

### TU-A5.2P.2

14:20

#### Millimeter Wave Wide-Angle Scanning Waveguide Slot Filtenna Array for 5G Applications

*Rong Lu, Chao Yu, Wei Hong, Southeast University, China*

### TU-A5.2P.3

14:40

#### Design of a Dual-Branch Dual-band Monopole Based MIMO Antenna for 5G mm-wave Smartphone Applications

*Prajwal Patnaik, Chinmoy Saha, Indian Institute of Space Science and Technology, India; Jogesh Chandra Dash, Debdeep Sarkar, Indian Institute of Science, India; Yahia M. M. Antar, The Royal Military College of Canada, Canada*

### TU-A5.2P.4

15:00

#### High Gain Tilted Beam SIW Horn Antenna for 5G Millimeter Wave Communication

*Sourav Ghosh, Naman Baghel, Satya Krishna Idury, Rajesh Shukla, Soumava Mukherjee, Indian Institute of technology Jodhpur, India*

### TU-A5.2P.5

15:20

#### A Wideband Slotted Microstrip Patch Antenna for mm-Wave 5G Applications

*Ademola Mustapha, Mohamed Abou-Khousa, Khalifa University of Science and Technology, United Arab Emirates*

### Break

15:40

### TU-A5.2P.6

16:00

#### A Low-cost Sub-Terahertz Circularly Polarized Antenna for 6G Wireless Communications

*Basem Aqlan, Hamsakutty Vettikalladi, King Saud University, Saudi Arabia; Mohamed Himdi, Université of Rennes 1, France*

### TU-A5.2P.7

16:20

#### Chamber-Decay Time in a mm-Wave Reverberation Chamber

*Anouk Hübrenchen, Ad Reniers, Bart Smolders, Sander Bronckers, Eindhoven University of Technology, Netherlands*

### TU-A5.2P.8

16:40

#### Design Of A Compact Ultra-Wideband Microstrip Antenna for Millimeter-Wave Communication

*Abdul Jabbar, Jalil Ur Rehman Kazim, Muhammad Ali Imran, Qammer Hussain Abbasi, Masood Ur Rehman, University of Glasgow, United Kingdom*

### TU-A5.2P.9

17:00

#### Eight-Port Wideband MIMO Antenna for Sub-6 GHz 5G Base Stations

*Jaime Molins-Benlliure, Marta Cabedo-Fabrés, Eva Antonino-Daviu, Miguel Ferrando-Bataller, Universitat Politècnica de València, Spain*

### TU-A5.2P.10

17:20

#### Substrate Integrated Waveguide Series Feed Patch Antenna at Millimeter wave for 5G application

*Mohamad Kamal A Rahim, Osman Ayop, Abd Menam Azzawi, Universiti Teknologi Malaysia, Malaysia*



Tuesday, December 7  
TU-A2.1P

14:00 - 17:40  
Peony Junior Ballroom 4512

## Electromagnetic Theory, Material Properties and Measurements II

Session Co-Chairs: Dirk Manteuffel, Leibniz University Hannover; Qun Lou, National University of Singapore

**TU-A2.1P.1** **14:00**

Research on Open Resonator at 35 GHz for Plasma Diagnosis

*Yihang Tu, En Li, Lin Qin, Yang Qiu, University of Electronic Science and Technology of China, China*

**TU-A2.1P.2** **14:20**

Scattering Analysis of Metallic Nanowires with Nonlocal Response Based on GNOR

*Bingqi Liu, Li Xu, Liang Li, Siyi Yang, Shucheng Huang, Bin Li, University of Electronic Science and Technology of China, China*

**TU-A2.1P.3** **14:40**

Multiphysics Analysis and Implementation of a High Power Y-Junction Waveguide Circulator

*Muhammad Atayyab Shahid, Tariq Mairaj Khan, Muhammad Waseem Khaliq, Qamar ul Hassan, Wahab Zarin, National University of Sciences and Technology, Pakistan*

**TU-A2.1P.4** **15:00**

Partial Arc Sampling Receiving Scheme for Demultiplexing of Orbital Angular Momentum Vortex Beam

*Yanming Zhang, Lijun Jiang, University of Hong Kong, Hong Kong SAR of China*

**TU-A2.1P.5** **15:20**

Replacement of the TD Wave Equation by a First Order Equation with Alternative Field Constituents

*Raphael Kastner, Tel-Aviv University, Israel*

**Break** **15:40**

**TU-A2.1P.6** **16:00**

Antenna's Radar Cross Section (RCS) Measurements

*Habiba Oslimani, Patricia Grassin Leze, Yacine Sekhri, Malik Gaoua, Frédérique Gadot, University paris Nanterre Paris Lumières, France*

**TU-A2.1P.7** **16:20**

Using Characteristic Modes for Determining the Incident Field in a Scattering Problem

*Lukas Grundmann, Dirk Manteuffel, Leibniz University Hannover, Germany*

**TU-A2.1P.8** **16:40**

A novel approach for the contactless estimation of the surface impedance

*Sandra Rodini, Simone Genovesi, Giuliano Manara, Filippo Costa, University of Pisa, Italy*

**TU-A2.1P.9** **17:00**

Near-Field Spherical Wave Formation in Resonant Leaky-Wave Lens Antennas

*Sjoerd Bosma, Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands*

**TU-A2.1P.10** **17:20**

Bridging the materials' permittivity traceability gap for 5G applications

*Malgorzata Celuch, Marzena Olszewska-Placha, QWED Sp. z o.o., Poland; Michael Hill, Intel Corp., United States; Tomasz Karpisz, Bartlomiej Salski, Warsaw University of Technology/QWED Sp. z o.o., Poland; Say Phommakesone, Keysight Technologies, United States; Urmi Ray, The International Electronics Manufacturing Initiative, United States*



Tuesday, December 7  
TU-A2.2P

14:00 - 17:40  
Peony Ballroom 4403

## Metasurface Applications II

Session Co-Chairs: Mirko Barbutto, Niccolò Cusano University; Alessio Monti, Niccolò Cusano University

**TU-A2.2P.1** 14:00

### Programmable Metasurface-Based DOA Estimation Using Atomic Norm Minimization

*Yangying Zhao, Peng Chen, Zhenxin Cao, Yu Zhang, State Key Laboratory of Millimeter Waves, Southeast University, China*

**TU-A2.2P.2** 14:20

### Inverse Design of Metasurface Polarization Converter with Controllable Bandwidth

*Kai Qu, Ke Chen, Yijun Feng, Nanjing University, China*

**TU-A2.2P.3** 14:40

### Gain Enhancement of H-Plane Scanning Phased Array Antenna Using Huygens Metasurface

*Zi-Hao Fu, Xue-Song Yang, University of Electronic Science and Technology of China, China*

**TU-A2.2P.4** 15:00

### Gain Enhancement of Patch Antenna Using Metasurface Lens

*Huanhuan Peng, Jianhua Yang, Zhiyu Xing, Shaolong Huang, Feng Yang, University of Electronic Science and Technology of China, China*

**TU-A2.2P.5** 15:20

### A Wide-Band Metasurface for Asymmetric Microwave Transmission with Circular Polarization Conversion for Satellite Communications

*Sahar Bibi, Noshewan Shoaib, National University of Sciences and Technology, Islamabad, Pakistan; Abdul Quddious, University of Cyprus, Cyprus; Symeon Nikolaou, Frederick Research Center, Nicosia, Cyprus*

**Break** 15:40

**TU-A2.2P.6** 16:00

### Square Ring Element for Tilted Beam Radiation Utilizing Metasurfaces

*Mohammed Alharbi, Meshal Alyahya, Saad Alhuwaimel, King Abdulaziz City for Science and Technology, Saudi Arabia; Saud Saeed, Prince Sattam bin Abdulaziz University, Saudi Arabia; Ibrahim Alsaif, Smart Measure Company, Saudi Arabia*

**TU-A2.2P.7** 16:20

### A Self-Filtering Horn Antenna Based on Multipolar All-Dielectric Metasurfaces

*Alessio Monti, Niccolò Cusano University, Italy; Andrea Ali, CUNY Advanced Science Research Center, United States; Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy*

**TU-A2.2P.8** 16:40

### A Hybrid RFID/Localization Antenna with HIS and 3D-Printed Inclusions

*Shobit Agarwal, Alessandra Costanzo, Universita di Bologna, Italy; David Chadzichristodoulou, RF and Microwave Solutions LTD, Cyprus; Abdul Quddious, University of Cyprus, Cyprus; Diego Masotti, University of Bologna, Italy; Symeon Nikolaou, Frederick University, Cyprus*

**TU-A2.2P.9** 17:00

### Designing Reflective Metasurfaces by Exploiting Composite Vortex Theory

*Mirko Barbutto, Andrea Bassotti, Niccolò Cusano University, Italy; Andrea Ali, CUNY Advanced Science Research Center, United States; Filiberto Bilotti, Alessandro Toscano, Roma Tre University, Italy*

**TU-A2.2P.10** 17:20

### Design of a Slotted Substrate Integrated Waveguide Antenna using a Metasurface

*Javier Chocarro, Iñigo Edera, Public University of Navarre, Spain*



Tuesday, December 7  
TU-A3.1P

14:00 - 17:40  
Peony Junior Ballroom 4511

## Computational Electromagnetics I

Session Co-Chairs: Guido Lombardi, Politecnico di Torino; Shunchuan Yang, Beihang University

**TU-A3.1P.1** **14:00**

**Non-Conformal SS-SIE Formulation Without Treatments on Junctions for Composite Objects**

*Zekun Zhu, Shunchuan Yang, Beihang University, China; Zhizhang (David) Chen, Fuzhou University, China*

**TU-A3.1P.2** **14:20**

**Analysis of Electromagnetic Scattering From Dielectric Problems by PMCHWT-SASF**

*Ming Jiang, Zhi Rong, Jun Hu, University of Electronic Science and Technology of China, China*

**TU-A3.1P.3** **14:40**

**Analysis of Electromagnetic Scattering from Composite Objects using a Multi-trace Surface Integral Equation**

**Method**

*Ran Zhao, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia; Jun Hu, University of Electronic Science and Technology, China*

**TU-A3.1P.4** **15:00**

**A NFFF approach using spheroidal wave functions in a cylindrical scanning geometry**

*Francesca Borrelli, Amedeo Capozzoli, Claudio Curcio, Angelo Liseno, Università di Napoli Federico II, Italy*

**TU-A3.1P.5** **15:20**

**Efficient Modelling of Antenna Measurements Including the Impact of the Anechoic Chamber**

*Francesco Saccardi, Maria Alberica Saporetti, Rubén Tena Sánchez, Lars Jacob Foged, MVI, Italy*

**Break** **15:40**

**TU-A3.1P.6** **16:00**

**An Integral-Equation-Based Method for Efficient and Accurate Solutions of Scattering Problems with Highly Nonuniform Discretizations**

*Bahram Khalichi, Vakur Behcet Erturk, Bilkent University, Turkey; Ozgur Ergul, Middle East Technical University, Turkey*

**TU-A3.1P.7** **16:20**

**Unified Approach to Characteristic Modes**

*Miloslav Capek, Lukas Jelinek, Vit Losenicky, Czech Technical University in Prague, Czech Republic; Mats Gustafsson, Lund University, Sweden; Kurt Schab, Santa Clara University, United States*

**TU-A3.1P.8** **16:40**

**Broadband Direction of Arrival Estimation Based on Layered Neural Network**

*Tian-Yu Sun, Wei Shao, Fu-Long Jin, University of Electronic Science and Technology of China, China*

**TU-A3.1P.9** **17:00**

**Wiener-Hopf Solution of E-Polarized Plane Wave Diffraction by a Dielectric Slit in a Thick Screen**

*Vito Daniele, Guido Lombardi, Politecnico di Torino, Italy*

**TU-A3.1P.10** **17:20**

**Analysis of Electromagnetic Scattering Characteristics of a Resonant Target**

*Dihia Sidi Ahmed, Laetitia Thirion-Lefèvre, Régis Guinvarc'h, Giovanni Manfredi, SONDR / CENTRALESUPELEC, France; Graziano Cerri, Paola Russo, Università Politecnica delle Marche, Italy*



## Propagation Modeling and Analysis II

Session Co-Chairs: Mio Taniguchi, Muroran Institute of Technology; Ramoni Adeagun, Aalborg University

**TU-A4.1P.1** **14:00**

Measured-based channel capacity of multimode OAM system with dual-loop receiver

*Xi Liao, Changwen He, School of Communication and Information Engineering Chongqing University of Posts and Telecommunications, China*

**TU-A4.1P.2** **14:20**

Performance analysis of Doppler effect suppression by subcarrier spacing in ultra-high-speed environment

*Jia Yu, Bo Ai, Dan Fei, Beijing Jiaotong University, China; Ning Wang, Zhengzhou University, China; Zhiping Chen, Zhongxing Telecom Equipment, China*

**TU-A4.1P.3** **14:40**

Analysis of foF2 Observations and Predictions of Modified Ionosphere Model in East-Asia

*Cheng Yang, Jian Wang, Tianjin University, China*

**TU-A4.1P.4** **15:00**

Urban and Suburban Bay Area Radio Environment for the UAV communications

*Mio Taniguchi, Erina Sasaki, Shoichi Kitazawa, Muroran Institute of Technology, Japan*

**TU-A4.1P.5** **15:20**

Power Delay Profile Analysis of 28 GHz Indoor Channel using Massive 3D-MIMO Arrays

*Qiongyang Guo, Yang Wang, Xi Liao, Chun Jin, Chongqing University of Posts and Telecommunications, China*

**Break** **15:40**

**TU-A4.1P.6** **16:00**

Reconfigurable Surface Wave Platform Using Fluidic Conductive Structures

*Zhiyuan Chu, Kai-Kit Wong, Kin-Fai Tong, University College London, United Kingdom*

**TU-A4.1P.7** **16:20**

On Propagation Graph Model for Industrial UWB Channels

*Ramoni Adeagun, Aalborg University, Denmark*

**TU-A4.1P.8** **16:40**

Comparative Analysis in Radar Cross Section of Low Profile and Conventionally Sized UHF SATCOM Antenna

*Enez Furkan Gihan, Mehmet Kopar, ASELSAN Inc., Turkey; Cumali Sabah, Middle East Technical University - Northern Cyprus Campus, Turkey*

**TU-A4.1P.9** **17:00**

A Study of Human Body Shadowing at 300 GHz in a Scattering Indoor Corridor Environment

*Andreas Prokscha, Fawad Sheikh, Yamen Zantah, Thomas Kaiser, University of Duisburg-Essen, Germany; Muath Al-Hasan, Al Ain University, Germany*

**TU-A4.1P.10** **17:20**

An Inverse Source Approach for Designing Smart Electromagnetic Environments

*Marco Salucci, Arianna Benoni, Mohammad Abdul Hannan, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*



## Mutual Coupling in Antenna Arrays I

Session Co-Chairs: Halim Boutayeb, Quebec University; Yantao Yu, Chongqing University

**WE-A1.1A.1** **08:20**

**Mutual Coupling Reduction in Dual Differential-Fed 2×1 Phased Array with Polarization and Pattern Diversity**

*Wenyu Zhou, Jordan Labossiere, Nima Javanbakht, Shakeeb Abdullah, Rony Amaya, Carleton University, Canada*

**WE-A1.1A.2** **08:40**

**High Isolation MIMO Antenna Using Dielectrically Loaded Printed Dipole For 5G applications**

*Jamal Zaid, Peiwei Wang, Huawei, Canada; Halim Boutayeb, Quebec University, Canada*

**WE-A1.1A.3** **09:00**

**Orbital Angular Momentum Based Isolation in Full Duplex Systems**

*Unaiza Tariq, Hiva Shahoei, Guang Yang, Duncan Macfarlane, Southern Methodist University, United States*

**WE-A1.1A.4** **09:20**

**Common Mode Suppression Technique for Dual-Band Array Environment**

*Evan Wayton, Wengang Chen, Niranjana Sundararajan, JMA Wireless, United States; Jay Lee, Syracuse University, United States*

**WE-A1.1A.5** **09:40**

**Array Antenna Decoupling and Low-Sidelobe Beamforming Based on Active Element Pattern Synthesis in 5G**

**Application**

*Xiaohui Li, Jinling Zhang, Beijing University of Posts and Telecommunications, China; Zhanqi Zheng, Datang Mobile Equipment Co., China*

**Break** **10:00**

**WE-A1.1A.6** **10:20**

**Decoupling of Horn Antennas Using Metamaterials**

*Zengdi Bao, Yong Yang, Peng Khiang Tan, Jian Lu, National University of Singapore, Singapore*

**WE-A1.1A.7** **10:40**

**Design of Dual-band Decoupling Network for Two Antennas**

*Min Li, Hong Kong University of Science and Technology, China; Lijun Jiang, Kwan Lawrence Yeung, University of Hong Kong, China*

**WE-A1.1A.8** **11:00**

**A T-shaped defected ground structure for decoupling circularly polarization microstrip antenna array**

*Zi-Liang Li, Zi-Jian Xing, Jian-Ying Li, Northwestern Polytechnical University, China*

**WE-A1.1A.9** **11:20**

**A Compact Large-scale Antenna with High Isolation for Base Station Applications**

*Ting Liu, Luyu Zhao, Xidian University, China*



## Electrically Small Antennas III

Session Co-Chairs: Ikmo Park, Ajou University; Wei Lin, University of Technology Sydney

<b>WE-A1.2A.1</b>	<b>08:20</b>
<b>Compact, Small, Chip-Inductor-Loaded Wi-Fi 6E Monopole Antenna</b> <i>Saou-Wen Su, ASUSTek Computer Inc., Taiwan</i>	
<b>WE-A1.2A.2</b>	<b>08:40</b>
<b>A Compact Series-Fed Two-Element Dipole Antenna</b> <i>Heesu Wang, Ikmo Park, Ajou University, Korea (South)</i>	
<b>WE-A1.2A.3</b>	<b>09:00</b>
<b>Feasible study of MACKEY II type R with Enhanced Robustness on metal</b> <i>Keisuke Miyashita, Shigeru Makino, Kenji Itoh, Kanazawa Institute of Technology, Japan</i>	
<b>WE-A1.2A.4</b>	<b>09:20</b>
<b>A Miniaturized Dual-Polarized Patch Antenna with L-shaped Feeds For C-Band Applications</b> <i>Xi Gu, Qing-Xin Chu, South China University of Technology, China</i>	
<b>WE-A1.2A.5</b>	<b>09:40</b>
<b>Ultra-Thin Uniform Linear Array of Electrically Small Huygens Dipole Antennas</b> <i>Wei Lin, Richard Ziolkowski, University of Technology Sydney, Australia</i>	
<b>Break</b>	<b>10:00</b>
<b>WE-A1.2A.6</b>	<b>10:20</b>
<b>A Compact Omnidirectional Circularly Polarized Antenna</b> <i>Yang Xiao, Qiang Liu, Hunan University, China</i>	
<b>WE-A1.2A.7</b>	<b>10:40</b>
<b>Development of MACKEY II type M miniaturized using multiple slits</b> <i>Kota Hakamata, Keisuke Miyashita, Shigeru Makino, Kenji Itoh, Kanazawa Institute of Technology, Japan</i>	
<b>WE-A1.2A.8</b>	<b>11:00</b>
<b>New Concept for BAW Antenna Induced by Magnon-Phonon Coupling</b> <i>Yahui Ji, Tianxiang Nan, School of Integrated Circuits, Tsinghua University, China; Yue Li, Tsinghua University, China</i>	
<b>WE-A1.2A.9</b>	<b>11:20</b>
<b>A Miniaturized Monopole Element Printed Quasi-Yagi Antenna using a Meandered Driven Element</b> <i>Amar Chaudhari, Kamla Prasan Ray, Defence Institute of Advanced Technology (DIAT), India</i>	
<b>WE-A1.2A.10</b>	<b>11:40</b>
<b>Small-sized Antenna for Impulse Radar Sensing of Bamboo Shoot in Agricultural Soil</b> <i>Kouta Iwamoto, Masaya Sakamoto, Subaru Iwaki, Futoshi Kuroki, National Institute of Technology, Kure College, Japan</i>	





## Phased Array Antennas III

Session Co-Chairs: Kate Duncan, United States Military Academy; Zhongxiang Shen, Nanyang Technological University

**WE-A1.3A.1** **08:20**

### Wide Angle ESA Fed Reflector Active Range Demonstration

*Carlos Romero, Aaron Rothlisberger, Thomas Hand, Joseph Torres, Joshua Gustafson, Mark Winebrand, Peter Maschetti, Lockheed Martin Space, United States*

**WE-A1.3A.2** **08:40**

### Proximity Feature Based Target Detection for Airborne Radar with Misaligned Antenna Array

*Rafi Ahmed, Hai Deng, Florida International University, United States*

**WE-A1.3A.3** **09:00**

### Reception Optimization Strategies for UHF Mobile Beacons

*Nolan Pearce, Kate Duncan, Gerald Popko, United States Military Academy, United States*

**WE-A1.3A.4** **09:20**

### A Compact mmWave SIW Blass Matrix

*Dimitrios Lialios, Constantinos Zekios, Stavros Georgakopoulos, Florida International University, United States*

**WE-A1.3A.5** **09:40**

### A Passive Phased-Array Antenna Module

*Amir Raeesi, Wael Abdel-Wahab, Suren Gigoyan, Safieddin Safavi-Naeini, University of Waterloo, Canada*

**Break** **10:00**

**WE-A1.3A.6** **10:20**

### Collimation of Experimental Antenna Array Using Embedded Calibration Lines

*Virendra Kumar, Shreeshail ., Beenamole K.S, Upendra Shankar Pandey, Beenamole K.S, DRDO, India; Ravi Kumar Gangwar, IIT(ISM), India*

**WE-A1.3A.7** **10:40**

### A 4×4 K/Ka-Band Sequentially Rotated Wideband Circularly Polarized Microstrip Phased Array Antenna with Stable Gain Performance

*Sanghamitra Das, Satish Sharma, Rudraishwarya Banerjee, San Diego State University, United States*

**WE-A1.3A.8** **11:00**

### Performance Analysis of Frequency Diverse Array with Frequency Offset Errors

*Hu Tang, Yi Liao, Wen-qin Wang, University of Electronic Science and Technology of China, China*

**WE-A1.3A.9** **11:20**

### Synthesis of Sparse Arrays With a More Efficient Reweighted $l_1$ -norm Minimization Algorithm

*Shaolong Huang, Feng Yang, Jianhua Yang, Zhiyu Xing, Huanhuan Peng, University of Electronic Science and Technology of China, China*

**WE-A1.3A.10** **11:40**

### Synthesis of Wide-Angle Difference Pattern with Low Side-lobe Level on Asymmetric Aperture of Hemispherical Conformal Array Antennas

*Hong Sheng Lin, Yu Jian Cheng, Hai Ning Yang, University of Electronic Science and Technology of China, China*



## Wideband Antennas

Session Co-Chairs: Wenmei Zhang, Shanxi University; Koushik Dutta, University of Central Florida

**WE-A1.4A.1** **08:20**

### Wideband Design of A Circularly Polarized Fabry-Perot Cavity Antenna

*Koushik Dutta, Raj Mittra, University of Central Florida, United States; Anirban Chatterjee, Netaji Subhash Engineering College, India*

**WE-A1.4A.2** **08:40**

### A High Aperture Efficiency Switched-Beam Lens-Based System with Tightly-Coupled Array Feed

*Theodore Prince, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder, United States*

**WE-A1.4A.3** **09:00**

### A Planar Ultra-Wideband Dual Polarized Reflectarray

*Muhammad Hamza, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States*

**WE-A1.4A.4** **09:20**

### Compact Slant 45° Dual-Polarized Butler-based Omni-Directional MIMO Antennas

*Lin-Ping Shen, Hamid Jamali, Communication Components Antenna Inc (CCA), Canada; Xiaojing Wu, Soochow University, China*

**WE-A1.4A.5** **09:40**

### Ultra-Wideband Dual-Polarized 4x4 MIMO Multi-Beam RET Antennas

*Lin-Ping Shen, Hua Wang, Erik Willis, Nasrin Hojjat, Hamid Jamali, Communication Components Antenna Inc (CCA), Canada; Xiaojing Wu, Soochow University, China*

**Break** **10:00**

**WE-A1.4A.6** **10:20**

### Ultra-Wide Band Variable Linear Polarization Rotator With High Cross-polarization Discrimination For Scanned Beams

*Kwok Kee Chan, Kwok Kee Chan Holdings Inc., Canada*

**WE-A1.4A.7** **10:40**

### Broadband Dual-Polarized Antenna Element for 5G Base Station Using Characteristic Mode Analysis

*Thi Anh Vu, Minh Thuy Le, Hanoi University of Science and Technology, Viet Nam; Trong Toan Do, Duc Nhat Nguyen, Vu Xuan Trung Nguyen, Thi Them Truong, Dinh Hai Truyen Hoang, Viettel Group, Viet Nam*

**WE-A1.4A.8** **11:00**

### A Broadband Dual-polarized Based Station Antenna with Notch Band

*Xinwei Chen, Yuewei Zhang, Wenmei Zhang, Shanxi University, China*

**WE-A1.4A.9** **11:20**

### Design of Broadband Dual-Polarized Conformal Phased Antenna

*Xun-Peng Long, Song-Zhao Zhou, Zhi-Yuan Zong, Wen Wu, Nanjing University of Science and Technology, China*

**WE-A1.4A.10** **11:40**

### A Compact Ultra-Wideband Antenna and Its Application in MIMO Systems

*Hong-yu Huang, Qing-xin Chu, South China University of Technology, China*



## Adaptive, Reconfigurable and Active Antennas

Session Co-Chairs: Nicola Anselmi, University of Trento; Jayanti Venkataraman, Rochester Institute of Technology

**WE-A1.5A.1** **08:20**

Generalized Eigenvalue Problem for Spatially-Discrete Traveling-Wave-Modulated Circuit Networks

*Cody Scarborough, Anthony Grbic, University of Michigan, United States*

**WE-A1.5A.2** **08:40**

Low-probability of Intercept/Detect (LPI/LPD) Communications Using Phased-arrays Employing Side-lobe Time Modulation

*Jiahao Zhao, John Booske, Nader Behdad, University of Wisconsin-Madison, United States*

**WE-A1.5A.3** **09:00**

Beam Steering Circular Arrays in Elevation and Azimuth Planes for Automotive Radar Applications

*Connor Devitt, Jayanti Venkataraman, Rochester Institute of Technology, United States*

**WE-A1.5A.4** **09:20**

A Novel Polarization Reconfigurable Antenna Based on Electrochemically-Controlled Liquid Metal

*Yi Zhou, Xiao Jia Huang, Mei Song Tong, Tongji University, China*

**WE-A1.5A.5** **09:40**

Experimental Verification of Harmonic Characteristic Analysis of Direction-finding System using Multi-element Time-modulated Arrays

*Jaisy M A, Aswathi P, Deepti Das Krishna, Cochin University of Science and Technology, India*

**Break** **10:00**

**WE-A1.5A.6** **10:20**

On the Phase and Amplitude Coverages of the Phase Modulation Antenna Array

*Qianwei Zeng, Peng Yang, Lu Yin, Hao Lin, Qiang Li, Liang Chen, Fei Zhang, Chuan Wu, Feng Yang, Shiwen Yang, University of Electronic Science and Technology of China, China*

**WE-A1.5A.7** **10:40**

Beamforming Experiment of Time-Modulated Array Using Phase Shifter

*Kazunari Kihira, Makoto Matsuki, Toru Fukasawa, Yoshio Inasawa, Mitsubishi Electric Corporation, Japan*

**WE-A1.5A.8** **11:00**

Beam Steerable Leaky Wave Antenna using FPMS

*Shahinshah Ali, Hamad M. Cheema, National University of Sciences and Technology, Pakistan; Farhan A. Ghaffar, Lakehead University, Canada*

**WE-A1.5A.9** **11:20**

A Folded 1-bit Reconfigurable Transmitarray With Wide Working Band

*Xin Dai, Kwai-Man Luk, City University of Hong Kong, Hong Kong SAR of China*

**WE-A1.5A.10** **11:40**

Band Switchable Monopole Antenna for UWB, 5G and Cognitive Radio Applications

*Rushiraj Jawale, Awanish Kumar, G Shrikanth Reddy, Indian Institute of Technology Mandi, India*



## MIMO Implementations and Applications

Session Co-Chairs: Mehrbod Mohajer, Amazon Lab126; Jayanta Mukherjee, Indian Institute of Technology Bombay

**WE-A5.1A.1** **08:20**

### System Simulations for MIMO Antenna Designs

*Mehrbod Mohajer, Seyed Yahya Mortazavi, Essam Elkhoully, Chen Chen, Amazon Lab126, United States*

**WE-A5.1A.2** **08:40**

### Implementation of DORT to a MIMO Radar with Planar Transmit and Receive Arrays

*Zhelin Cao, Kamal Sarabandi, University of Michigan, United States*

**WE-A5.1A.3** **09:00**

### Experimental Verification of Maximized SNR against RCS from Overrepresented MIMO Virtual Array

*Richard Tanski, Syracuse University, Qualcomm Inc., United States; Jay Lee, Syracuse University, United States*

**WE-A5.1A.4** **09:20**

### 28 GHz Millimeter-Wave Digital Beamformer : Design and Experimental Evaluation

*Kefayat Ullah, Sathesh Bajja Venkatakrishnan, John L. Volakis, Florida International University, United States*

**WE-A5.1A.5** **09:40**

### Contention Based Medium Access Control Protocol for Point-To-Multipoint Backhaul Networks in the 3.65 GHz Band

*Abdellah Chehri, University of Quebec in Chicoutimi, Canada*

**Break** **10:00**

**WE-A5.1A.6** **10:20**

### A Four-Port MIMO Antenna with High Isolation for Sub-6GHz 5G Communication

*Wen Jie Liu, Kai Kai Guan, Mei Song Tong, Tongji University, China*

**WE-A5.1A.7** **10:40**

### Multiband 4-Port DGS MIMO Antenna with DR Isolating Element for Wireless Applications

*Jayshri Kulkarni, Vishwakarma Institute of Information Technology, India; Tuan-Yung Han, National Taitung Junior College, Taiwan; Jeen-Sheen Row, National Changhua University of Education, Taiwan; Chow-Yen-Desmond Sim, Feng Chia University, Taiwan*

**WE-A5.1A.8** **11:00**

### Electrically Small VHF MIMO Antenna For Underground Coal Mine Application

*Jogesh Chandra Dash, Nagalakshmaiah Kalva, Jayanta Mukherjee, Indian Institute of Technology Bombay, India*

**WE-A5.1A.9** **11:20**

### Wideband MIMO Antenna Based on Quarter-Mode SIW and 90-Degree Bent Planar Dipole

*Mahesh Kumar Busineni, Ayaz Ahmad, Jayanta Mukherjee, Indian Institute of Technology Bombay, India*

**WE-A5.1A.10** **11:40**

### Design of Series-fed Patch Array with Modified Binomial Coefficients for MIMO Radar Application

*Jogesh Chandra Dash, Debdeep Sarkar, Indian Institute of Science, Bangalore, India; Yahia Antar, Royal Military College of Canada, Canada*



## Workshop: Quantum Technology Related to Electromagnetics

Session Co-Chairs: Weng Chew, Purdue University; Amir Boag, Tel Aviv University; Wei Sha, Zhejiang University

**WE-SP.1A.1** 08:20

### Multimode Correlated Light for Quantum Imaging

*Haechan An, Ali Shakouri, Mahdi Hosseini, Purdue University, United States*

**WE-SP.1A.2** 08:40

### Frequency Bin Photonic Entanglement

*Andrew Weiner, Purdue University, United States*

**WE-SP.1A.3** 09:00

### Enhanced Quantum Optical Effects with Epsilon-Near-Zero Plasmonic Waveguides

*Ying Li, Nanjing University of Information Science and Technology, China; Christos Argyropoulos, University of Nebraska-Lincoln, United States*

**WE-SP.1A.4** 09:20

### Theoretical investigation of current-induced light emission in scanning tunneling microscopy molecular junctions

*Chiyung Yam, Beijing Computational Science Research Center, China*

**WE-SP.1A.5** 09:40

### Towards Optimal Single-Photon Sources and Applications

*Yu-Ming He, USTC, Hefei, China*

**Break** 10:00

**WE-SP.1A.6** 10:20

### Semiclassical Quantum Electromagnetics: From Numerical Models to Real Applications

*Guoda Xie, Zhixiang Huang, Anhui University, China; Wei Sha, Zhejiang University, China*

**WE-SP.1A.7** 10:40

### Characteristic Mode-based Quantization for Modeling of Lossless Scattering

*Gregory Slepyan, Ilay Levie, Amir Boag, Tel-Aviv University, Israel; Dmitri Mogilevtsev, Belarus National Academy of Sciences, Belarus*

**WE-SP.1A.8** 11:00

### Molecular Lanthanide Complexes for Quantum Technologies

*Stergios Piligkos, University of Copenhagen, Denmark*



## Future Technologies for Biomedical Applications

Session Co-Chairs: Koichi Ito, Chiba University; Asimina Kiourt, The Ohio State University

**WE-SP.2A.1** **08:20**

### Real-Time Human Activity Recognition System Exploiting Ubiquitous Wi-Fi Signals

*Yao Ge, Kia Dashtipour, Jonathan Cooper, Muhammad Imran, Qammer Abbasi, University of Glasgow, United Kingdom; Syed Shah, Coventry University, United Kingdom*

**WE-SP.2A.2** **08:40**

### Dual-band Microstrip Patch Antenna for Fully-Wireless Smart Stent

*Jungang Zhang, Rupam Das, Hadi Heidari, Qammer Abbasi, John Mercer, Nosrat Mirzai, University of Glasgow, United Kingdom*

**WE-SP.2A.3** **09:00**

### UHF Tags Array for Holographic Target Localization and Wireless Health Monitoring

*Aline Eid, Manos Tentzeris, Georgia Institute of Technology, United States; Jiang Zhu, Luzhou Xu, Google LLC, United States; Jimmy Hester, Atheraxon/Georgia Institute of Technology, United States*

**WE-SP.2A.4** **09:20**

### Wearable Planar Magnetoinductive Waveguide WBANS: Bending Around Anatomical Curvatures

*Vigyanshu Mishra, Asimina Kiourt, The Ohio State University, United States*

**WE-SP.2A.5** **09:40**

### RF-induced Heating for Active Implantable Medical Device with Dual Parallel Leads under MRI

*Wei Hu, Yu Wang, Qingyan Wang, Zahidul Islam, Ji Chen, University of Houston, United States; Jeffrey Tsang, Saluda Medical, Australia; Wolfgang Kainz, US Food and Drug Administration, United States*

**Break** **10:00**

**WE-SP.2A.6** **10:20**

### Minimally Invasive Deep Brain Stimulation Using Intracranial Stents

*Kaitlin L. Hall, Cynthia M. Furse, University of Utah, United States; David Hasan, University of Iowa, United States*

**WE-SP.2A.7** **10:40**

### Miniaturization of Implantable Antenna and Discussion of Concentration of Fields

*Tara Spafford, Kaitlin L. Hall, Cynthia M. Furse, University of Utah, United States*

**WE-SP.2A.8** **11:00**

### Performance Evaluation of Implant Communication Module with Miniaturized Antennas in the 10-60 MHz Band

*Yuki Fujii, Hiroaki Takagi, Jianqing Wang, Nagoya Institute of Technology, Japan; Yutaro Yokoyama, Kazuyuki Saito, Koichi Ito, Chiba University, Japan*

**WE-SP.2A.9** **11:20**

### A noncontact RF sensor with loop antennas based on PT-symmetry

*Yunjing Zhang, Xingli He, Peng Li, Soochow University, China*

**WE-SP.2A.10** **11:40**

### Small Triple-Band Meandered PIFA for Brain-Implantable Bio-telemetric Systems: Optimization of Substrate/Superstrate Effectiveness

*Nikta Pournoori, Lauri Sydänheimo, Leena Ukkonen, Toni Björninen, Tampere University, Finland; Yahya Rahmat-Samii, University of California, Los Angeles, United States*



Wednesday, December 8

08:20 - 12:00

WE-A5.2A

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Millimeter-Wave Antennas II

Session Co-Chairs: Jingxue Wang, Hohai University; Nima Javanbakht, Carleton University

**WE-A5.2A.1**

**08:20**

### A Millimeter Wave Tri-Polarized Patch Antenna with a Bandwidth-Enhancing Parasitic Element

*Ali Alreshaid, Yepu Cui, Ryan Bahr, Manos Tentzeris, Georgia Institute of Technology, United States; Mohammad Sharawi, University of Montréal, Canada*

**WE-A5.2A.2**

**08:40**

### Dual-Polarized mm-Wave Antenna Integrated within Microstrip PMC Packaging Cavity Environment

*Nadeem Ashraf, Marco Antoniadis, Ryerson University, Canada; Abdel Sebak, Ahmed Kishk, Concordia University, Canada*

**WE-A5.2A.3**

**09:00**

### A Kapton-Based Flexible Wideband Antenna with Metamaterial Resonators for Millimeter-Wave Wireless Applications

*Mohammad Faridani, Gaozhi Xiao, National Research Council of Canada, Canada; Rony E Amaya, Nima Javanbakht, Carleton University, Canada; Mustapha C.E Yagoub, University of Ottawa, Canada*

**WE-A5.2A.4**

**09:20**

### Frequency Reconfigurable Antenna for 5G Millimeter-Wave Applications

*Zohre Pourgholamhossein, Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada*

**WE-A5.2A.5**

**09:40**

### A Pattern Reconfigurable Conformal mmWave Antenna for 5G Applications

*Antonio Stroh, Matthew Sigda, Kevin Carbone, Dillon Baur, Md Abu Saleh Tajin, Oday Bshara, Vasil Pano, Kapil Dandekar, Drexel University, United States*

**Break**

**10:00**

**WE-A5.2A.6**

**10:20**

### Optimizing Rotmen Lens Topologies for 5G Wireless Grids

*Aline Eid, Manos Tentzeris, Georgia Institute of Technology, United States; Jimmy Hester, Atheraxon/Georgia Institute of Technology, United States*

**WE-A5.2A.7**

**10:40**

### A Wideband Millimeter-Wave 3-dB Hybrid Coupler Based on Printed-RGW Technology

*Zahra Mousavirazi, Mohamed Mamdouh M. Ali, Tayeb A. Denidni, Institut national de la recherche scientifique (INRS), Canada*

**WE-A5.2A.8**

**11:00**

### Wideband Substrate-Integrated-Coaxial-Line-Fed Magneto-Electric Dipole Antenna with End-Fire Radiation

*Jingxue Wang, Hohai University, China; Fan Wu, Southeast University, China*

**WE-A5.2A.9**

**11:20**

### Design of SICL fed Dual Polarized Dipole Antenna for Millimeter wave Application

*Naman Baghel, Satya Krishna Idury, Sourav Ghosh, Rajesh Shukla, Soumava Mukherjee, Indian Institute of Technology Jodhpur, India*

**WE-A5.2A.10**

**11:40**

### Surface Wave Launcher Based Multi-beam Antenna for 5G Applications

*Fahad Imran Khattak, Muhammad Umar Khan, National University of Sciences and Technology, Pakistan; Rifaqat Hussain, King Fahd University of Petroleum and Minerals, Saudi Arabia; Mohammad S. Sharawi, Polytechnique Montréal, Canada*



**Wednesday, December 8**  
**WE-UF.1A**

**08:20 - 10:00**  
**Peony Junior Ballroom 4512**

## **Propagation Effects, Models and Measurements**

Session Co-Chairs: David Michelson, University of British Columbia; Max Bright, University of Michigan

**WE-UF.1A.1** **08:20**

**Validation of 28 GHz Coverage Predictions in a Variety of Small Cell Environments**

*Esther Xu, Akhil Prabhu, David Michelson, University of British Columbia, Canada*

**WE-UF.1A.2** **08:40**

**Progress in Measuring and Modeling Wireless Propagation in Shipboard Environments**

*David Michelson, Xin Chen, Zahra Vali, Arash Rizvi, University of British Columbia, Canada*

**WE-UF.1A.3** **09:00**

**Time-Frequency Jigsaw Puzzle for Gabor Frame-Based Propagation over Long Ranges**

*Max Bright, Eric Michielssen, University of Michigan, United States*

**WE-UF.1A.4** **09:20**

**Long-Range Propagation in 3D with Gabor Frame-Based Sparsification and Radiation Boundary Conditions**

*Max Bright, Eric Michielssen, University of Michigan, United States*

**WE-UF.1A.5** **09:40**

**Diffraction Effects of Islands on the Over-the-horizon Propagation of a Low-power Wide-area System**

*Yuji Ito, Hiroki Ichiba, Toshihiko Hamasaki, Hiroshima Institute of Technology, Japan*



**Wednesday, December 8**  
**WE-A4.1A**

**10:20 - 12:00**  
**Peony Junior Ballroom 4512**

## **Propagation and Scattering in Random or Complex Media**

Session Co-Chairs: Jinhwan Koh, Gyeongsang National University; Zaifeng Yang, A\*STAR Institute of High Performance Computing

**WE-A4.1A.1** **10:20**

**Link-Quality Measurement and Performance of WirelessHART in Industrial Environments**

*Abdellah Chehri, University of Quebec in Chicoutimi, Canada*

**WE-A4.1A.2** **10:40**

**Effective Acoustic Media for GHz Ultrasonic Lens Focusing in Fourier Transform Application**

*Zaw Oo Zaw, Viet Phuong Bui, Zaifeng Yang, Ching Eng Png, A\*STAR Institute of High Performance Computing, Singapore*

**WE-A4.1A.3** **11:00**

**Response of Laminated Composites to Guided Microwave Pulse**

*Kang An, Changyou Li, Jun Ding, Northwestern Polytechnical University, China*

**WE-A4.1A.4** **11:20**

**Direction Finding with Cyclostationarity for Multiple Signals Based on Time-modulated Array**

*Liu Han, Jingfeng Chen, Gang Ni, Chong He, Ronghong Jin, Shanghai Jiao Tong University, China*

**WE-A4.1A.5** **11:40**

**A Super Resolution Algorithms for Time Delay Measurement.**

*Vasantha Chandrasegar, Gyutae Park, Jinhwan Koh, Gyeongsang National University, Korea (South)*





## Metasurfaces, FSS and EBG Materials I

Session Co-Chairs: Arun Kesavan, Institut national de la recherche scientifique (INRS); Ashwin Iyer, University of Alberta

**WE-A2.1A.1** **08:20**

Wideband FSS as reflector for circularly polarized millimeter-wave antenna

*Arun Kesavan, Tayeb A. Denidni, Institut national de la recherche scientifique (INRS), Canada*

**WE-A2.1A.2** **08:40**

Nonuniform Metasurfaces for Gain Enhancement of Dual and Circularly Polarized Antennas

*Ahmad Hoorfar, Christopher Israel, Villanova University, United States*

**WE-A2.1A.3** **09:00**

Conformal Miniaturized Antenna with Enhanced Bandwidth and Efficiency Using Periodic Magneto-Dielectric

Anisotropic Meta-Substrate

*Milad Mirzaee, Yanghyo Kim, Stevens Institute of Technology, United States*

**WE-A2.1A.4** **09:20**

Dual Band FSS Based on Four Arms Star Geometry for 5G Applications

*Caio Vasconcelos Benigno de Abrantes, Thamyris da Silva Evangelista, Federal University of Campina Grande, Brazil; Alexandre Serres, Federal University of CampinaGrande, Brazil; Alfredo Gomes Neto, Federal Institute of Paraiba, Brazil*

**WE-A2.1A.5** **09:40**

Low-Profile Transmitarray for Wide-Angle Conical Scanning: Concept, Optimization and Validation

*Anastasios Papanthanasopoulos, Yahya Rahmat-Samii, University of California, Los Angeles, United States*

**Break** **10:00**

**WE-A2.1A.6** **10:20**

On the Effect of Design Parameters on Fringing Fields of a Loop-Based FSS

*Swathi Muthyala Ramesh, Mahboobeh Mahmoodi, Kristen Donnell, Missouri University of Science and Technology, United States*

**WE-A2.1A.7** **10:40**

Square Plate Active Limiting Frequency Selective Surface at X-band

*Patrick Bay, Payam Nayeri, Colorado School of Mines, United States*

**WE-A2.1A.8** **11:00**

MTM-EBG-based Microstrip Bandstop Filter for the 900 MHz ISM Band

*Samuel Clark, Ashwin Iyer, University of Alberta, Canada*

**WE-A2.1A.9** **11:20**

Strain-induced Frozen-mode Enhanced Electro-optic Effects for Tunable Delay in Coupled Silicon Ridge Waveguides

*Banaful Paul, Kubilay Sertel, Niru K. Nahar, The Ohio State University, United States*

**WE-A2.1A.10** **11:40**

Miniatured LPF Design on a Double-Layered Defected Ground Structure

*Young Joo Kim, Dongho Seo, Dal Ahn, Sang-Min Han, Soonchunhyang University, Korea (South); Won-Sang Yoon, Hoseo University, Korea (South)*



## Computational Electromagnetics II

Session Co-Chairs: Ahmed M. Hassan, University of Missouri-Kansas City; Botian Zhang, University of California, Los Angeles

**WE-A3.1A.1** **08:20**

Investigation of Photoconductive Antenna Electrodes on Terahertz Signal Generation

*Jose Santos Batista, Magda El-Shenawee, University of Arkansas, United States*

**WE-A3.1A.2** **08:40**

Predicting RF Coupling to a UAV Wiring System Using the Equivalent Circuit Approach

*Mohamed Hamdalla, Anthony Caruso, Ahmed Hassan, University of Missouri-Kansas City, United States*

**WE-A3.1A.3** **09:00**

The Hybrid Embedded Domain Decomposition Method for Scattering by Bi-anisotropic Objects

*Xiang Yang, Lin Lei, Jun Hu, University of Electronic Science and Technology of China, China*

**WE-A3.1A.4** **09:20**

Efficient Implementation of Adjoint Variation Method for Finite Element with 3D Edge Elements

*Botian Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States*

**WE-A3.1A.5** **09:40**

Highly Parallelized Hybrid FDTD Solver for Simulating Electromagnetic Wave Propagation in Dense Urban

Environments

*Kazem Sabet, Anca Stefan, EMAG Technologies Inc., United States; Kamal Sarabandi, University of Michigan, United States; Brian Sadler, Fikadu Dagefu, Army Research Laboratory, United States*

**Break** **10:00**

**WE-A3.1A.6** **10:20**

A One-Stage  $O(N \log N)$  Algorithm for Generating Nested Low-Rank Representation of Electrically Large Volume Integral Equations

*Yifan Wang, Dan Jiao, Purdue University, United States*

**WE-A3.1A.7** **10:40**

A Simple and Effective Method for Compressing Electrically Large Integral Operators

*Chang Yang, Dan Jiao, Purdue University, United States*

**WE-A3.1A.8** **11:00**

Comparison of electromagnetic force densities evaluated in the electrodynamic lattice-Boltzmann method and finite-difference time-domain method

*Cael Warner, Loïc Markley, Kenneth Chau, University of British Columbia, Canada*

**WE-A3.1A.9** **11:20**

Broadband Green's Function-KKR-Multiple Scattering Method for the Calculations of Band Structures in Topological Acoustics

*Tien-Hao Liao, California Institute of Technology, United States; Leung Tsang, University of Michigan, United States; Shurun Tan, Zhejiang University, China*

**WE-A3.1A.10** **11:40**

An Efficient Approach for Evaluation of Multilayered Media Green's Functions

*Ozlem Ozgun, Hacettepe University, Turkey; Chao Li, Ecole Polytechnique de Montreal, Canada; Mustafa Kuzuoglu, Middle East Technical University, Turkey; Raj Mittra, University of Central Florida, United States*



**Wednesday, December 8**  
**WE-A4.2A**

**08:20 - 12:00**

**Virtual (Chairs/Speakers to go to Peony Ballroom 4502)**

## **Remote Sensing I**

Session Co-Chairs: Leung Tsang, University of Michigan; Charles Lynch, Georgia Institute of Technology

**WE-A4.2A.1** **08:20**

### **High-Accuracy Ranging Using a Dual-Channel IEEE 802.11 Legacy Preamble**

*Anton Schlegel, Jeffrey A. Nanzer, Michigan State University, United States*

**WE-A4.2A.2** **08:40**

### **A Dynamic Antenna Array for Imageless Contraband Detection**

*Daniel Chen, Jeffrey Nanzer, Michigan State University, United States*

**WE-A4.2A.3** **09:00**

### **Multi-frequencies Full-wave Simulations of Wave Propagation in Vegetation for Remote Sensing of Soil Moisture**

*Weihui Gu, Leung Tsang, University of Michigan, United States*

**WE-A4.2A.4** **09:20**

### **Scattering from Random Rough Surfaces at X and Ku band for Global Remote Sensing of Terrestrial Snow**

*Jiyue Zhu, Leung Tsang, University of Michigan, United States; Tien-Hao Liao, California Institute of Technology, United States*

**WE-A4.2A.5** **09:40**

### **Airborne Radar Clutter Suppression in Angle-Doppler Domain Using Clutter-Proximity Feature**

*Rafi Ahmed, Hai Deng, Florida International University, United States*

**Break** **10:00**

**WE-A4.2A.6** **10:20**

### **High-Resolution Range-Doppler Maps of Moving Targets in Traffic Scene**

*Adib Nashashibi, Mani Kashanianfard, Tanner Douglas, Kamal Sarabandi, University of Michigan, United States; Stephen Decker, General Motors, United States*

**WE-A4.2A.7** **10:40**

### **Location and Identification of Linear and Nonlinear Targets in 3D using PI-DORT and Time of Flight**

*Enyi Dong, Coleman Weaver, Chuhan Feng, Jacob Back, Zhengshan Fang, Michael Lee, Edward Wheeler, Rose-Hulman Institute of Technology, United States; Sun K. Hong, Soongsil University, Korea (South)*

**WE-A4.2A.8** **11:00**

### **Flexible Passive Smart Skin Temperature Sensor for Remote Sensing in Structural Health Monitoring Applications**

*Charles Lynch, Ajibayo Adeyeye, Bijan Tehrani, Manos Tentzeris, Georgia Institute of Technology, United States*

**WE-A4.2A.9** **11:20**

### **Extended GHI-LFM Algorithm for Sparse Array**

*Yang Meng, Chongqing University of Posts and Telecommunications, China; Chuan Lin, Anyong Qing, Southwest Jiaotong University, China; Natalia Nikolova, McMaster University, Canada*

**WE-A4.2A.10** **11:40**

### **Experimental Verification for Pipeline Detection Using a 3-D Bistatic Imaging Radar**

*Abdulrahman Aljurbua, King Abdulaziz City for Science and Technology, Saudi Arabia; Kamal Sarabandi, University of Michigan, United States*



## Mutual Coupling in Antenna Arrays II

Session Co-Chairs: Yiyang Wang, Guilin University Of Electronic Technology; Eqab Almajali, University of Sharjah

### WE-A1.1P.1

14:00

#### Decoupling Method for Two Planar Inverted-F Antennas using Characteristic Mode Analysis

Quan Phung Quang, Naobumi Michishita, Hisashi Morishita, National Defense Academy, Japan; Hiroshi Sato, Yoshio Koyanagi, Panasonic Corporation, Japan

### WE-A1.1P.2

14:20

#### Isolation Improvement of 5G MIMO Antenna Based on the Theory of Characteristic Modes

Danting He, Yantao Yu, Shenshen Mao, Chongqing University, China

### WE-A1.1P.3

14:40

#### Characteristic Mode Analysis of a MIMO Antenna with DGS

Danting He, Yantao Yu, Shenshen Mao, Chongqing University, China

### WE-A1.1P.4

15:00

#### Compact Dual-frequency MIMO antenna with High Port Isolation

Shenshen Mao, Yantao Yu, Danting He, Chongqing University, China

### WE-A1.1P.5

15:20

#### A Self-Isolated Wideband Circularly Polarized MIMO Antenna for 5G communications

Qian Li, Xi'an University of Posts and Telecommunications, China; Yanyu Wei, University of Electronic Science and Technology of China, China

### Break

15:40

### WE-A1.1P.6

16:00

#### Vertical-Wall Between Tightly Spaced Patch Antennas for Decoupling and Radiation Pattern Correction

Yiyang Wang, Shengfei Zhang, Xinhua Yu, Guilin University Of Electronic Technology, China; Yuntao Yan, EM Technologies Research Test Center Xi'an Electronic Engineering Research Institute, China; Ahmed A Kishk, Concordia University, Canada

### WE-A1.1P.7

16:20

#### Isolation Improvement in MIMO Dielectric Resonator Antennas

Manzoor Elahi, Amir Altaf, Sungkyunkwan University, Korea (South); Jawad Yousof, Abu Dhabi University, United Arab Emirates; Eqab Almajali, University of Sharjah, United Arab Emirates

### WE-A1.1P.8

16:40

#### Synthesis of Thinned Planar Arrays with Accurate Mutual Coupling Modeling

Lorenzo Poli, Alessandro Polo, Paolo Rocca, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy; A-Min Yao, Erni Zhu, Shanghai Huawei Technologies Co., Ltd., China

### WE-A1.1P.9

17:00

#### Glide-Symmetric Planar EBG Structure for Mutual Coupling Reduction Between Microstrip Patch Antennas

Boules A. Mouris, Ragnar Thobaben, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden

### WE-A1.1P.10

17:20

#### Mutual Coupling Reduction for Compact Wideband Two-Element Dual-Polarized Array by Utilizing H-Shaped Interdigital Structure

Zhiyuan Chen, Mei Li, Ming-Chun Tang, Chongqing University, China



Wednesday, December 8  
WE-A1.2P

14:00 - 17:40  
Melati Ballroom 4104

## Dielectric Resonator Antennas

Session Co-Chairs: Rakesh Singh Kshetrimayum, IIT Guwahati; Haihan Sun, Nanyang Technological University

**WE-A1.2P.1** **14:00**

### CP Gain Enhancement of MM-Wave SIW-Integrated DRA Array Antenna

*Heba El-Sawaf, Wael Abdel-Wahab, Safieddin Safavi-Naeini, University of Waterloo, Canada; Hussam Al-Saedi, University of Technology, Iraq*

**WE-A1.2P.2** **14:20**

### Compact and Wideband Design of Substrate Integrated Waveguide Fed Dielectric Resonator Antenna Array

*Koushik Dutta, Raj Mittra, University of Central Florida, United States*

**WE-A1.2P.3** **14:40**

### Study on Homogenization Methods of Stacked Rectangular Dielectric Resonator Antennas

*Buyuan Ma, University of Electronic Science and Technology of China; National University of Singapore, Singapore; Jin Pan, University of Electronic Science and Technology of China, China*

**WE-A1.2P.4** **15:00**

### A Near-Field Focused Circular Array Based on Dielectric Resonator Antenna

*Runze Huang, Beijia Liu, Qi Tan, Harbin Institute of Technology, China*

**WE-A1.2P.5** **15:20**

### A New and Wideband Circularly Polarized Antenna using CRLH-TL and CDRA Loading for S and C-band Applications

*Mohammad Ameen, Raghendra Kumar Chaudhary, Indian Institute of Technology (Indian School of Mines), Dhanbad, India*

**Break** **15:40**

**WE-A1.2P.6** **16:00**

### A Frequency-Tunable Broadband Dielectric Resonator Antenna with Metasurface

*Ge Zhao, Mei Song Tong, Tongji University, China*

**WE-A1.2P.7** **16:20**

### A Bidirectional pattern of DRA by Employing Cylindrical Spoof Surface Plasmon Polariton Structure

*Sonu Kumar, Abhishek Maganbhai Sonagara, Rakesh Singh Kshetrimayum, IIT Guwahati, India*

**WE-A1.2P.8** **16:40**

### Dielectric Resonator Antenna for Compact High-Power Mesoband Generation

*Luciano Prado Oliveira, Felix Vega, Chaouki Kasmî, Mae Almansoori, Technology Innovation Institute, United Arab Emirates*

**WE-A1.2P.9** **17:00**

### A Class of Dielectric Resonator Antennas with Thermally Enhanced Performance

*Guillaume Theis, A.Bart Smolders, Gabriele Federico, Eindhoven University of Technology, Netherlands; Diego Caratelli, The Antenna Company, Netherlands*

**WE-A1.2P.10** **17:20**

### A Dual-Band Hollow Dielectric Resonator Antenna for GPS Applications

*José Bruno de Araújo, Carlos David Morales, Christophe Morlaas, Alexandre Chabory, ENAC - Université de Toulouse, France; Romain Pascaud, Marjorie Grzeskowiak, ISAE SUPAERO - Université de Toulouse, France; Gautier Mazingue, Anywaves, France*



## Wideband Phased Array Antennas I

Session Co-Chairs: Yuehe Ge, Fuzhou University; Maria Alonso-delPino, Delft University of Technology

**WE-A1.3P.1** 14:00

### Wideband Circularly Polarized LTCC Modular Phased Array Antenna at Ka-band

*Bo Shi, Nasimuddin Nasimuddin, Xianming Qing, Francois Chin, Institute for Infocomm Research, Singapore*

**WE-A1.3P.2** 14:20

### A Miniaturized End-fire Antenna Planar Array with Wide-angle Scanning Performance for Base-Station Applications

*Shilin Yang, Jianyi Zhou, Southeast University, China*

**WE-A1.3P.3** 14:40

### Design of a Compact Phased Array Using 16 Surface-Wave Antenna Elements

*Zhenting Chen, Zhongxiang Shen, Nanyang Technological University, Singapore*

**WE-A1.3P.4** 15:00

### Dual-Pol Wide Scan Connected Slot Array for Ku- and Ka-band Satcom with Low Cross-Polarization

*Alexander J. van Katwijk, Andrea Neto, Daniele Cavallo, Delft University of Technology, Netherlands; Giovanni Toso, European Space Agency, Netherlands*

**WE-A1.3P.5** 15:20

### A Wideband Dual-Polarized Wide-Angle Scanning Array With Low Sidelobe Levels and Low Cross-Polarization

*Fu-Long Jin, Wei Shao, University of Electronic Science and Technology of China, China; Zhi Ning Chen, National University of Singapore, Singapore*

**Break** 15:40

**WE-A1.3P.6** 16:00

### A W-band, Microfabricated, Tiled Phased Array Realized by Bricked Tapered Slot Antenna Element

*Jian Xu Sun, Yu Jian Cheng, Yong Fan, University of Electronic Science and Technology of China, China*

**WE-A1.3P.7** 16:20

### Ku/Ka Wide-Band Dual-Band Dual-Polarized Shared-Aperture Phased Array Antenna with High Aperture Efficiency

*Yan Ran Ding, Yu Jian Cheng, University of Electronic Science and Technology of China, China*

**WE-A1.3P.8** 16:40

### A Circularly-Polarized Mechanically Beam-Steerable Antenna

*Jingru Wang, Huaqiao University, China; Yuehe Ge, Fuzhou University, China; Zhizhang Chen, Dalhousie University, China*

**WE-A1.3P.9** 17:00

### Multi-Mode Leaky-Wave Feed for Scanning Lens Phased Array at 550 GHz

*Sjoerd Bosma, Maria Alonso-delPino, Nuria Llombart, Delft University of Technology, Netherlands; Cecile Jung-Kubiak, Goutam Chattopadhyay, Jet Propulsion Laboratory, United States*

**WE-A1.3P.10** 17:20

### An Ultra-wideband Dual-Polarized Low-Profile Tightly Coupled Dipole Array

*Bingjun Wang, Shiwen Yang, Yikai Chen, Shiwei Qu, University of Electronic Science and Technology of China, China*



## Wideband Circularly Polarized Antennas

Session Co-Chairs: Takeshi Fukusako, Kumamoto University; Xin Cao, Southwest University of Science and Technology

**WE-A1.4P.1** **14:00**

### A Novel Miniaturized Broadband Dual-polarization Antenna for 2G/3G/LTE Base Station

*Tang Chen, Qiang-Ming Cai, Xin Cao, Yu-yu Zhu, Jun Fan, Southwest University of Science and Technology, China; Mu-lin Liu, Innovation Center of Zhongshan Torch Modern Industrial Engineering Technology Research Institute, China; Lei Han, Air Force Engineering University, China; Tao Liu, Sichuan Jiuzhou Electric Group Co., Ltd, China; Li Gu, China Academy of Engineering Physics, China*

**WE-A1.4P.2** **14:20**

### A Wideband Circularly Polarized Ridge Substrate Integrated Waveguide (RSIW) Endfire Antenna

*Huakang Chen, Yu Shao, Jiao Xiang, Zhangjian He, Changhong Zhang, Chongqing University of Posts and Telecommunications, China*

**WE-A1.4P.3** **14:40**

### Broadband Circularly Polarized Microstrip Patch Antenna Using Artificial Ground Structure with Rotated Rectangular Unit Cells

*Uganbayar Purevdorj, Ryuji Kuse, Takeshi Fukusako, Kumamoto University, Japan*

**WE-A1.4P.4** **15:00**

### A Compact Broadband Circularly Polarized Spiral Antenna for Conformal Applications

*Wei Huang, Yejun He, Wenting Li, Long Zhang, Sai-Wai Wong, Shenzhen University, China*

**WE-A1.4P.5** **15:20**

### Miniaturized Differentially-Fed Circularly Polarized Antenna Based on SRR

*Shuxuan Liu, Yuandan Dong, University of Electronic Science and Technology of China, China*

**Break** **15:40**

**WE-A1.4P.6** **16:00**

### Design of A Broadband Circularly Polarized Patch Antenna with Differential Feeding

*Sheng-Jie Guo, Yan Cheng, Nanjing Research Institute of Electronics Technology, China*

**WE-A1.4P.7** **16:20**

### Elliptic Stripline Resonator Antenna on Glass-Epoxy Substrates for X-band Circular Polarization Systems

*Yumi Takizawa, The Institute of Statistical Mathematics, Japan; Atsushi Fukasawa, Cahya Edi Santosa, Josaphat Tetuko Sri Sumantyo, Chiba University, Japan*

**WE-A1.4P.8** **16:40**

### A Wideband Circularly Polarized Leaky Wave Antenna based on ISGW

*Dechao Meng, Dongya Shen, Yunnan University, China; Xiupu Zhang, Concordia University, Canada*

**WE-A1.4P.9** **17:00**

### A Broadband Dual-polarized Base Station Antenna for LTE/5G Application

*Qiang-Ming Cai, Tang Chen, Xin Cao, Yu-yu Zhu, Jun Fan, Southwest University of Science and Technology, China; Lei Han, Air Force Engineering University, China; Tao Liu, Sichuan Jiuzhou Electric Group Co., Ltd, China; Mu-lin Liu, Innovation Center of Zhongshan Torch Modern Industrial Engineering Technology Research Institute, China; Li Gu, China Academy of Engineering Physics, China*

**WE-A1.4P.10** **17:20**

### Circularly Polarized Huygens Source Antenna Based on Two Stacked Dielectric Resonators

*Carlos David Morales, José Bruno de Araújo, Christophe Morlaas, Alexandre Chabory, ENAC - Université de Toulouse, France; Romain Pascaud, Marjorie Grzeskowiak, ISAE SUPAERO - Université de Toulouse, France; Gautier Mazingue, Anywaves, France*



## Reconfigurable Metasurfaces and Antennas

Session Co-Chairs: Muhammad Ramlee Kamarudin, Universiti Tun Hussein Onn Malaysia; Ronghong Jin, Shanghai Jiao Tong University

### WE-A2.1P.1

14:00

#### A Dual-Port Antenna With Reconfigurable Metasurface

Chaofan Ren, Junping Geng, Han Zhou, Kun Wang, Jingzheng Lu, Da Su, Yangzhou Zhang, Silei Yang, Chong He, Xianling Liang, Ronghong Jin, Shanghai Jiao Tong University, China

### WE-A2.1P.2

14:20

#### Design Of Reconfigurable Transmit-Reflect Unit Cell

Pan Li, Jianxun Su, Zengrui Li, Communication University of China, China; Guanghong Liu, Information Science Academy of China Electronic, China

### WE-A2.1P.3

14:40

#### A Pure-Water Inverted-L Antenna With Frequency Reconfigurability

Fei Fan, Shiyan Wang, Gang Zhang, Nanjing Normal University, China; Yin Li, Southern University of Science and Technology, China

### WE-A2.1P.4

15:00

#### Collapsible, Wideband, Dual-polarization Patch Antenna

Jian Lu, Peng Kiang Tan, Ankang Liu, Sek Meng Sow, Theng Huat Gan, National University of Singapore, Singapore

### WE-A2.1P.5

15:20

#### Reconfigurable Metasurface for Dynamical Modulation of Reflection, Transmission, and Absorption

Xinyun Song, Weiren Zhu, Shanghai Jiao Tong University, China

### Break

15:40

### WE-A2.1P.6

16:00

#### Polarization-insensitive Absorptive Microwave Device With Electronically-Controllable Reflectance

Jing Tian, Huizhen Wang, Xianlu Zeng, Jifei Zou, Hongtao Zhong, University of Electronic Science and Technology of China, China

### WE-A2.1P.7

16:20

#### Enhanced Microwave Heating Uniformity using Reconfigurable Fresnel Zone Plate

Daehyeon Kim, Minhyeock Kim, Youngno Youn, Suho Chang, Wonbin Hong, Pohang University of Science and Technology, Korea (South); Jeongwon Kim, Bukuk Oh, LG Electronics, Korea (South)

### WE-A2.1P.8

16:40

#### Design of Reconfigurable Transmission Unit Cell with Independent and Continuous Manipulations of Amplitude and Phase

He Li, Yun Bo Li, Tie Jun Cui, Southeast University, China

### WE-A2.1P.9

17:00

#### A Broadband Metasurface with Voltage-Controlled Transmission Phase

Jing Rui Wang, Mei Song Tong, Tongji University, China; Yun Jing Zhang, Soochow University, China

### WE-A2.1P.10

17:20

#### Reconfigurable Wideband-Narrowband Vivaldi Antenna

Sahar Chaghavand, Mohamad Rijal Hamid, UTM-MIMOS Centre of Excellence in Telecommunication Technology, Faculty of Electrical Engineering, Universiti Teknologi Malaysia, 81310 UTM Skudai, Johor, Malaysia, Iran; Muhammad Ramlee Kamarudin, Universiti Tun Hussein Onn Malaysia, Malaysia





## MIMO Implementations and Applications II

Session Co-Chairs: Zhinong Ying, Sony; Ben Minnaert, Odisee University College of Applied Sciences

**WE-A5.1P.1** 14:00

**A Compact Four-Element Self Decoupled MIMO Antenna for Sub-6 GHz 5G Applications**

*Shameena V A, Anila P V, Mohanan P, Cochin University of Science and Technology, India*

**WE-A5.1P.2** 14:20

**A Pattern/Polarization Diversity Antenna Based on Three-mode Composite Transmission Line**

*Kai Sun, Boming Wang, Sihao Liu, Yanwen Zhao, Deqiang Yang, University of Electronic Science and Technology of China, China*

**WE-A5.1P.3** 14:40

**Generalized Cramer-Rao Bound for Passive MIMO Radar Multi-target Parameter Estimation**

*Liming Wang, Qian He, Huiyong Li, University of Electronic Science and Technology of China, China*

**WE-A5.1P.4** 15:00

**Measurement of compact MIMO antennas with  $0.3 \lambda$  spacing under different polarization and coupling**

*Meng Wang, Dazhi Piao, Communication University of China, China*

**WE-A5.1P.5** 15:20

**Flexible 60-GHz Balanced Dipole Antennas for Broadband End-Fire Radiation Operations**

*Tzu-Ming Huang, Chih-Feng Chang, He-Sheng Lin, Yi-Cheng Lin, National Taiwan University, Taiwan*

**Break** 15:40

**WE-A5.1P.6** 16:00

**Antenna Designs for a Milimeter Wave Massive MIMO Testbed with Hybrid Beamforming**

*Zhinong Ying, Sony, Sweden; Olof Zander, Sony Nordic, Sweden; Minkeun Chung, Liang Liu, Fredrik Tufvesson, Lund University, Sweden*

**WE-A5.1P.7** 16:20

**SbD-Synthesis of Electromagnetic Smart Skins Enabling Optimal Wireless City Coverage**

*Marco Salucci, Arianna Benoni, Alessandro Polo, Mohammad Abdul Hannan, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*

**WE-A5.1P.8** 16:40

**On User Effects of a Low-Profile MIMO Terminal Antenna with Wideband Multimodal Excitation**

*Hanieh Aliakbari, Buon Kiong Lau, Lund University, Sweden*

**WE-A5.1P.9** 17:00

**Improving the 5G Massive MIMO Performance for Aerial Base Stations by Exploiting Triangular Lattice Arrays**

*Francesco Alessio Dicandia, IDS Ingegneria dei Sistemi SpA, Italy; Simone Genovesi, University of Pisa, Italy*

**WE-A5.1P.10** 17:20

**Efficiency Angle as Figure of Merit for Reciprocal MIMO Networks**

*Ben Minnaert, Odisee University College of Applied Sciences, Belgium*



Wednesday, December 8  
WE-SP.1P Special Session

14:00 - 15:40  
Peony Ballroom 4501AB

## Innovative Trends in Antenna Tolerance Analysis and Robust Design

Session Co-Chairs: Paolo Rocca, University of Trento; Peng Li, Xidian University

**WE-SP.1P.1** 14:00

Far Field EVM Characterization of Antenna Frequency Response via Full-Wave Analysis  
*Dustin Brown, Yahya Rahmat-Samii, University of California, Los Angeles, United States*

**WE-SP.1P.2** 14:20

Monte Carlo Tolerance Analysis of Antennas/Radomes with Mesh/Element Strip Grouping  
*Wanye Xu, Kai Wu, Peng Li, Xidian University, China*

**WE-SP.1P.3** 14:40

Robust Simulation-Driven Antenna Design using Parallel Bayesian Optimization  
*Jialu Li, Jinzhu Zhou, Yu Si, Nongding Wen, Xidian University, China*

**WE-SP.1P.4** 15:00

Tolerance Analysis of Spherical Conformal Array Antenna based on Interval Arithmetic  
*Guangda Ding, Peng Li, Chao Wang, Xidian University, China*

**WE-SP.1P.5** 15:20

Tolerance Analysis of Continuous and Discrete Apertures Through a Novel Probabilistic Interval Arithmetic Method  
*Nicola Anselmi, Arianna Benoni, Paolo Rocca, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*



Wednesday, December 8  
WE-SP.2P Special Session

16:00 - 17:20  
Peony Ballroom 4501AB

## Material Intelligence for Next Generation Wireless Systems

Session Co-Chairs: Giacomo Oliveri, University of Trento; Gabriele Gradoni, University of Nottingham

**WE-SP.2P.1** 16:00

From Tunable and Reconfigurable to Space-Time Modulated Multifunctional Metasurfaces  
*Xuchen Wang, Sergei Tretyakov, Aalto University, Finland*

**WE-SP.2P.2** 16:20

Defeating the LOS Curse through Smart Electromagnetic Environments – State-of-the-art and Recent Advancements @ ELEDIA Research Center  
*Andrea Massa, Giacomo Oliveri, Paolo Rocca, Marco Salucci, Alessandro Polo, ELEDIA@UniTN - University of Trento, Italy*

**WE-SP.2P.3** 16:40

RIS-assisted Wireless Communication Link Optimization via Quantum Annealing  
*Gabriele Gradoni, University of Nottingham, United Kingdom; Charles Ross, Zhen Peng, University of Illinois at Urbana-Champaign, United States; Marco Di Renzo, Centre National de la Recherche Scientifique (CNRS), France*

**WE-SP.2P.4** 17:00

Wavefront shaping in the microwave domain using tunable metasurfaces: from Physics to Reconfigurable Intelligent Surfaces  
*Geoffroy Lerosey, Greenerwave, France*



## Wearable and Implantable Antennas II

Session Co-Chairs: John Ho, National University of Singapore; Pongphan Leelatien, Thammasat University

**WE-A5.2P.1** 14:00

### Wearable Radio-frequency Plasmonic Resonance Sensor for Non-contact Vital Sign Monitoring

*Xin Yang, Xi Tian, John Ho, National University of Singapore, Singapore*

**WE-A5.2P.2** 14:20

### A Feed-through Sharing Structure of a Wireless Power Transfer Coil and Stimulation Electrodes for Implantable Medical Devices

*Jaechun Lee, Chisung Bae, Sang Joan Kim, Samsung Advanced Institute of Technology, Korea (South)*

**WE-A5.2P.3** 14:40

### First-of-its-kind Demonstration of Seamless Brain Stimulation of Untethered Animals Using Wireless Power Transfer

*Jinhyun Kim, Jungsuek Oh, Seoul National University, Korea (South)*

**WE-A5.2P.4** 15:00

### Wireless Propagation and Focusing into the Human Body with Wearable Metamaterials

*Qihang Zeng, Xi Tian, John Ho, National University of Singapore, Singapore*

**WE-A5.2P.5** 15:20

### Deionized Water Insulator Loaded Brain-Implanted UWB Antenna

*Geonyeong Shin, Ick-Jae Yoon, Chungnam National University, Korea (South)*

**Break** 15:40

**WE-A5.2P.6** 16:00

### Study of Time-Domain Characteristics for Liver-Implant Ultrawideband Communications

*Pongphan Leelatien, Thammasat University, Thailand*

**WE-A5.2P.7** 16:20

### Body-to-Antenna Gap Effect on a UHF Wearable Textile Antenna Performance

*Quoc Hung Dang, Shengjian Jammy Chen, Damith Chinthana Ranasinghe, Christophe Fumeaux, University of Adelaide, Australia*

**WE-A5.2P.8** 16:40

### Wearable Microstrip Circular Patch Antenna for Breast Cancer Detection

*S Bhavani, Research Scholar, India*

**WE-A5.2P.9** 17:00

### A Dual-band Dual Mode Antenna for On/Off-Body Communications

*Sarosh Ahmad, Kashif Nisar Paracha, Yawar Ali Sheikh, Government College University, Faisalabad, Pakistan; Adnan Ghaffar, Xue Jun Li, Auckland University of Technology Auckland, New Zealand*

**WE-A5.2P.10** 17:20

### Compact Magnetically Symmetric Antenna Design for Implantable Biomedical Applications

*Lin-mei Yan, University of Electronic Science and Technology of China, China; Abdoalbasat Abohmra, Jalil Ur Rehman Kazim, Abu bakar Sharif, Muhammad Ali Imran, Masood Ur Rahman, Qammer Abbasi, University of Glasgow, United Kingdom*



## Millimeter-Wave Antennas III

Session Co-Chairs: Teng Li, Southeast University; Ahmed Omar, Pohang University of Science and Technology (POSTECH)

**WE-A5.3P.1** **14:00**

### Design of stub loaded transmission line matching circuit for series fed patch array

*M. P. Mohan, A Alphones, M. Y. Siyal, M Faeyz Karim, Nanyang Technological University, Singapore; L Zhao, J. Jimeno, NCS, Singapore*

**WE-A5.3P.2** **14:20**

### Wideband Star-shaped mmWave Planar Array Antenna with Liquid Crystal

*Divya Krishnan, A. Alphones, Nanyang Technological University, Singapore; Nasimuddin., I2R A-STAR, Singapore*

**WE-A5.3P.3** **14:40**

### Design and Modeling of a 77~ GHz Time-Modulated Transmitter Array for Enhanced Backoff Efficiency

*Zhehao Yu, Xuyang Lu, Chong Han, University of Michigan- Shanghai Jiao tong University Joint Institute, China; Suresh Venkatesh, Princeton University, United States*

**WE-A5.3P.4** **15:00**

### A Yagi-Uda Array of Bond Wire Antennas with High Front-to-Back Ratio

*Binshan Zhao, Zheng Gao, Min Tang, Shanghai Jiao Tong University, China*

**WE-A5.3P.5** **15:20**

### Design of Wideband Dual-Polarized Metasurface Antenna Using Characteristic Mode Analysis

*Teng Li, Wenbin Dou, Southeast University, China; Akanksha Bhutani, Thomas Zwick, Karlsruhe Institute of Technology, Germany; Yuanyan Su, École Polytechnique Fédérale de Lausanne, Switzerland*

**Break** **15:40**

**WE-A5.3P.6** **16:00**

### Co-Design of a Substrate Integrated Coaxial Line Filter-Antenna for Millimeter-wave Applications

*Satya Krishna Idury, Naman Baghel, Rajesh Shukla, Sourav Ghosh, Soumava Mukherjee, Indian Institute of Technology Jodhpur, India*

**WE-A5.3P.7** **16:20**

### Dual-Function Dielectric Layer Enabling Compact Wideband End-Fire Millimeter-Wave Antenna

*Ahmed Omar, Wonbin Hong, Pohang University of Science and Technology, Korea (South)*

**WE-A5.3P.8** **16:40**

### Wideband Millimeter-wave Slot Antenna Using Dielectric Cover for Gain Enhancement

*Wei Song, Zhijiao Chen, Limei Qi, Yuan Yao, Junsheng Yu, Beijing University of Posts and Telecommunications, China; Xiaodong Chen, Queen Mary University of London, United Kingdom*

**WE-A5.3P.9** **17:00**

### Incorporation of Spatial Modulation in In VIVO Frequency Selective Nano Networks.

*Fadila Berrahma, Hicham Bousbia-Salah, National Polytechnical School, Algeria; Khalida Ghanem, Center for Development of Advanced Technologies, Algeria; Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada*

**WE-A5.3P.10** **17:20**

### Micromachined Ridge Gap Waveguide Transmission Line and Transition at 220–310 GHz

*Sadia Farjana, Per Lundgren, Peter Enoksson, Ashraf Uz Zaman, Chalmers University of Technology, Sweden*



Wednesday, December 8  
WE-A4.1P

14:00 - 17:40  
Peony Junior Ballroom 4512

## Scattering, Diffraction and RCS

Session Co-Chairs: Hoi-Shun Lui, University of Technology Sydney; Yakir Hadad, Tel-Aviv University

**WE-A4.1P.1** 14:00

### PEC Wedge in Anisotropic Media: Generalized Wiener-Hopf Equations

*Vito Daniele, Guido Lombardi, Politecnico di Torino, Italy*

**WE-A4.1P.2** 14:20

### Study on Scattered Magnetic Field from a Metal Cylinder Covered with a Lossless Medium

*Toru Kawano, Keiji Goto, Takumi Nagasawa, Takahiro Fujita, Masashi Yamazaki, National Defense Academy, Japan*

**WE-A4.1P.3** 14:40

### Characterization of Rectangular Plates using Complex Natural Resonance

*Siyuan Li, University of Queensland, Australia; Chad Hargrave, Commonwealth Scientific and Industrial Research Organisation, Australia; Hoi-Shun Lui, University of Technology Sydney, Australia*

**WE-A4.1P.4** 15:00

### Analysis of Scattered Fields by an Impedance Sphere Coated with Multilayered Dielectric

*Mahesh Singh, Bratin Ghosh, Indian Institute of Technology, Kharagpur, India; Kamal Sarabandi, University of Michigan, Ann Arbor, United States*

**WE-A4.1P.5** 15:20

### Predicting the Direction of the Reflected Wave from a Phase Gradient Metasurface with Arbitrary Incident Angle

*Wihlan Bamard, Johann Odendaal, Johan Joubert, University of Pretoria, South Africa*

**Break** 15:40

**WE-A4.1P.6** 16:00

### A Low-Scattering Conformal Phased Array Based on Resistor-Loaded Metasurface

*Zhechen Zhang, Shiwen Yang, Yikai Chen, Shi-Wei Qu, University of Electronic Science and Technology of China, China*

**WE-A4.1P.7** 16:20

### RCS Reduction for Wideband Antenna Array

*Yuewen Gou, Yikai Chen, Shiwen Yang, University of Electronic Science and Technology of China, China*

**WE-A4.1P.8** 16:40

### Radar Cross Section Estimation For Entomological Applications: Target Dielectric Characterization And Its Impacts

*Omar Alzaabi, Khalifa University, United Arab Emirates; Mohammad Al-Khaldi, University Corporation for Atmospheric Research, United States; Mohamed Alkhatib, Diego Peñaloza, Julio Urbina, James Breakall, Michael Lanagan, Pennsylvania State University, United States*

**WE-A4.1P.9** 17:00

### One-way Guiding by Acoustic Sub-Diffraction Chain Under Transverse Mean Flow

*Ohad Silbiger, Yakir Hadad, Tel-Aviv University, Israel*

**WE-A4.1P.10** 17:20

### Clutter Removal for Detection of Slow-moving Targets with a mm-Wave FMCW Radar

*Walid Chekkar, Jérôme Lanteri, Claire Migliaccio, Université Côte d'Azur, France*



## Metasurfaces, FSS and EBG Materials II

Session Co-Chairs: Hisamatsu Nakano, Hosei University; Nasimuddin N, I2R A-STAR

**WE-A2.2P.1** **14:00**

Radiation Pattern Roundness Improvement of Off-center Monopole Antenna Using Electromagnetic Band-gap (EBG) Structure

*Bo Zhang, Zhi Ning Chen, National University of Singapore, Singapore*

**WE-A2.2P.2** **14:20**

Study of low-profile broadband circularly polarized patch antenna-based on metasurface structure

*Jinping Zhang, Zijian Xing, Jianying Li, Northwestern Polytechnical University, China*

**WE-A2.2P.3** **14:40**

A Miniaturized Wideband Filtering Metasurface Antenna with Improved Frequency Selectivity

*Bing-Jie Chen, Xue-Song Yang, Shun Zhang, Bing-Zhong Wang, University of Electronic Science and Technology of China, China*

**WE-A2.2P.4** **15:00**

Phase of Radiation From a Square Principal Source Region

*Hisamatsu Nakano, Tomoki Abe, Junji Yamauchi, Hosei University, Japan*

**WE-A2.2P.5** **15:20**

A Metasurface-based Stacked Patch Antenna for Wideband Circularly-Polarized Radiation

*Nasimuddin ., Xianming Qing, I2R A-STAR, Singapore*

**Break** **15:40**

**WE-A2.2P.6** **16:00**

Vivaldi Array Antenna With Low In-band RCS and Low Cross-polarization Properties by Loading Spoof Surface Plasmon Polariton Absorber

*Peng Jiang, Wen Jiang, Shuxi Gong, Xidian University, China*

**WE-A2.2P.7** **16:20**

Cavity Antenna Based on AMC-Reflector and FSS Superstrate for Gain improvement

*Boukern Dounya, Abdelhafid Bouacha, Tlemcen Telecommunication Laboratory, University of Tlemcen, Algeria; Djelloul Aissaoui, Tlemcen Telecommunication Laboratory, Algeria; Tayeb A. Denidni, EMT-INRS, Institut national de la recherche scientifique., Canada*

**WE-A2.2P.8** **16:40**

Miniaturized Circularly polarized Single-layer Metasurface antenna using Characteristic Modes

*Ahmed El Yousfi, Abdenasser Lamkaddem, Karlos Atia Abdalmalak, Luis Enrique Garcia Munoz, Daniel Segovia Vargas, Carlos III University of Madrid, Spain*

**WE-A2.2P.9** **17:00**

Electromagnetic Band-Gap Leaky-Wave Antennas Based on Grounded Dielectric Lattices

*Ludovica Tognolatti, Paolo Baccarelli, Silvio Ceccuzzi, Cristina Ponti, Giuseppe Schettini, Roma Tre University, Italy; Vakhtang Jandieri, University of Duisburg-Essen, Germany*



## Computational Electromagnetics III

Session Co-Chairs: Liang Chen, King Abdullah University of Science and Technology (KAUST); Qiang-Ming Cai, Southwest University of Science and Technology

**WE-A3.1P.1** **14:00**

### An Efficient Higher Order MoM-PO Method for EM Scattering From Electrically Large Objects

*Chao Zhang, Qiang-Ming Cai, Xin Cao, Yuyu Zhu, Jun Fan, Southwest University of Science and Technology, China; Lei Han, Air Force Engineering University, China; Yan-Wen Zhao, University of Electronic Science and Technology of China, China; Tao Liu, Sichuan Jiuzhou Electric Group Co, China*

**WE-A3.1P.2** **14:20**

### An Integral Equation Solver for Analyzing Propagation Problems Involving Metasurfaces

*Sebastian Celis, Rui Chen, Ran Zhao, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia*

**WE-A3.1P.3** **14:40**

### A Time-domain Carrier Generation Rate Model for Optoelectronic Device Simulations

*Liang Chen, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia*

**WE-A3.1P.4** **15:00**

### Near-Field-Based Preconditioning Technique in the Incomplete-Leaf MLFMA for Nonuniformly Discretized Electromagnetic Scattering Problems

*Bahram Khalichi, Vakur Behcet Erturk, Bilkent University, Turkey; Ozgur Ergul, Middle East Technical University, Turkey*

**WE-A3.1P.5** **15:20**

### Solving 4,000 Wavelengths 2-D TM Scatterer Using Entire-Domain High-Precision MoM

*Jovana Petrović, Dragan Olčan, University of Belgrade, School of Electrical Engineering, Serbia*

**Break** **15:40**

**WE-A3.1P.6** **16:00**

### An Implicit-Explicit Dual-Mesh Discontinuous Galerkin Scheme for Multiphysics Simulation of Organic Electrochemical Transistors

*Ming Dong, Liang Chen, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia*

**WE-A3.1P.7** **16:20**

### A Hybridizable Discontinuous Galerkin-Boundary Integral Formulation for Efficient Analysis of Electromagnetic Scattering

*Ran Zhao, Liang Chen, Hakan Bagci, King Abdullah University of Science and Technology, Saudi Arabia; Jun Hu, University of Electronic Science and Technology, China*

**WE-A3.1P.8** **16:40**

### On the Oblique Generalization of the Quasi-Helmholtz Projectors for a Low-Frequency and Contrast Stable Electric Flux Volume Integral Equation

*Clément Henry, Francesco P. Andriulli, Politecnico di Torino, Italy; Adrien Merlini, IMT Atlantique, France*

**WE-A3.1P.9** **17:00**

### Applying Huygens' Equivalence Surfaces in the Local Mesh Refinement of Multiscale Problems

*Alberto Serna, Victor F Martin, University of Extremadura, Spain; Jorge Tobán, Francesca Vipiana, Politecnico di Torino, Italy; Zheng Peng, University of Illinois, United States*

**WE-A3.1P.10** **17:20**

### Maximum Radiation Efficiency of Implanted Antennas Employing a Novel Hybrid Method

*Lukas Jelínek, Jakub Liska, Miloslav Capek, Vit Losenicky, Czech Technical University in Prague, Czech Republic; Mats Gustafsson, Lund University, Sweden*



## Remote Sensing II

Session Co-Chairs: Zhijiao Chen, Beijing University of Posts and Telecommunications; Fabien Ferrero, Université Côte d'Azur

**WE-A4.2P.1** **14:00**

### Resonance-based Radar Target Classification using the Matrix Pencil Method and the Cauchy Method

*Siyan Li, University of Queensland, Australia; Chad Hargrave, Commonwealth Scientific and Industrial Research Organisation, Australia; Hoi-Shun Lui, University of Technology Sydney, Australia*

**WE-A4.2P.2** **14:20**

### Use of UHF compact Circularly Polarized antenna for food analysis

*Lic Tran Van, University of Danang - University of Science and Technology, Viet Nam; Canh Doan Thi Ngoc, University of Danang - University of Economics, Viet Nam; Huy Trinh Le, University of Information Technology - Vietnam National University, Viet Nam; Fabien Ferrero, Nhan Le-Thanh, Université Côte d'Azur, France*

**WE-A4.2P.3** **14:40**

### Single-Mode Wireless Sensing by Nonlinear Parity-Time-Symmetric Circuits

*Zhipeng Li, John Ho, National University of Singapore, Singapore*

**WE-A4.2P.4** **15:00**

### Hand Gesture Recognition using Deep learning Method

*Gyutae Park, Vasantha Chandrasegar, Jinhwan Koh, Gyeongsang National University, Korea (South)*

**WE-A4.2P.5** **15:20**

### Cloud Monitoring in Singapore Using GPS Residuals

*Ding Yu Heh, Yee Hui Lee, Liang Mong Koh, Nanyang Technological University, Singapore*

**Break** **15:40**

**WE-A4.2P.6** **16:00**

### Numerical Evaluation of Impacts of Dust and Water Vapor on Indoor Channel Characteristics

*Hao Qin, Xingqi Zhang, University College Dublin, Ireland; Weibin Hou, Jiadong Du, China Academy of Information and Communications Technology, China; Shunchuan Yang, Beihang University, China*

**WE-A4.2P.7** **16:20**

### A Method for Sensing the Liquid in Infusion Bag

*Haixin Jiang, Zhijiao Chen, Limei Qi, Yuan Yao, Junsheng Yu, Beijing University of Posts and Telecommunications, China; Xiaodong Chen, Queen Mary University of London, United Kingdom*

**WE-A4.2P.8** **16:40**

### A Fully Analog Power-Based Direction-of-Arrival Sensor

*Nga Vu, Minh Q. Dinh, Minh Thuy Le, Hanoi University of Science and Technology, Viet Nam*

**WE-A4.2P.9** **17:00**

### Planar Spiral Resonators for remote tracking of displacement

*Mahmoud Elgeziry, Filippo Costa, Simone Genovesi, University of Pisa, Italy*

**WE-A4.2P.10** **17:20**

### Statistical Characterization of Signals Backscattered from Stationary Ground Targets for Radar Refractivity Estimation

*Brais Sánchez-Rama, Rubén Nacelo López, Verónica Santalla del Río, University of Vigo, Spain*





## Slotted and Guided Wave Antennas I

Session Co-Chairs: Yuandan Dong, University of Electronic Science and Technology of China; Shubhendu Bhardwaj, Florida International University

**TH-A1.1A.1** **08:20**

### Compact Coaxial Waveguide-Based Antenna

*Roshanak Zabih, Christopher G. Hynes, Rodney G. Vaughan, Simon Fraser University, Canada*

**TH-A1.1A.2** **08:40**

### Orbital Angular Momentum (OAM) Carrying Vortex Wave generation in Dielectric Filled Circular Waveguide

*Md Khadimul Islam, Arjuna Madanayake, Shubhendu Bhardwaj, Florida International University, United States*

**TH-A1.1A.3** **09:00**

### Dispersion Relation Extraction of Periodic Leaky-Wave Antennas using Complex Eigenmodes

*João Guilherme Nizer Rahmeier, Mohamed K. Emar, Shulabh Gupta, Carleton University, Canada*

**TH-A1.1A.4** **09:20**

### Conformal Modulated Reactance Surface Synthesis for Leaky-Wave Radiation

*Hakjune Lee, Do-Hoon Kwon, University of Massachusetts Amherst, United States*

**TH-A1.1A.5** **09:40**

### Single-Ridged Waveguide Antenna for X-Band Applications

*Shilu Deng, Qiang-Ming Cai, Xin Cao, Yuyu Zhu, Feng Guo, Jun Fan, Southwest University of Science and Technology, China; Lei Han, Air Force Engineering University, China; Tao Liu, Sichuan Jiuzhou Electric Group Co., Ltd, China*

**Break** **10:00**

**TH-A1.1A.6** **10:20**

### Design of Rectangular Waveguide Slot Array Antenna

*Tao Liu, Sichuan Jiuzhou Electric Group Co., Ltd, China; Shilu Deng, Qiang-Ming Cai, Xin Cao, Southwest University of Science and Technology, China; Lei Han, Air Force Engineering University, China*

**TH-A1.1A.7** **10:40**

### Near-Field-Focused 2-D Frequency Scanning Ridge-Gap Waveguide Slot Array Antenna

*Ya Fei Wu, Yu Jian Cheng, Hong Bin Wang, Yong Fan, University of Electronic Science and Technology of China, China*

**TH-A1.1A.8** **11:00**

### Novel Offset Complementary Split Ring Resonators on Narrow-wall of Waveguides for HPM Applications

*Mohammad Saif ur Rehman, Meiqin Liu, Chun Liang Liu, Xi'an Jiaotong University, China; Edl Schamiloglu, University of New Mexico, United States*

**TH-A1.1A.9** **11:20**

### Design of Rectangular Waveguide Slot Antenna for Anti-interference Applications

*Xuemeng Chen, Xianling Liang, Shanghai Jiao Tong University, China; Chong He, Shanghai Jiao Tong University, China; Qian Chen, Anhui University, China*

**TH-A1.1A.10** **11:40**

### Novel Planar Fixed-Beam Leaky-Wave Antenna With Dual-Beam Radiation

*Yongsheng Pan, Tianqi Ao, Yuandan Dong, University of Electronic Science and Technology of China, China*



Thursday, December 9  
TH-A1.2A

08:20 - 12:00  
Melati Ballroom 4104

## Microstrip Antennas and Arrays I

Session Co-Chairs: Constantinos L. Zekios, Florida International University; Ankang Liu, National University of Singapore

**TH-A1.2A.1** **08:20**

### A Novel Miniaturized MIMO Microstrip Patch Antenna Array with EBG- and Slot-Loading

*DaHan Liao, Jin Dong, Teja Kuruganti, Oak Ridge National Laboratory, United States*

**TH-A1.2A.2** **08:40**

### A First Implementation of a Single-Layer 4x4 Butler Matrix on Flexible PET Using Printed Silver

*Shakeeb Abdullah, NRC & Carleton University, Canada; George (Gaozhi) Xiao, NRC, Canada; Joseph Hyland Hyland, Wenyu Zhou, Rony Amaya, Carleton University, Canada*

**TH-A1.2A.3** **09:00**

### A Compact Multi-Band MIMO Antenna

*Nicholas Russo, Constantinos Zekios, Stavros Georgakopoulos, Florida International University, United States*

**TH-A1.2A.4** **09:20**

### New Topology of 8 x 8 Compact Single-Layer Butler Matrix Without Crossovers for Multibeam Array Antenna

*Siwar Louati, Larbi Talbi, Khelifa Hettak, Halim Boutayeb, University of Quebec in Outaouais, Canada*

**TH-A1.2A.5** **09:40**

### Compact Parallel Coupled-Line Bandpass Filter Dedicated to E-band Homodyne Front-End Radars

*Mansoor Dashti Ardakani, Serioja Ovidiu Tatu, INRS University, Canada; Reza Karimian, Shahrokh Ahmadi, Mona Zaghloul, George Washington University, United States; Javad Pourahmadazar, Concordia University, Canada*

**Break** **10:00**

**TH-A1.2A.6** **10:20**

### Magnetically Tunable 28 GHz Array Antenna Using BaM/PDMS Composite

*Renuka Bowrothu, Hae-in Kim, Connor Smith, David Arnold, Yong Kyu Yoon, University of Florida, United States*

**TH-A1.2A.7** **10:40**

### Compact Circularly Polarized CPW-fed Antenna for GNSS Applications

*Alireza Gharaati, Azita Goudarzi, Rashid Mirzavand, University of Alberta, Canada*

**TH-A1.2A.8** **11:00**

### Circumferentially Short-circuited Circular Sector Patch Antenna with Broadened Beamwidth

*Xiao-Hui Mao, Fei-Yan Ji, Shan-Shan Gu, Jian Yu, Wen-Jun Lu, Nanjing University of Posts and Telecommunications, China*

**TH-A1.2A.9** **11:20**

### Multiband Microstrip Antenna Arrays with Improved Performance using Metasurfaces

*Brinta Chowdhury, Abdullah Eroglu, North Carolina A&T State University, United States*

**TH-A1.2A.10** **11:40**

### Antenna for satellite and UAV communications

*Diana Veronica Navarro-Mendez, Luis Fernando Carrera, Escuela Politécnica Nacional, Ecuador; Mariano Baquero-Escudero, Universitat Politècnica de Valencia, Spain*



## Wideband Phased Array Antennas II

Session Co-Chairs: Sven van Berkel, Jet Propulsion Laboratory; Bo Shi, Institute for Infocomm Research

**TH-A1.3A.1** **08:20**

### Two-way Passive Phased Array Antenna for Simultaneous Transmit and Receive Signals

*Zahra Rahimian Omam, Wael M. Abdel-Wahab, Naimeh Ghafarian, Suren Gigoyan, Safieddin Safavi-Naeini, University of Waterloo, Canada*

**TH-A1.3A.2** **08:40**

### An Inhomogeneous 3D Block Lens For Hemispherical Scan Coverage In Phased Arrays

*Pramod Srinivas Bhat, Amrithaa Seshadri, John Sanford, University of California, San Diego, United States*

**TH-A1.3A.3** **09:00**

### High Gain 6X6 Patch Phased Array Antenna For Millimeter-wave 5G Applications at 28 Ghz

*Mohamed Lamine Seddiki, Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada*

**TH-A1.3A.4** **09:20**

### A Millimeter-Wave Wide Band, Wide Scanning Phased Array-Fed Reflector Architecture

*Thomas Hand, Joseph Torres, Tonya Nielsen, Joshua Gustafson, Peter Moschetti, Lockheed Martin Space, United States*

**TH-A1.3A.5** **09:40**

### Ultra-wideband CRLH magneto-electric phased array

*Senglee Foo, Huawei Technologies Canada, Canada*

**Break** **10:00**

**TH-A1.3A.6** **10:20**

### Design of an Ultra-Broadband Phased Array Using Self-Similar Elements

*Amrithaa Seshadri, Pramod Srinivas Bhat, John R. Sanford, University of California, San Diego, United States*

**TH-A1.3A.7** **10:40**

### A Wideband Phased Array Antenna with Grating Lobe Cancellation

*Jia-Chi Chieh, Naval Information Warfare Center Pacific, United States; Satish Sharma, Sanghmitro Das, San Diego State University, United States*

**TH-A1.3A.8** **11:00**

### Compact Planar Design of 2-D Butler Matrix for Passive Beamforming of 2×2 Patch Array in D-Band

*Kai-Qi Huang, Madhavan Swaminathan, Georgia Institute of Technology, United States*

**TH-A1.3A.9** **11:20**

### A 1-D Submm-wave Leaky-Wave Phased Array using MEMS Phase Shifters

*Sven van Berkel, Subash Khanal, Sofia Rahiminejad, Cecile Jung-Kubiak, Alain Maestrini, Goutam Chattopadhyay, Jet Propulsion Laboratory, United States*

**TH-A1.3A.10** **11:40**

### A Symmetrically Stacked Phased Array Exhibiting Enhanced Spherical Coverage CDF for mmWave Cellular Handsets with Metallic Frame

*Junho Park, Ahmed Abdelmottaleb Omar, Jonghyun Kim, Jaehyun Choi, Wonbin Hong, Pohang University of Science and Technology, Korea (South); Beakjun Seong, Jongwoo Lee, Kreemo Inc, Korea (South)*



## Frequency-Domain Methods

Session Co-Chairs: Branislav Notaros, Colorado State University; Vladimir Okhmatovski, University of Manitoba

**TH-UB.1A.1** **08:20**

**An Alternative hp-Refinement Methodology in CEM: Applications to Problems with Singular Solutions in 2D FEM**  
*Jeremiah Corrado, Jake Harmon, Branislav Notaros, Colorado State University, United States*

**TH-UB.1A.2** **08:40**

**A New Domain Decomposition Technique for Full-wave Analysis of Inhomogeneous Electromagnetic Surfaces with Connected Conductors**  
*Reza Gholami, Parinaz Naseri, Piero Triverio, Sean Hum, University of Toronto, Canada*

**TH-UB.1A.3** **09:00**

**Error-Controlled Evaluation of Michalski-Zheng's Mixed-Potential Layered Media Green's Function with Spectral Differential Equation Approximation Method**  
*Xinbo Li, Ian Jeffrey, Vladimir Okhmatovski, University of Manitoba, Canada*

**TH-UB.1A.4** **09:20**

**A New Approach to Providing Matched Termination for the Computation of S-parameters of Antennas and Microwave Circuits via EM Simulation**  
*Chao Li, Mohammad Sharawi, Polytechnique Montreal, Canada; Raj Mittra, University of Central Florida, United States*

**TH-UB.1A.5** **09:40**

**A Modified PMCHWT Scheme for Subsurface Reservoir Characterization Using Low Frequency Electromagnetics**  
*Chaoxian Qi, Donald Wilton, Jiefu Chen, University of Houston, United States*

**Break** **10:00**

**TH-UB.1A.6** **10:20**

**H-Matrix Fast Direct Solution of Scattering Problems with Locally Corrected Nystrom Discretized Electric Field Integral Equation**  
*Omid Babazadeh, Tianke Qiu, Vladimir Okhmatovski, University of Manitoba, Canada; Reza Gholami, University of Toronto, Canada; Emrah Sever, Gebze Technical University, Turkey*

**TH-UB.1A.7** **10:40**

**Low-Backscattering Energy-Selective Surfaces**  
*Lin Zhou, Zhongxiang Shen, Nanyang Technological University, Singapore*

**TH-UB.1A.8** **11:00**

**Augmentation of Hybrid Integral Equations for Low-Frequency Analysis of Dielectric Objects**  
*Li Zhang, Mei Song Tong, Tongji University, China*

**TH-UB.1A.9** **11:20**

**Accuracy Improvement of the Algebraic Fast Methods for the Volume-Surface Integral Equation**  
*Han Wang, Mingjie Pang, Hai Lin, State Key Laboratory of CAD&CG, China*

**TH-UB.1A.10** **11:40**

**Fast Characteristic Mode Analysis for Material Body with Multilevel Fast Multipole Algorithm**  
*Jihong Gu, Chao-Fu Wang, National University of Singapore, Singapore*



### 3D Printed Antennas and Structures

Session Co-Chairs: Avinash Sharma, The Johns Hopkins University Applied Physics Laboratory; Yanghyo Kim, Stevens Institute of Technology

**TH-A5.1A.1** **08:20**

#### Low-Cost Circularly Polarized Millimeter-Wave Antenna using 3D Additive Manufacturing Dielectric Polarizer

*Yazan Al-Alem, Yahia Antar, The Royal Military College of Canada, Canada; Syed Sifat, Ahmed Kishk, Concordia University, Canada; Gaozhi (George) Xiao, National Research Council of Canada, Canada*

**TH-A5.1A.2** **08:40**

#### 3D Printed Wideband Monopole Antennas

*Kevin Leong, Evan Nguyen, Jesse Tice, Vesna Radisic, Northrop Grumman, United States*

**TH-A5.1A.3** **09:00**

#### 3D Metal Printed Broadband X-Band Septum Polarizer

*Avinash Sharma, The Johns Hopkins University Applied Physics Laboratory, United States*

**TH-A5.1A.4** **09:20**

#### Design of 3D-Printed Air-Like Structural Supports for Meanderline Polarizers at L-Band

*Songyi Yen, Gaeron R. Friedrichs, Ljubodrag Boskovic, Dejan Filipovic, University of Colorado Boulder, United States; Erik Lier, Tom Hand, Neill Kefauver, Lockheed Martin Space, United States*

**TH-A5.1A.5** **09:40**

#### On the Effect of Variable Thickness of Conductive Trace for 3D Printed Antennas

*Sagar Hossain, Pratik Sinai K., Sayan Roy, South Dakota School of Mines & Technology, United States*

**Break** **10:00**

**TH-A5.1A.6** **10:20**

#### On the Manufacturing Process of a 3D Printed Patch Antenna with Variable Trace Height

*Pratik Sinai K., Sagar Hossain, Sayan Roy, South Dakota School of Mines & Technology, United States*

**TH-A5.1A.7** **10:40**

#### On the Coupling Between a Transmission Line Additively Manufactured with Electrifi Filament and a Copper Stepped Impedance Filter in the S-Band

*Henry Wolf, Dipankar Mitra, Ryan Striker, Jerika Cleveland, Benjamin Braaten, North Dakota State University, United States*

**TH-A5.1A.8** **11:00**

#### Aperture-Coupled Feed for Surface-Mounted Additively Manufactured Arrays

*Brian Gibbons, R. Henry Tillman, Jason Jones, Michael Presley, Johns Hopkins Applied Physics Laboratory, United States*

**TH-A5.1A.9** **11:20**

#### On Changing the Phase of the Radiated Field from a Microstrip Patch Antenna Using a 3D-printed Conformal Metasurface

*Ruisi Ge, Ryan Striker, Benjamin Braaten, North Dakota State University, United States*

**TH-A5.1A.10** **11:40**

#### Design Method for Bowtie Antenna with Enhanced Bandwidth and Controllable Gain Using 3D-Printing Technology

*Milad Mirzaee, Yanghyo Kim, Stevens Institute of Technology, United States*



Thursday, December 9  
TH-A3.1A

08:20 - 12:00  
Peony Ballroom 4402

## Optimization Methods in EM Designs I

Session Co-Chairs: Constantinos L. Zekios, Florida International University; Botian Zhang, University of California, Los Angeles

**TH-A3.1A.1** **08:20**

### Performance of Random Forest Algorithm in High-Dimensional Surrogate Modeling of Antennas

*Md Rayhan Khan, Constantinos L. Zekios, Shubhendu Bhardwaj, Stavros V. Georgakopoulos, Florida International University, United States*

**TH-A3.1A.2** **08:40**

### Some Numerical Experiments on Enhanced-Directivity Dielectric Resonator Antennas

*Mohammed Nasser, Derek McNamara, Mustapha Yagoub, University of Ottawa, Canada; Hamad Alroughani, Kuwait University, Kuwait*

**TH-A3.1A.3** **09:00**

### Choice of Optimization Parameters in an Inverse Metasurface Design Algorithm

*Tianke Qiu, Trevor Brown, Puyan Mojabi, University of Manitoba, Canada*

**TH-A3.1A.4** **09:20**

### Adaptive Moment (Adam) Estimation Optimization Applied to AVM-FEM for Rapid Convergence

*Botian Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States*

**TH-A3.1A.5** **09:40**

### Nonuniform Planar Array Synthesis Including Mutual Coupling Effects Based on ANN

*Yu Gong, Shaoqiu Xiao, Yu Zheng, Bingzhong Wang, University of Electronic Science and Technology of China, China*

**Break** **10:00**

**TH-A3.1A.6** **10:20**

### Near field sampling compression based on matrix CUR decomposition

*Chunhua Wu, Huapeng Zhao, Jun Hu, University of Electronic Science and Technology of China, China*

**TH-A3.1A.7** **10:40**

### An Improved Particle Swarm Optimization for Antenna Design

*Ruoyu Cui, Zhonglei Mei, Tiaoming Niu, Lanzhou University, China*

**TH-A3.1A.8** **11:00**

### Feedless Mode Tracking Optimization of Metasurface Antenna Using Characteristic Mode Analysis

*Yu Kuang, Zhi Ning Chen, National University of Singapore, Singapore; Qingsha S. Cheng, Southern University of Science and Technology, China*

**TH-A3.1A.9** **11:20**

### The Edge Diffraction Effect on the Radiation Pattern of Elements for Antenna Array Synthesis

*Xianjie Liu, Huapeng Zhao, Jun Hu, University of Electronic Science and Technology of China, China*

**TH-A3.1A.10** **11:40**

### Improved and Agile Metasurface Beamforming Using Hybrid Intelligent Algorithms

*Euiho Shin, Jungsuek Oh, Seoul National University, Korea (South)*



## Transforming Electromagnetics Education after Covid

Session Co-Chairs: Cynthia M. Furse, University of Utah; Krishnasamy Selvan, Sri Sivasubramaniya Nadar College of Engineering

**TH-SP.1A.1** **08:20**

### COVID-19 Wake-Up Call: Technology-Based Electromagnetic Education Revisited

*Magdy F. Iskander, Zhengqing Yun, University of Hawaii at Manoa, United States*

**TH-SP.1A.2** **08:40**

### Maintaining an Active Learning Environment During a Pandemic

*Andrew Chrysler, Idaho State University, United States*

**TH-SP.1A.3** **09:00**

### University of Utah Hybrid-Flexible Education

*Cynthia M. Furse, James Nagel, Berardi Sensale-Rodriguez, Jamesina Simpson, University of Utah, United States*

**TH-SP.1A.4** **09:20**

### Evaluating Oral Exams in Large Undergraduate Engineering Courses

*Curt Schurgers, Saharnaz Baghadadchi, Marko Lubarda, Maziar Ghazinejad, Alex Phan, Huihui Qi, University of California, San Diego, United States*

**TH-SP.1A.5** **09:40**

### Conversion of Electromagnetics Courses to Synchronous Online Delivery Using Active and Problem-Based Learning

*Branislav Notaros, Colorado State University, United States*

**Break** **10:00**

**TH-SP.1A.6** **10:20**

### Strategies for the Fully Remote Delivery of a Microwave Engineering Course with a Hands-On Lab Component

*Ashwin Iyer, Braden Smyth, Mitchell Semple, Christopher Barker, University of Alberta, Canada*

**TH-SP.1A.7** **10:40**

### Three Key Lessons Learned from Teaching Fields and Waves Online during COVID-19

*Soo Yong Lim, University of Nottingham Malaysia, Malaysia*

**TH-SP.1A.8** **11:00**

### Mobile Apps, Online Assessments and Examination for Electromagnetics Education

*Eng Leong Tan, Nanyang Technological University, Singapore*

**TH-SP.1A.9** **11:20**

### Effective electromagnetics teaching, no matter what!

*Hugo G. Espinosa, Griffith University, Australia; Levent Sevgi, Istanbul OKAN University, Turkey*

**TH-SP.1A.10** **11:40**

### Online EM Teaching: E-XAM tool for Students' Self-Evaluation and Final Assessment

*Alessandro Polo, Nicola Anselmi, Renzo Azaro, Giorgio Gottardi, Mohammad Abdul Hannan, Giacomo Oliveri, Lorenzo Poli, Paolo Rocca, Marco Salucci, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy; Hanen Ahmadi, ELEDIA@Innov'COM - Sup'COM, Italy; Jin Huang, Peng Li, ELEDIA@XIDIAN - Xidian University, Italy; Maokun Li, ELEDIA@TSINGHUA - Tsinghua University, Italy; Sotirios Goudas, ELEDIA@AUTH - Aristotle University of Thessaloniki, Italy; Shiwen Yang, ELEDIA@UESTC - UESTC, Italy*



## Electromagnetics in Biology and Medicine I

Session Co-Chairs: Jean-Marie Bouteiller, University of Southern California; DEZHI WANG, Purdue University

**TH-UK.1A.1** **08:20**

### Active Impedance Matching of a Passive and Wireless Neopotential Recorder

*Melany Gutierrez-Hernandez, Carolina Moncion, Satheesh Bajja-Venkatakrishnan, John L. Volakis, Florida International University, United States*

**TH-UK.1A.2** **08:40**

### Stimulus Waveform Designs for Selective Activation of Retinal Ganglion Cells in Epiretinal Prostheses

*Javad Paknahad, Gianluca Lazzi, University of Southern California, United States*

**TH-UK.1A.3** **09:00**

### Safety assessment for electrical stimulation of peripheral nerve: A multi-scale computational study

*Jinze Du, Andres Morales, Javad Paknahad, Pragya Kosta, Jean-Marie Bouteiller, Gianluca Lazzi, University of Southern California, United States*

**TH-UK.1A.4** **09:20**

### Analysis of Beamforming Sensitivity to Dynamic Dielectric Properties during Noninvasive Microwave Thermal

#### Treatment of Tumors

*Tessa Haldes, Susan Hagness, University of Wisconsin-Madison, United States; Ahona Bhattacharyya, Jeffrey Nanzer, Michigan State University, United States*

**TH-UK.1A.5** **09:40**

### Impact of Retinal Degeneration on Response of ON and OFF Cone Bipolar Cells to Electrical Stimulation

*Shayan Farzad, Javad Paknahad, Pragya Kosta, Ege Iseri, Gianluca Lazzi, University of Southern California, United States*

**Break** **10:00**

**TH-UK.1A.6** **10:20**

### Monitoring Neuronal Activity with a Multichannel Passive Wireless Neurosensing System

*Carolina Moncion, Lakshmini Balachandar, Satheesh Bajja-Venkatakrishnan, Jorge Riera Diaz, John Volakis, Florida International University, United States*

**TH-UK.1A.7** **10:40**

### Fast E-field Simulation in the Transcranial Magnetic Stimulation Using Adaptive Cross Approximation

*Dezhi Wang, Nahian Hasan, Luis Gomez, Purdue University, United States*

**TH-UK.1A.8** **11:00**

### The Response of the Simulated Dentate Gyrus Network Model to Extracellular Electrical Stimulation Varies with Axonal Morphological Complexity

*Tzu Fei Millard, Gene Yu, Javad Paknahad, Jean-Marie Bouteiller, Theodore Berger, Gianluca Lazzi, University of Southern California, United States*

**TH-UK.1A.9** **11:20**

### Virtual Head Model Embedding for Population-Based Uncertainty Quantification

*Nahian I. Hasan, Dezhi Wang, Luis J. Gomez, Purdue University, United States*

**TH-UK.1A.10** **11:40**

### Voltage Gradient Modulations in Biological Tissues during Electrical Stimulation using External Circuits

*Xiecheng Shao, Manjunath Machnoor, Javad Paknahad, Ege Iseri, Kimberly Gokoffski, Gianluca Lazzi, University of Southern California, United States*





Thursday, December 9  
TH-A5.2A

08:20 - 10:00

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Software Defined/Cognitive Radio

Session Co-Chairs: Johnson Wang, Wang Electro-Opto Corporation; Bumhyun Kim, Pohang University of Science and Technology (POSTECH)

**TH-A5.2A.1**

**08:20**

### A Machine Learning Enhanced Small Circular Array for Amplitude Only Direction Finding

*Gaeron Friedrichs, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder, United States*

**TH-A5.2A.2**

**08:40**

### Stealth Communication (SC) for 5G/6G Wireless to ensure spectral efficiency and privacy/cybersecurity

*Johnson Wang, Wang Electro-Opto Corporation (weo.com), United States*

**TH-A5.2A.3**

**09:00**

### Physical Layer Wireless Security Through the Rotation of Polarized Antennas

*Brandon Starks, Karsen Robinson, Binod Sitaula, Andrew Chrysler, Idaho State University, United States*

**TH-A5.2A.4**

**09:20**

### Robust Beamforming for Conformal Antenna Arrays using Software Defined Radio

*Jiahao Wang, Koenraad Mouthaan, National University of Singapore, Singapore*

**TH-A5.2A.5**

**09:40**

### A Reconfigurable Phased Array Architecture with Reduced RF Ports Based on Software-Defined Radio for Beyond 5G Applications

*Bumhyun Kim, Junho Park, Dongkwon Choi, Wonbin Hong, Pohang University of Science and Technology, Korea (South); Sumin Yun, JaeHoon Jo, Hosaeng Kim, Samsung Electronics, Korea (South)*



Thursday, December 9  
TH-A5.3A

10:20 - 12:00

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Millimeter-Wave Waveguide and Cavity Antennas I

Session Co-Chairs: Carlos Saavedra, Queen's University; Xianming Qing, Institute for Infocomm Research

**TH-A5.3A.1**

**10:20**

### A Wideband CP Cavity-Backed SIW Antenna Fed by Printed-RGW Technology

*Zahra Mousavirazi, Mohamed Mamdouh M. Ali, Tayeb A. Denidni, Institut national de la recherche scientifique (INRS), Canada; Vahid Rafiei, GraphenePI company, Turkey*

**TH-A5.3A.2**

**10:40**

### A High-Order Mode Leaky Wave Antenna

*Gian P. Carrara, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States*

**TH-A5.3A.3**

**11:00**

### A Dual High-Order Mode Leaky Wave Antenna

*Gian P. Carrara, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States*

**TH-A5.3A.4**

**11:20**

### Metal-Coated Flexible Dielectric Waveguides for Millimeter-Wave Multi-Lane Wireline Communications

*Milad Mirzaee, Yanghyo Kim, Stevens Institute of Technology, United States*

**TH-A5.3A.5**

**11:40**

### Millimeter-Wave Quadruplet Filtering-Antenna

*Matthew Brown, Carlos Saavedra, Queen's University, Canada*



## Artificial Intelligence and Deep Learning: A New Era in Imaging and Inverse Scattering

Session Co-Chairs: Ji Chen, University of Houston; Marco Salucci, ELEDIA@UniTN - University of Trento

**TH-SP.2A.1** **08:20**

**Deep Learning Enhanced Joint Inversion of Multiphysics Data with Nonconforming Discretization**  
*Yanyan Hu, Jiefu Chen, Xuqing Wu, University of Houston, United States; Yueqin Huang, Cyentech Consulting LLC, United States*

**TH-SP.2A.2** **08:40**

**Convolutional Neural Networks for Radio Source Detection**  
*Jayakrishnan Vijayamohanam, Arjun Gupta, Oameed Noakoosteen,, Christos Christodoulou, University of New Mexico, United States*

**TH-SP.2A.3** **09:00**

**Predicting MRI RF Exposure for Passive Implantable Medical Devices Using a Mesh-based Convolutional Neural Network**  
*Qianlong Lan, Jianfeng Zheng, Jiajun Chang, Ran Guo, Ji Chen, University of Houston, United States; Wolfgang Kainz, US Food and Drug Administration, United States*

**TH-SP.2A.4** **09:20**

**Prediction of Active Implantable Medical Device Electromagnetic Models Using a Neural Network**  
*Jiajun Chang, Qianlong Lan, Ran Guo, Jianfeng Zheng, Ji Chen, University of Houston, United States; Wolfgang Kainz, US Food and Drug Administration, United States*

**TH-SP.2A.5** **09:40**

**Deep Surrogate Models for Time-Domain Electromagnetic Analysis using Attention: Going Beyond Recurrent Neural Networks**  
*Oameed Noakoosteen, Jayakrishnan Vijayamohanam, Arjun Gupta, Christos Christodoulou, University of New Mexico, United States*

**Break** **10:00**

**TH-SP.2A.6** **10:20**

**Data-Driven Electromagnetic Scalar Field Estimation of a Patch Antenna Using Deep Convolutional Neural Network**  
*Md Rayhan Khan, Constantinos L. Zekios, Shubhendu Bhardwaj, Stavros V. Georgakopoulos, Florida International University, United States*

**TH-SP.2A.7** **10:40**

**Sequential Deep Learning for In-Home Activity Monitoring Using mm-Wave FMCW Radar**  
*Hajar Abedi, Ahmad Ansariyan, Plinio Morita, Jennifer Bager, Alexander Wong, George Shaker, University of Waterloo, Canada*

**TH-SP.2A.8** **11:00**

**A Machine Learning-Based Model for Fast Recognition of Orbital Angular Momentum Modes**  
*Jia-Jing Sun, Sheng Sun, Jun Hu, University of Electronic Science and Technology of China, China*

**TH-SP.2A.9** **11:20**

**A Tailored Semi-Physics-Driven And Semi-Data-Driven Artificial Neural Network For Electromagnetic Full-Wave Inversion**  
*Feng Han, Yanjin Chen, Xiamen University, China*

**TH-SP.2A.10** **11:40**

**Electromagnetic Inverse Scattering Based on Deep Learning**  
*Renzhou Gui, Tianyu Tang, Juan Li, Huilin Zheng, Xiaohong Ji, Jun Zhao, Xiaomeng Zhao, Tongji University, China*



## Recent Advances in Generalized Sheet Transition Conditions (GSTCs): Theory, Capabilities, Realizations, and Applications

Session Co-Chairs: Jordan Budhu, University of Michigan; Anthony Grbic, University of Michigan

<b>TH-SP.3A.1</b>	<b>08:20</b>
<b>Advances in Bianisotropic GSTC-based Metasurfaces</b> <i>Guillaume Lavigne, Polytechnique Montreal, Canada; Christophe Caloz, KU Leuven, Belgium</i>	
<b>TH-SP.3A.2</b>	<b>08:40</b>
<b>Static and Dynamic Beamforming with Huygens' Metasurface Antennas</b> <i>Vasileios Ataloglou, Minseok Kim, George Eleftheriades, University of Toronto, Canada</i>	
<b>TH-SP.3A.3</b>	<b>09:00</b>
<b>Interface Field Optimization for Wide-Angle Metasurface Refractors in TM Polarization</b> <i>Do-Hoon Kwon, University of Massachusetts Amherst, United States</i>	
<b>TH-SP.3A.4</b>	<b>09:20</b>
<b>Applying GSTCs in Electromagnetic Surface Inverse Design Using Optimization and Machine Learning</b> <i>Stewart Pearson, Parinaz Naseri, Zhengzheng Wang, Sean Hum, University of Toronto, Canada</i>	
<b>TH-SP.3A.5</b>	<b>09:40</b>
<b>Accurate Modeling and Rapid Synthesis Methods for Beamforming Metasurfaces</b> <i>Jordan Budhu, Luke Szymanski, Anthony Grbic, University of Michigan, United States</i>	
<b>Break</b>	<b>10:00</b>
<b>TH-SP.3A.6</b>	<b>10:20</b>
<b>Investigation into Curvilinear Metasurfaces using IE-GSTCs with Normal Surface Polarizabilities</b> <i>Ville Tiukuvaara, Tom Smy, Shulabh Gupta, Carleton University, Canada</i>	
<b>TH-SP.3A.7</b>	<b>10:40</b>
<b>Primary Surface Transition Modules for Metasurface Designs</b> <i>Xiao Jia, Fan Yang, Tsinghua University, China; Yinghong Wen, Beijing Jiaotong University, China</i>	
<b>TH-SP.3A.8</b>	<b>11:00</b>
<b>Straightforward emulation of generalized sheet transition conditions (GSTCs) in commercial solvers using electrically-thick Fabry-Perot metasurfaces</b> <i>Sherman W. Marcus, Ariel Epstein, Technion - Israel Institute of Technology, Israel</i>	
<b>TH-SP.3A.9</b>	<b>11:20</b>
<b>Calculation of Far-Field Scattering from Nonuniform Reflective Metasurfaces: A Critical Perspective</b> <i>Ana Diaz-Rubio, Sergei Tretyakov, Aalto University, Finland</i>	
<b>TH-SP.3A.10</b>	<b>11:40</b>
<b>Simulation of Shaped Metasurface antennas, including the Feeder Coupling</b> <i>Jean Cavillot, Modeste Bodehou, Christophe Craeye, Université catholique de Louvain, Belgium</i>	



Thursday, December 9  
TH-UB.2A

08:20 - 10:00  
Peony Junior Ballroom 4511

## Time-Domain Methods I

Session Co-Chairs: Loïc Markley, University of British Columbia; Rosmin Mohan, Agency for Science Technology and Research

**TH-UB.2A.1** **08:20**

**A Dissipation Theory for Creating New Stable FDTD Algorithms with Potentials**

*Fadime Bekmambetova, Piero Triverio, University of Toronto, Canada*

**TH-UB.2A.2** **08:40**

**Discontinuous Galerkin Time Domain Method for Simulation of Curved Metasurfaces**

*Shaowen Tian, Kaiming Wu, Qiang Ren, Beihang University, China*

**TH-UB.2A.3** **09:00**

**A PML for the Constraint-Preserving FVTD Method**

*Dinshaw Balsara, University of Notre Dame, United States; Kaiser Niknam, Jamesina Simpson, University of Utah, United States*

**TH-UB.2A.4** **09:20**

**WENO-ADPT Methods for AMR and Scheme Design in CED**

*Dinshaw Balsara, Saurav Samantary, University of Notre Dame, United States; Jamesina Simpson, University of Utah, United States*

**TH-UB.2A.5** **09:40**

**Modeling frequency-dependent dispersion in a one-dimensional electrodynamic lattice-Boltzmann method**

*Cael Warner, Loïc Markley, Kenneth Chau, University of British Columbia, Canada*



Thursday, December 9  
TH-A3.2A

10:20 - 12:00  
Peony Junior Ballroom 4511

## Time-Domain Methods II

Session Co-Chairs: Zhen Peng, University of Illinois at Urbana-Champaign; Zaw Oo Oo, Institute of High Performance Computing

**TH-A3.2A.1** **10:20**

**Conformal Perfectly Matched Layer for Matrix-Free Time-Domain Method in Unstructured Meshes**

*Vinicius C. do Nascimento, Dan Jiao, Purdue University, United States*

**TH-A3.2A.2** **10:40**

**FDTD modeling of transparent conducting oxide metasurfaces for near infrared reflection control**

*Rosmin Elsa Mohan, Thomas Ang, Eng Huat Khoo, Agency for Science, Technology and Research (A\*STAR), Singapore*

**TH-A3.2A.3** **11:00**

**Multi-GPU based Leapfrog CDI-FDTD Method for Large-Scale Electromagnetic Problems**

*Shuo Liu, Bin Zou, Harbin Institute of Technology, China; Eng Leong Tan, Nanyang Technological University, Singapore*

**TH-A3.2A.4** **11:20**

**Wavefront Computing in Solids: The Design Parameters and The Ideal Lens**

*Zaifeng Yang, Bui Viet Phuong Bui, Zaw Zaw Oo Oo, Png Ching Eng Png, Institute of High Performance Computing, Singapore; Eldwin Jiaqiang Ng, Kevin Chai Tshun Chuan Chai, Institute of Microelectronics, Singapore; Amit Lal, Cornell University, United States*

**TH-A3.2A.5** **11:40**

**Monochromatic Near Field Calculation of Aperture Antenna and Its Accuracy**

*Vladislav Kopytin, Nikolay Lysenko, Grigory Uskov, Voronezh State University, Russia; Sergey Skulkin, National Research University Higher School of Economics, Russia*



Thursday, December 9

TH-UB.3A

08:20 - 12:00

Virtual (Chairs/Speakers to go to Peony Ballroom 4502)

## Propagation, Scattering, Imaging and Remote Sensing I

Session Co-Chairs: Piergiorgio L. E. Uslenghi, University of Illinois at Chicago; Yilong Lu, Nanyang Technological University

**TH-UB.3A.1**

**08:20**

Exact Geometrical Optics Scattering by a 45o Anti-Isorefractive DNG Metamaterial Wedge Under Multiple Plane Waves Illumination

*Piergiorgio L. E. Uslenghi, University of Illinois at Chicago, United States*

**TH-UB.3A.2**

**08:40**

Polarimetric Backscatter Measurements of Road Surfaces at J-Band Frequencies for Standoff Road Condition Assessment

*Tanner Douglas, Adib Nashashibi, Mani Kashanianfard, Kamal Sarabandi, University of Michigan, United States*

**TH-UB.3A.3**

**09:00**

Selective Power Deposition Efficacy of Adaptive Microwave Beamforming in a Dynamic Dielectric Medium with Partial Channel State Knowledge

*Ahona Bhattacharya, Jeffrey Nanzer, Michigan State University, United States; Tessa Haldes, Susan Hagness, University of Wisconsin-Madison, United States*

**TH-UB.3A.4**

**09:20**

A Method for Fast Analysis and Accurate Modeling of Millimeter-Wave Propagation and Scattering in Rain

*Behzad Yektakhah, Kamal Sarabandi, University of Michigan, United States*

**TH-UB.3A.5**

**09:40**

Improving single-negative superlensing through object-lens resonance

*Marek Splawinski, Spencer Bostock, Kenneth Chau, Loic Markley, University of British Columbia, Canada*

**Break**

**10:00**

**TH-UB.3A.6**

**10:20**

A Corn Field Electromagnetic Scattering Model Based on FEM Solvers

*A. Kaleo Roberts, Kamal Sarabandi, University of Michigan, United States; Jasmeet Judge, University of Florida, United States*

**TH-UB.3A.7**

**10:40**

Experimental Detection of Buried Sub-mm Diameter Wires Using Microwave Ground-Penetrating Radar

*Samuel Wagner, Stephen Pancozio, Ababil Hossain, Anh-Vu Pham, University of California, Davis, United States*

**TH-UB.3A.8**

**11:00**

Ground Surface Clutter Suppression for GPR

*Motoyuki Sato, Yoshitada Morita, Tohoku University, Japan*

**TH-UB.3A.9**

**11:20**

Depolarization Characteristics of Rough Materials at mm-Wave Frequencies

*Minghao Ren, Xi Liao, Yang Wang, School of Communication and Information Engineering Chongqing University of Posts and Telecommunications, China; Jie Zhang, University of Sheffield, China*

**TH-UB.3A.10**

**11:40**

An Analytical Approach for the Generation of Second-Order Floquet-Bloch Mode for Anomalous Reflection Using Metagratings

*Dhruvajyoti Bhattacharya, Indian Institute of Information Technology Bhagalpur, India; Debidas Kundu, Indian Institute of Technology Roorkee, India*



Thursday, December 9  
TH-A1.1P

14:00 - 17:40

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Slotted and Guided Wave Antennas II

Session Co-Chairs: Yuehe Ge, Fuzhou University; Maksim Kuznetsov, Edinburgh University

**TH-A1.1P.1**

**14:00**

### Low-Profile High-Gain Leaky-Wave Antenna With a Phase-Correcting Metasurface

*Xiaolei Ren, Huaqiao University, China; Yuehe Ge, Zhizhang Chen, Fuzhou University, China*

**TH-A1.1P.2**

**14:20**

### A Rectangular Waveguide Slot Filtering Linear Array Antenna

*Xuemeng Chen, Xianling Liang, Shanghai Jiao Tong University, China*

**TH-A1.1P.3**

**14:40**

### A Wideband Slot Pair Array Based on SIDL Technology for 5G Millimeter-Wave Application

*Zi-Jun Guo, Zhang-Cheng Hao, Southeast University, China*

**TH-A1.1P.4**

**15:00**

### High-Aperture-Efficiency and Short-Longitudinal Length 2×2 Square Horn Antenna Array

*Weihua Tan, Rui Xu, Zhongxiang Shen, Nanyang Technological University, Singapore; Jian Lu, National University of Singapore, Singapore*

**TH-A1.1P.5**

**15:20**

### Compact Holographic Antenna using Pillbox Feeding Structure

*Chan Yeong Park, Donghyn Kim, Seung Hun Cha, Young Joong Yoon, Yonsei University, Korea (South)*

**Break**

**15:40**

**TH-A1.1P.6**

**16:00**

### Bow-tie Slot Antenna Loaded with Superstrate Layers for 5G/6G Applications

*Mohamed Salah El-Din, Hadia El Hennawy, Ain Shams University, Egypt; Shoukry Shams, Concordia University, Egypt; Abdelmegid Allam, German University in Cairo, Egypt; Mohamed Fathy, Abdelhamid Gafaar, Arab Academy for Science and Technology, Egypt*

**TH-A1.1P.7**

**16:20**

### One-Sided Leaky-Wave Antenna with TM Surface Wave Feeding and Open-Stopband Suppression

*Maksim Kuznetsov, Symon Podilchak, Edinburgh University, United Kingdom; Davide Comite, Paolo Burghignoli, Alessandro Galli, Sapienza University of Rome, Italy; Paolo Baccarelli, Roma Tre University, Italy; Alois Freundorfer, Yahia Antar, The Royal Military College of Canada, Canada*

**TH-A1.1P.8**

**16:40**

### STUDY OF PTD-SYMMETRIC SQUARE WAVEGUIDE

*Iram Nadeem, Enrica Martini, Alberto Toccafondi, Stefano Maci, University of Siena, Italy; Valentina Verri, Huawei Technologies, Milan Research Center, Italy*

**TH-A1.1P.9**

**17:00**

### A Dual Circularly Polarized Antenna Array With Compact Feeding Network

*Wenyu Zhao, Xiuping Li, Zihang Qi, Beijing University of Posts and Telecommunications, China*

**TH-A1.1P.10**

**17:20**

### A Horizontally Polarized Omnidirectional Antenna for LTE Applications

*Shichao Wen, Yizhen Xu, Yuandan Dong, University of Electronic Science and Technology of China, China*



Thursday, December 9  
TH-A1.2P

14:00 - 17:40  
Melati Ballroom 4104

## Microstrip Antennas and Arrays II

Session Co-Chairs: Debatosh Guha, University of Calcutta; Stefano Selleri, University of Florence

**TH-A1.2P.1** 14:00

### Compact Filtering Planar Inverted-F Antenna With Two Radiation Nulls

*Qun Li, Shaoqiu Xiao, Sun Yat-sen University, China*

**TH-A1.2P.2** 14:20

### ENG-TL based Two-Element Diversity Antenna with Metasurface Shielding for High Isolation

*Mohammad Ameen, Raghendra Kumar Chaudhary, Indian Institute of Technology (Indian School of Mines), Dhanbad, India*

**TH-A1.2P.3** 14:40

### Metamaterial-Based Dual-Mode Monopole-Like Multifunctional Antenna

*Liyang Nie, Zhaoneng Jiang, Meibin Qi, Hefei University of Technology, China*

**TH-A1.2P.4** 15:00

### Dual-Resonant Patch Antenna with Tilted Circularly Polarized Beam

*Jian Yu, Shan-Shan Gu, Xiao-Hui Mao, Wen-Jun Lu, Nanjing University of Posts and Telecommunications, China*

**TH-A1.2P.5** 15:20

### Improvement of Rectangular Microstrip Antenna by Mode Specific Meta Element Concept

*Debi Dutta, Debatosh Guha, University of Calcutta, India; Chandrakanta Kumar, U. R. Rao Satellite Centre, India*

**Break** 15:40

**TH-A1.2P.6** 16:00

### A Compact Series Array for Intelligent Transportation System in C-band

*Alessandro Cidonali, Giovanni Collodi, Stefano Maddio, Giuseppe Pelosi, Stefano Selleri, University of Florence, Italy*

**TH-A1.2P.7** 16:20

### Size Optimized Antenna-in-Package with Quasi-Isotropic Radiation Pattern

*Maria Bermudez Arboleda, Kirill Klionovski, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia*

**TH-A1.2P.8** 16:40

### A Biodegradable Textile-based Graphene Antenna for 5G Wearable Applications

*Anikó Németh, Syeda Fizzah Jilani, Aberystwyth University, United Kingdom; Shaker Alkaraki, Queen Mary University of London, United Kingdom; Qammer H. Abbasi, University of Glasgow, United Kingdom*

**TH-A1.2P.9** 17:00

### Low-SCS Phased Array Based on Optimized RLC Circuit

*Peng-Fa Li, Shi-Wei Qu, Shiwen Yang, University of Electronic Science and Technology of China, China*

**TH-A1.2P.10** 17:20

### A Very Low Profile Wideband Patch Array with Wide Scan Ability

*Turku Abanuzoğlu, Burak Alptuğ Yılmaz, ASELSAN Incorporated, Turkey*



## Reflector and Reflectarray Antennas I

Session Co-Chairs: Paola Pirinoli, Politecnico di Torino; Gokhan Karaova, Middle East Technical University

**TH-A1.3P.1** **14:00**

### A Wideband Reflectarray Adopting Quasi-Self-Complementary Elements

*Peng Ning, Hong Zhu, Lu Guo, Nanjing University of Science and Technology, China*

**TH-A1.3P.2** **14:20**

### Analysis and Design of THz 1-Bit RRA Element with Series Inductance

*Xiaotian Pan, Xiaochu Nie, Beijing Institute of Radio Measurement, China; Fan Yang, Tsinghua University, China*

**TH-A1.3P.3** **14:40**

### Design, Simulation, and Measurement of Passive Microwave Reflectors Optimized for Field Coverage

*Gokhan Karaova, Ozgur Ergul, Middle East Technical University, Turkey*

**TH-A1.3P.4** **15:00**

### High-efficiency Reflectarray Using Dielectric Resonator Elements

*Andrea Massaccesi, Michele Beccaria, Paola Pirinoli, Politecnico di Torino, Italy*

**TH-A1.3P.5** **15:20**

### E-band Point-to-Multipoint Antennas Based On Wide-Scan Focal Plane Arrays

*Roel Budé, Amr Elsakka, Meerten Versluis, Ulf Johannsen, Bart Smolders, Eindhoven University of Technology, Netherlands*

**Break** **15:40**

**TH-A1.3P.6** **16:00**

### A Dual-Band (Tx/Rx) Multiple-Beam Reflector Antenna using a Doubly Curved Frequency Selective Sub-Reflector for Ka-Band Applications

*Andreas Ericsson, Min Zhou, Stig Busk Sørensen, Tonny Rubæk, TICRA, Denmark; Mathieu Riel, MDA, Canada; Nelson Fonseca, ESA-ESTEC, Canada*

**TH-A1.3P.7** **16:20**

### A Circular Reflectarray for OAM Generation at Terahertz Regime for 6G Applications

*Ali Ali, Mohsen Khalily, Ali Araghi, Seyed Ehsan Hosseinienejad, Rahim Tafazolli, University of Surrey, United Kingdom*

**TH-A1.3P.8** **16:40**

### Non-Radiating Sources: A New Powerful Recipe for Designing Reflectarray Antennas

*Giacomo Oliveri, Francesco Zardi, Marco Salucci, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*

**TH-A1.3P.9** **17:00**

### Beam Reconfigurable Reflective Metasurface for Indoor Wireless Communications

*Qiyuan Liang, Buon Kiong Lau, Lund University, Sweden*

**TH-A1.3P.10** **17:20**

### Graphene-based Reconfigurable Reflecting Surface for Future Communications

*Salman Behboudi Amlashi, Mohsen Khalily, Tim Brown, Pei Xiao, Rahim Tafazolli, University of Surrey, United Kingdom*





## Multi-Band Antennas I

Session Co-Chairs: Takeshi Fukusako, Kumamoto University; Stavros Koulouridis, University of Patras

**TH-A1.4P.1** 14:00

**A Compact, Dual-band, Polarization-Reconfigurable Antenna for Phased Array Applications**

*Aoyun Meng, Xiaoming Chen, Ming-Chun Tang, Chongqing University, China*

**TH-A1.4P.2** 14:20

**Integrated Loop Antenna for Smartwatch**

*Junliang Li, Zhao Wang, Jingchen Wang, Mark Leach, Rui Pei, Eng Gee Lim, Yongmin Luo, Xi'an-jiaotong Liverpool University, China*

**TH-A1.4P.3** 14:40

**Dual-band Shared-aperture Microstrip Antenna Array for 4G/5G Applications**

*Shuyu Wang, Wangyu Sun, Yuxin Ren, Yuhang Zhang, Yue Li, Tsinghua University, China*

**TH-A1.4P.4** 15:00

**A Multiband Quasi-Yagi Antenna for WiFi/Bluetooth/WiMAX/Zigbee Applications**

*Goksel Turan, Hayrettin Odabasi, Eskisehir Osmangazi University, Turkey*

**TH-A1.4P.5** 15:20

**A Low Profile Dual Band (28/38GHz) and Dual Polarized Antenna for 5G MIMO Applications**

*Panagiotis Petroustos, Stavros Koulouridis, University of Patras, Greece*

**Break** 15:40

**TH-A1.4P.6** 16:00

**A Compact Tri-port Antenna System for Cognitive Radio Applications**

*Naveen Kumar, Institut de Recherche Technologique Railenium, France; Divitha Seetharamdo, M. Hassanein Rabah, Universite Gustave Eiffel, France*

**TH-A1.4P.7** 16:20

**A Four-Band Circularly Polarized Patch Antenna for Applications in S- and C-band**

*Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy*

**TH-A1.4P.8** 16:40

**Graphene Printed Antenna Array for Wireless Communication Applications**

*Xinyao Zhou, Ting Leng, Kewen Pan, Zhirun Hu, University of Manchester, United Kingdom; Mahmoud Abdalla, Military Technical College, Egypt*

**TH-A1.4P.9** 17:00

**Dual-Band Planar Antenna with AMC Screen for On-Body Applications**

*Eva Antonino-Daviu, Carlos Alexander Chuquitarco-Jimenez, Ferdaous Abderrazak, Ferdaous Ferrando-Bataller, Universitat Politecnica de Valencia, Spain*

**TH-A1.4P.10** 17:20

**Design of a Dual-Polarized Dual-Band and Wideband Multi-Ring Microstrip Antenna Fed by Two L-Probes with a Cavity Structure for Stable Gain Characteristics**

*Yuki Kimura, Sakuyoshi Saito, Yuichi Kimura, Saitama University, Japan*



## Printed and Chip Antennas

Session Co-Chairs: Debatosh Guha, University of Calcutta; Zhijiao Chen, Beijing University of Posts and Telecommunications

**TH-A5.1P.1** **14:00**

Revisiting Ground Plane Current for Improved Diagonal Plane Cross-Polarized Characteristics: An Innovative Design Applicable to a Wide Range of Microstrip Antennas

*Chandreyee Sarkar, Debatosh Guha, University of Calcutta, India; Chandrakanta Kumar, Indian Space Research Organisation, India*

**TH-A5.1P.2** **14:20**

Dual Polarized Sub-array Antenna for mmW 5G Applications

*Youngsub Kim, Dohyuk Ha, Youngju Lee, Samsung Electronics, Korea (South)*

**TH-A5.1P.3** **14:40**

A 4-Element Wideband MIMO Antenna using Quarter-Mode SIW and 90-Degree Bent Planar Dipole

*Mahesh Kumar Busineni, Ayaz Ahmad, Jayanta Mukherjee, Indian Institute of Technology Bombay, India*

**TH-A5.1P.4** **15:00**

3D Printed Wideband Dielectric Rod Antenna with Surface Wave Manipulation at a Low Cost

*Sheng Huang, King Yuk Chan, Rodica Ramer, University of New South Wales, Australia*

**TH-A5.1P.5** **15:20**

A W-band Dielectric Loaded Antenna with Sum and Difference Beams for Unmanned Aerial Vehicle

*Zhijiao Chen, Wei Song, Limei Qi, Yuan Yao, Junsheng Yu, Beijing University of Posts and Telecommunications, China; Xiaodong Chen, Queen Mary University of London, United Kingdom*

**Break** **15:40**

**TH-A5.1P.6** **16:00**

Ka-Band 3D Printed Wideband Dual-Polarized Antenna Array Fed by Differential Feeding Cavity

*Fanqi Sun, Yujian Li, Junhong Wang, Beijing Jiaotong University, China*

**TH-A5.1P.7** **16:20**

A Compact Waveguide-Based Reflection-Type Phase Shifter

*Ankang Liu, Jian Lu, Peng Khiang Tan, Theng Huat Gan, Sek Meng Sow, National University of Singapore, Singapore*

**TH-A5.1P.8** **16:40**

Electrically Small Surface Mountable Chip Antenna for 5G WiMAX / WLAN Applications

*Jyotibhusan Padhi, Shrikanth Reddy, Indian Institute of Technology Mandi, India*

**TH-A5.1P.9** **17:00**

A D-Band Stacked Patch Antenna with Air Trenches in BiCMOS Technology

*Wael Ahmad, IHP, Germany; Sebastian Schmitz, Rohde & Schwarz, Germany; Herman Ng, Karlsruhe University of Applied Sciences, Germany; Dietmar Kissinger, Ulm University, Germany*

**TH-A5.1P.10** **17:20**

A Folded Waveguide Reflectarray Antenna

*Ankang Liu, Jian Lu, Peng Khiang Tan, Theng Huat Gan, Sek Meng Sow, National University of Singapore, Singapore*



Thursday, December 9  
TH-A3.1P

14:00 - 18:20  
Peony Ballroom 4402

## Optimization Methods in EM Designs II

Session Co-Chairs: Yasuhide Tsuji, Muroran Institute of Technology; Alessandro Polo, ELEDIA@UniTN - University of Trento

**TH-A3.1P.1** **14:00**

### Fast Reduced Order Model of Low Frequency Integral Solver for Wireless Power Transfer System

*Wen-jing Chen, Sheng Sun, Jun Hu, School of Electronic Science and Engineering, University of Electronic Science and Technology of China, China*

**TH-A3.1P.2** **14:20**

### Optimal Design of 90° Bend in NRD Guide Using DBS Algorithm and 2D-FVEM

*Tahir Bashir, Keita Morimoto, Akito Iguchi, Yasuhide Tsuji, Muroran Institute of Technology, Japan; Tatsuya Kashiwa, Kitami Institute of Technology, Japan*

**TH-A3.1P.3** **14:40**

### Constrained Semidefinite Optimization of Reactively Loaded Antenna Arrays: Verification and Tolerances

*Michel Nyffenegger, Hans-Dieter Lang, OST - Eastern Switzerland University of Applied Sciences, Switzerland; Costas Sarris, University of Toronto, Canada*

**TH-A3.1P.4** **15:00**

### Frequency-Bandwidth Dependent Degrees of Freedom as a Bound of Super-Directivity

*Laura Passalacqua, Cristina Yepes, Enrica Martini, Stefano Maci, University of Siena, Italy; Alejandro Murillo Barrera, Huawei Technologies, Germany*

**TH-A3.1P.5** **15:20**

### Synthesis of Unconventional Feasible Sources for Smart Electromagnetic Environments

*Marco Salucci, Mohammad Abdul Hannan, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*

**Break** **15:40**

**TH-A3.1P.6** **16:00**

### Real-Time CSI-Based Wireless Imaging for Human-Machine Interaction

*Alessandro Polo, Marco Salucci, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy; Stefano Verzura, Huawei Technologies, Segrate, Italy*

**TH-A3.1P.7** **16:20**

### Planar SIW Horn and Aperture Design for Surface-Wave Control and Power Routing by Genetic Algorithm Optimization

*Maksim Kuznetsov, Symon Podilchak, Edinburgh University, United Kingdom*

**TH-A3.1P.8** **16:40**

### Two-Level Antenna Modeling with Domain Confinement and Explicit Dimensionality Reduction

*Slawomir Koziel, Reykjavik University, Iceland; Anna Pietrenko-Dabrowska, Gdansk University of Technology, Poland*

**TH-A3.1P.9** **17:00**

### Low-Cost Antenna Modeling Using Constrained Domains with Adaptive Lateral Dimensions

*Slawomir Koziel, Reykjavik University, Iceland; Anna Pietrenko-Dabrowska, Gdansk University of Technology, Iceland*

**TH-A3.1P.12** **18:00**

### Optimization of 2D Heterogeneous Lenses viaBFGS and Volume Integral Equation Method

*Felipe Vico, Marta Cabedo-Fabrés, Miguel Ferrando-Bataller, Eva Antonino-Daviu, Universitat Politècnica de València, Spain*



Thursday, December 9  
TH-SP.1P

14:00 - 15:40  
Peony Ballroom 4501AB

## Electromagnetics Education

Session Co-Chairs: Cynthia M. Furse, University of Utah; Krishnasamy Selvan, Sri Sivasubramaniya Nadar College of Engineering

**TH-SP.1P.1** **14:00**

### CubeSat Link Budget as Antennas Class Project

*Reyhan Baktur, Rakib Hasan, Utah State University, United States*

**TH-SP.1P.2** **14:20**

### Ten Fundamental Antenna-Theory Puzzles Solved by the Antenna Equation

*Everett Farr, Farr Fields, LC, United States*

**TH-SP.1P.3** **14:40**

### Experiences from teaching an online short-term course on bioelectricity during the pandemic

*Esther Sundarsingh, Selvan T. Krishnasamy, Sri Sivasubramaniya Nadar College of Engineering, India; Hugo G. Espinosa, Griffith University, Australia; Cynthia Furse, University of Utah, United States*

**TH-SP.1P.4** **15:00**

### Intervention to enhance PsyCap in EM courses

*Amanda Biggs, Hugo G. Espinosa, Griffith University, Australia*

**TH-SP.1P.5** **15:20**

### Microstrip Band-Stop Filter Design via Brick-Based Microwave Training Kit

*Anil Arici, Umut Bulus, Antenom Antenna Technologies, Turkey*



Thursday, December 9  
TH-SP.2P **Special Session**

16:00 - 17:40  
Peony Ballroom 4501AB

## International Standards Development and Applications

Session Co-Chairs: Vikass Monebhurrn, UMR CNRS - CentraleSupélec - Université Paris-Saclay - Sorbonne Université; Xudong Chen, National University of Singapore

**TH-SP.2P.1** **16:00**

### Reference solutions for thin-wire MoM codes

*David Davidson, Curtin University, Australia*

**TH-SP.2P.2** **16:20**

### Parameter uncertainty quantification of components of a CAD mobile phone model

*Runze Hu, Xiu Li, Tsinghua University, China; Vikass Monebhurrn, Université Paris-Saclay, Sorbonne Université, France; Fumie Costen, University of Manchester, United Kingdom*

**TH-SP.2P.3** **16:40**

### A multi-band CAD mobile phone model for specific absorption rate calculation benchmarking

*Vikass Monebhurrn, CentraleSupélec, France; Alexander Prokop, Dassault Systèmes, France*

**TH-SP.2P.4** **17:00**

### Recently Revised IEEE Std 1502™-2020

*Eric Mokole, The MITRE Corporation, United States; William (Mark) Dorsey, U.S. Naval Research Laboratory, United States; Vikass Monebhurrn, UMR CNRS - CentraleSupélec - Université Paris-Saclay - Sorbonne Université, France*

**TH-SP.2P.5** **17:20**

### Biconical Antenna: A Wideband Benchmark Antenna for IEEE P2816

*Ramakrishna Janaswamy, University of Massachusetts Amherst, United States*



## Electromagnetics in Biology and Medicine II

Session Co-Chairs: Sen Liu, National Institute of Information and Communications Technology; Shao Ying Huang, Singapore University of Technology

### TH-UK.1P.1

14:00

#### Microwave Denervation Temperature Rise Prediction Using Machine Learning Algorithm

*Aditya Rakhmadi, Kazuyuki Saito, Chiba University, Japan*

### TH-UK.1P.2

14:20

#### Partial Differential Equation Modeling of Blood Oxygen Transmission

*Renzhou Gui, Xiaohong Ji, Juan Li, Huilin Zheng, Jun Zhao, Xiaomeng Zhao, Tianyu Tang, Wei Wu, Hehua Zhu, Tongji University, China*

### TH-UK.1P.3

14:40

#### Clinical Test of Surface Rejection Method for Microwave Breast Cancer Imaging

*Haiyang Ma, Shouhei Kidera, University of Electro-Communications, Japan; Shinsuke Sasada, Morihito Okada, Takamaro Kikkawa, Hiroshima University, Japan*

### TH-UK.1P.4

15:00

#### Retinal Disease Detection Based on Optical Coherence Tomography Images Using Improved YOLOv5

*Xiaojun Bi, Minzu University of China, China; Lu Han, Harbin Engineering University, China*

### TH-UK.1P.5

15:20

#### Attention-Augmented Electromagnetic Representation of Sign Language for Human-Computer Interaction in Deaf-and-Mute Community

*Shengchang Lan, Linting Ye, Harbin Institute of Technology, China; Kang Zhang, Korea Advanced Institute of Science and Technology, Korea (South)*

### Break

15:40

### TH-UK.1P.6

16:00

#### E-Field Strength Measurements of a 5G Base Station in 28 GHz Band for EMF Exposure Assessment

*Sen Liu, Teruo Onishi, Masao Taki, Miwa Ikuyo, Kazuhiro Tobita, Soichi Watanabe, National Institute of Information and Communications Technology, Japan; Yukihiisa Suzuki, Tokyo Metropolitan University, Japan*

### TH-UK.1P.7

16:20

#### Estimation of SAR Enhancement Due to Medical Metal Implants with Screws

*Atsuki Otsuka, Takashi Hikage, Hokkaido University, Japan; Tomoaki Nagaoka, Kanako Wake, National Institute of Information and Communications Technology, Japan*

### TH-UK.1P.8

16:40

#### Comparative Analysis of RF Coils for Low-Field Portable MRI

*Meena Rajendran, Shao Ying Huang, Singapore University of Technology, Singapore*

### TH-UK.1P.9

17:00

#### A Graphene-based Microstrip Antenna Array for Neurodegenerative Disease Monitoring

*Minghui Zhao, Tughrul Arslan, Imran Saied, University of Edinburgh, United Kingdom*

### TH-UK.1P.10

17:20

#### Microwave Tomographic Imaging of Experimental Bone Phantoms for Bone Imaging Application

*Bilal Amin, Martin O'Halloran, Muhammad Adnan Elahi, National University of Ireland Galway, Ireland; Atif Shahzad, Institute of Metabolism and Systems Research, University of Birmingham, United Kingdom*



Thursday, December 9  
TH-A5.2P

14:00 - 17:20

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Millimeter-Wave Waveguide and Cavity Antennas II

Session Co-Chairs: Hongjian Wang, NSSC; Shahab Oddin Dabironezare, Technical University of Delft

**TH-A5.2P.1**

**14:00**

### High Gain Slot Antenna Array Based on Substrate Integrated Waveguide at Ka Band

*Jinghui Qiu, Xu Han, Nannan Wang, Alexander Denisov, Harbin Institute of Technology, China; Geer Teni, Beijing Xibao Electronic Technology Co., Ltd, China*

**TH-A5.2P.2**

**14:20**

### Terahertz Scanning Leaky Wave Antenna

*Hongjian Wang, NSSC, China*

**TH-A5.2P.3**

**14:40**

### A 60-GHz-Band Beam-Tilted Corporate-Fed Waveguide Slot Array

*Miao Zhang, Xiamen University, China; Jiro Hirokawa, Tokyo Institute of Technology, Japan*

**TH-A5.2P.4**

**15:00**

### Design of High Gain W-Band Glass-Based IPD Quarter-Mode Substrate-Integrated Waveguide Antenna

*Ta-Yeh Lin, Hsing-Hsiang Wang, Shuw-Guann Lin, Yin-Cheng Chang, Chaoping Hsieh, Da-Chiang Chang, Taiwan Semiconductor Research Institute, National Applied Research Laboratories, Taiwan*

**TH-A5.2P.5**

**15:20**

### Circularly Polarized Fabry-Pérot Cavity Antenna

*Yuan-Long Li, Kwai-Man Luk, City University of Hong Kong, China*

**Break**

**15:40**

**TH-A5.2P.6**

**16:00**

### Design of Wide Field-of-View Imagers based on Focal Plane Arrays of Leaky-wave Lenses

*Huasheng Zhang, Shahab Oddin Dabironezare, Nuria Llombart, Technical University of Delft, Netherlands*

**TH-A5.2P.7**

**16:20**

### A Differential Dual-Polarized Laminated Resonator Antenna With Backed SIW Cavity Excitation

*Yaowei Hou, Yueping Zhang, Junfa Mao, Shanghai Jiao Tong University, China*

**TH-A5.2P.8**

**16:40**

### Broadband Patch Loaded Substrate-Integrated Cavity Backed Slot Array for Millimeter-Wave Applications

*Qianshuai Li, Yan Zhang, Wei Hong, Southeast University, China*

**TH-A5.2P.9**

**17:00**

### A 94 GHz On-Chip Antenna Employing Embedded Guiding Structures for Realizing Ultra-Thin Artificial Magnetic Conductor

*Yiyang Yu, Zubair Akhter, Atif Shamim, King Abdullah University of Science and Technology, Saudi Arabia*



Thursday, December 9  
TH-SP.3P

14:00 - 17:40  
Peony Junior Ballroom 4512

## Machine Learning for Inverse Scattering and Imaging

Session Co-Chairs: Abdulkadir C. Yucel, Nanyang Technological University; Marco Salucci, ELEDIA@UniTN - University of Trento

**TH-SP.3P.1** **14:00**

### A Deep Learning Scheme for Rapidly Reconstructing 3D Permittivity Maps from GPR C-scans

*Qiqi Dai, Yee Hui Lee, Hai-Han Sun, Abdulkadir C. Yucel, Nanyang Technological University, Singapore; Genevieve Ow, Mohamed Lokman, National Parks Board, Singapore*

**TH-SP.3P.2** **14:20**

### A Two-Stage Deep Neural Network for Ground-Penetrating Radar Data Inversion under Heterogeneous Soil Conditions

*Qiqi Dai, Yee Hui Lee, Hai-Han Sun, Abdulkadir C. Yucel, Nanyang Technological University, Singapore; Genevieve Ow, Mohamed Lokman, National Parks Board, Singapore*

**TH-SP.3P.3** **14:40**

### Multi-Domain Learning Scheme for Full-Wave Nonlinear Inverse Scattering Problems

*Yusong Wang, Zhun Wei, Zhejiang University, China*

**TH-SP.3P.4** **15:00**

### Deep Learning Structure Influence on Reconstruction Performance in 3D Inverse Scattering Problems

*Yulong Zhou, Tiantian Yin, Xudong Chen, National University of Singapore, Singapore*

**TH-SP.3P.5** **15:20**

### Fast Full-wave Microwave Imaging With Physics Embedded Deep Neural Network

*Rui Guo, Maokun Li, Fan Yang, Shenheng Xu, Aria Abubakar, Tsinghua University, China*

**Break** **15:40**

**TH-SP.3P.6** **16:00**

### Learning-Assisted Fast Inversion for Solving Inverse Scattering Problems with Phaseless Data

*Kuiwen Xu, Zeming Qian, Peng Zhao, Hangzhou Dianzi University, China*

**TH-SP.3P.7** **16:20**

### Model-Based Data Generation for Support Vector Machine Stroke Classification

*Valeria Mariano, Jorge Alberto Tobon Vasquez, Mario Roberto Casu, Francesca Vipiana, Politecnico di Torino, Italy*

**TH-SP.3P.8** **16:40**

### Intelligent Meta-Imagers: From Compressed to Learned Sensing

*Philipp del Hougne, CNRS, France*

**TH-SP.3P.9** **17:00**

### AI-Assisted Computationally-Efficient Global Optimization for Inverse Scattering

*Marco Salucci, Mohammad Abdul Hannan, Alessandro Polo, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*

**TH-SP.3P.10** **17:20**

### Neural Network and Microwave Sensing for Food Contamination Monitoring

*Marco Ricci, Mario Roberto Casu, Francesca Vipiana, Politecnico di Torino, Italy*



## Metasurfaces, FSS and EBG Materials III

Session Co-Chairs: Yu Shao, Chongqing University of Posts and Telecommunications; Qun Lou, National University of Singapore

**TH-A2.1P.1** **14:00**

### Flexible Frequency Selective Surfaces With Ultra-Large Incidence Angle

*Qian Wang, Sihong Chen, Taisong Pan, Guang Yao, Min Gao, Yuan Lin, University of Electronic Science and Technology of China, China*

**TH-A2.1P.2** **14:20**

### A Tri-band Highly Selective Passband Frequency Selective Surface Based on Multi-layer Coupling

*Zhangjian He, Yu Shao, Junjie Huang, Changhong Zhang, Jie Zhang, Chongqing University of Posts and Telecommunications, China*

**TH-A2.1P.3** **14:40**

### Miniaturized Angularly Stable Single and Dual Bands Bandpass Frequency Selective Surfaces with Transmission Zeros Near the Sidebands

*Soumik Dey, Mohammad Abdul Shukoer, Sukomal Dey, IIT Palakkad, India*

**TH-A2.1P.4** **15:00**

### A novel almost all-angle-insensitive FSS structure for high-performance radome

*Tianwu Li, Da Li, Er-ping Li, Zhejiang University, China*

**TH-A2.1P.5** **15:20**

### A Novel Frequency Selective Surface for the RCS Reduction of Antenna Array

*Zihao Zhang, Tianle Xing, Hao Luo, Wenhao Tan, Houjun Sun, Beijing Institute of Technology, China*

**Break** **15:40**

**TH-A2.1P.6** **16:00**

### High Gain and High Efficiency UHF Tag with Enhanced Complementary Spilt Ring Resonator Metamaterials

*Lifeng Duan, Jinling Zhang, Beijing University of Posts and Telecommunications, China; Xiongzhi Zhu, Zhengzhou University, China; Zhanqi Zheng, Datang Mobile Equipment Co., China*

**TH-A2.1P.7** **16:20**

### Modeling of Finite-size Fabry-Perot Antennas with Array Feeds

*Shih-Wei Liu, Yi-Cheng Lin, National Taiwan University, Taiwan*

**TH-A2.1P.8** **16:40**

### A Wideband Low-Profile Fabry-Perot Antenna Employing a Multi-Resonant Metasurface Based Superstrate

*Alpha O. Bah, Y. Jay Guo, Pei-Yuan Qin, Trevor S. Bird, University of Technology, Sydney, Australia*

**TH-A2.1P.9** **17:00**

### Miniaturized Self-Complementary Frequency Selective Surface for GNSS Applications

*Assia Boularas, Laboratoire d'Ingénierie des Systèmes et Télécommunications, Université de M'hamed Bougara Boumerdes, Algeria, Algeria; Khaled Rouabah, Mustapha Flissi, University of Mohamed El Bachir El-Ibrahimi, Bordj Bou Arreridj, Algeria*

**TH-A2.1P.10** **17:20**

### Topological Edge-Mode Characterization Using Foldy-Lax Multiple Scattering Theory and Interpretation with Classical EM Theory

*Zhaoyang Feng, Shurun Tan, Zhejiang University, China*





## Antenna Theory, Design and Measurements

Session Co-Chairs: Ala Sharaiha, IETR/universit  de Rennes 1; Jiexi Yin, National University of Singapore

**TH-UB.1P.1** **14:00**

### Machine Learning Assisted Array Synthesis Under Mutual Coupling and Platform Effects

*Qi Wu, Chen Yu, Haiming Wang, Wei Hong, Southeast University, China*

**TH-UB.1P.2** **14:20**

### Multipath Machine Learning Assisted Optimization and Its Application for Antenna Design

*Weiqi Chen, Qi Wu, Chen Yu, Haiming Wang, Wei Hong, Southeast University, China; Weishuang Yin, Zhongxing Telecom Equipment Corporation, China*

**TH-UB.1P.3** **14:40**

### Dual-polarized Base Station Antenna Design using Machine Learning-Assisted Optimization Method

*Subin Wang, Qi Wu, Chen Yu, Haiming Wang, Wei Hong, Southeast University, China; Weishuang Yin, Zhongxing Telecommunication Equipment Corporation, China*

**TH-UB.1P.4** **15:00**

### Transmission Progress in Rectangular-Coordinate Orthogonal Multiplexing by Excitation Optimization of Slot Arrays Based on the Scattering Parameters

*Baoquan Duan, Takashi Tomura, Jiro Hirokawa, Tokyo Institute of Technology, Japan; Miao Zhang, Xiamen University, China*

**TH-UB.1P.5** **15:20**

### Antennas for Implantable Medical Device Communication in 40-60 MHz

*Yutaro Yokoyama, Chiba University, Japan; Kazuyuki Saito, Center for Frontier Medical Engineering, Chiba,*

**Break** **15:40**

**TH-UB.1P.6** **16:00**

### Design of a Waveguide Two-plane Hybrid Coupler with Nonuniform Division

*Qi Li, Jiro Hirokawa, Takashi Tomura, Tokyo Institute of Technology, Japan; Nelson J. G. Fonseca, European Space Agency, Netherlands*

**TH-UB.1P.7** **16:20**

### Non-Rotationally Symmetric Geodesic Lens Antennas Modelled Using a Raytracing Model

*Sarah Clendinning, Qiao Chen, Qingbi Liao, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden; Francisco Mesa, University of Sevilla, Spain*

**TH-UB.1P.8** **16:40**

### Quadrature non-Foster-inspired Matching of Small Transmitting Antenna: A Generalization of Background Theory

*Silvio Hrabar, University of Zagreb, Croatia (Hrvatska)*

**TH-UB.1P.9** **17:00**

### Stability, Bandwidth, and Efficiency of non-Foster-matched Short Dipole

*Dominik Zanic, Ante Brizic, Katarina Lebo, Silvio Hrabar, University of Zagreb, Croatia (Hrvatska)*

**TH-UB.1P.10** **17:20**

### Ultra-miniaturized monopole antenna using magneto-dielectric materials for aeronautic applications

*Thomas Finet, IETR/universit  de Rennes, France; Aladdin Kaban, Ala Sharaiha, Anne Claude Tarot, IETR/universit  de Rennes 1, France*



Thursday, December 9

TH-UB.2P

14:00 - 15:40

Virtual (Chairs/Speakers to go to Peony Ballroom 4502)

## Wireless Communications and Sensing Networks

Session Co-Chairs: Chao-Fu Wang, National University of Singapore; Amit Singh, Indian Institute of Technology Jammu

TH-UB.2P.1

14:00

### Energy Scavenging Assisted Power Supply System for Smart Dust Sensor Applications

*Sang Hyun Kim, Wonjun Lee, Jongsik Lim, Sang-Min Han, Soonchunhyang University, Korea (South)*

TH-UB.2P.2

14:20

### Radio Propagation Analysis of Auditoriums for the Deployment of Enhanced Experience Applications

*Imanol Picallo, Peio Lopez-Iturri, Francisco Falcone, Public University of Navarre, Spain; Hicham Klaina, Ana Vazquez Alejos, University of Vigo, Spain; Aida Vidal-Balea, Oscar Blanco-Novoa, Paula Fraga-Lamas, Tiago M. Fernández-Caramés, Universidade da Coruña, Spain; Leyre Azpilicueta, Tecnológico de Monterrey, Mexico*

TH-UB.2P.3

14:40

### Early Detection and Prevention of Red Palm Weevil Along with Irrigation Management System

*Osama M. Haraz, Assiut university, Egypt; Waleed Saad, Menoufia University, Egypt; Mohamed Ali, Tayeb A. Denidni, Université du Québec, Canada*

TH-UB.2P.4

15:00

### Underground, Near-ground and Over-ground Wireless Channel Assessment at 2.4 GHz and 868 MHz in Urban Botanical Gardens

*Hicham Klaina, Ana Vazquez Alejos, University of Vigo, Spain; Imanol Picallo, Peio Lopez-Iturri, Jose Javier Astrain, Francisco Falcone, Public University of Navarre, Spain; Leyre Azpilicueta, Tecnológico de Monterrey, Mexico; Otman Aghzout, Abdelmalek Essaadi University, Morocco*

TH-UB.2P.5

15:20

### Performance of Reconfigurable Intelligent Surfaces vs. Relaying for UAV-Assisted Communications

*Mohammad Abualhayja'a, Anthony Centeno, Lina Mohjazi, Qammer Abbasi, Muhammad Imran, University of Glasgow, United Kingdom; Majid Butt, Philippe Sehier, Nokia Bell Labs, France*



Thursday, December 9

TH-UC.1P

16:00 - 17:40

Virtual (Chairs/Speakers to go to Peony Ballroom 4502)

## Radio Communication and Signal Processing Systems I

Session Co-Chairs: Yee Hui Lee, Nanyang Technological University; Rui Xu, Nanyang Technological University

TH-UC.1P.1

16:00

### An Ultrawide Band Uniform Diffraction Tomography Algorithm for Ground Penetrating Radar

*Mehdi Mousavi, Sajjad Sadeghi, Alireza Madannejad, University of Tehran, Iran; Robert Burkholder, The Ohio State University, United States*

TH-UC.1P.2

16:20

### Detecting Blurred Ground-based Sky/Cloud Images

*Mayank Jain, Soumyabrata Dev, University College Dublin, Ireland; Navya Jain, Ram Lal Anand College, University of Delhi, India; Yee Hui Lee, Nanyang Technological University, Singapore; Stefan Winkler, National University of Singapore, Singapore*

TH-UC.1P.3

16:40

### Multi-Sensing Data Fusion for Human Activity Recognition based on Neuromorphic Computing

*Zheqi Yu, William Taylor, Hadi Heidari, Muhammad Imran, Qammer Abbasi, University of Glasgow, United Kingdom; Adnan Zahid, Heriot Watt University, United Kingdom*

TH-UC.1P.4

17:00

### Deterministic Time/Frequency Characterization of Volumetric Inter-Wagon Train Communications

*Imanol Picallo, Peio López-Iturri, Francisco Falcone, Public University of Navarre, Spain; Mikel Celaya-Echarri, Leyre Azpilicueta, Tecnológico de Monterrey, Spain*

TH-UC.1P.5

17:20

### Realization of Efficient Channel Estimation using Programmable Metasurface

*Yueheng Li, Xueyun Long, Eisenbeis Joerg, Sven Bettinga, Thomas Zwick, Karlsruhe Institute of Technology, Germany; Wan Xiang, Tiejun Cui, Southeast University, China*



Friday, December 10  
FR-A3.1A

08:20 - 10:00

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Practical and High-Performance Computing

Session Co-Chairs: Vince Rodriguez, NSI-MI; Jihong Gu, National University of Singapore

**FR-A3.1A.1**

**08:20**

Minimal-Order Model for Fast Electromagnetic Analysis of On-Chip Power Grid

*Yuhang Dou, Dan Jiao, Purdue University, United States*

**FR-A3.1A.2**

**08:40**

A Space-Time Stochastic Green's Function Method for Statistical Analysis of Wave Physics in Ray-Chaotic Enclosures

*Shen Lin, Zhen Peng, University of Illinois at Urbana-Champaign, United States*

**FR-A3.1A.3**

**09:00**

Analysis of the Quiet Zone of Tapered Chambers

*Vince Rodriguez, NSI-MI, United States*

**FR-A3.1A.4**

**09:20**

A Computational Study of COVID-19 Detection using Colorimetric Plasmonic Sensors

*Somen Baidya, Graduate Research Assistant, United States; Ahmed M. Hassan, Associate Professor, Director of the Multiscale Multidisciplinary Electromagnetics Lab (MMEL), United States*

**FR-A3.1A.5**

**09:40**

Multi-polarization phase retrieval in near field farfield transformation

*Ping Yuan, Lijun Jiang, University of Hong Kong, Hong Kong SAR of China*



Friday, December 10  
FR-A3.2A

10:20 - 12:00

Virtual (Chairs/Speakers to go to Melati Ballroom 4002)

## Parallel and Special-Processor-Based Numerical Methods

Session Co-Chairs: Magda El-Shenawee, University of Arkansas; Ahmed M. Hassan, University of Missouri-Kansas City

**FR-A3.2A.1**

**10:20**

3D Model of Terahertz Photoconductive Antenna using COMSOL Multiphysics

*Jose Santos Batista, Magda El-Shenawee, University of Arkansas, United States*

**FR-A3.2A.2**

**10:40**

Split-Field Domain Decomposition Algorithm with Fast Convergence for Electromagnetic Analysis

*Shuzhan Sun, Dan Jiao, Purdue University, United States*

**FR-A3.2A.3**

**11:00**

Scalable Acceleration of Characteristic Mode Analysis Using Big Data Techniques

*Khulud Al Sultan, Ahmed M. Hassan, University of Missouri-Kansas City, United States; Praveen Rao, University of Missouri - Columbia, United States*

**FR-A3.2A.4**

**11:20**

Real Time Correction of Multipath Error in Satellite Positioning using FPGA-Accelerated Ray Tracing

*Gaosong Lv, Huaopeng Zhao, Jun Hu, University of Electronic Science and Technology of China, China*

**FR-A3.2A.5**

**11:40**

Unified GPU Parallel Framework Based on Discontinuous Galerkin Method

*Shu-Cheng Huang, Li Xu, Bing-Qi Liu, Zhong-Hai Yang, Bin Li, University of Electronic Science and Technology of China, China*



## Microstrip Antennas and Circuits I

Session Co-Chairs: Jordan Budhu, University of Michigan; Mehri Borhani Kakhki, Huawei Technologies Canada

**FR-A1.1A.1** **08:20**

### Design of a Shape Optimized Printed-circuit Beamformer

*Luke Szymanski, Anthony Grbic, University of Michigan, United States; Gurkan Gok, Raytheon Technologies Research Center, United States*

**FR-A1.1A.2** **08:40**

### Cavity-Backed Antenna with a Tilted Directive Beam for 5G Applications

*Azita Goudarzi, Mohammad Mahdi Honari, Alireza Gharaati, Rashid Mirzavand, University of Alberta, Canada*

**FR-A1.1A.3** **09:00**

### Compact and Wideband 4×4 Butler Matrix for Millimeter-wave 5G Applications

*Mehri Borhani Kakhki, Fayez Hyjazie, Ahmed Shehata Abdellatif, David Wessel, Huawei Technologies Canada Co., Canada*

**FR-A1.1A.4** **09:20**

### A Miniaturized Microstrip Branch-Line Hybrid Coupler Using Two Sections and Coupled-Lines

*Xiaoqing Wu, Soochow University, China; Lin-Ping Shen, Communication Components Antenna Inc, Canada*

**FR-A1.1A.5** **09:40**

### Modified Square Loop Antennas with an Increased Axial-Ratio Bandwidth

*Kazuhide Hirose, Keijiro Ishii, Shibaura Institute of Technology, Japan; Hisamatsu Nakano, Hosei University, Japan*

**Break** **10:00**

**FR-A1.1A.6** **10:20**

### A Wideband Circularly Polarized SIW Cavity-Backed Patches Antenna with Air Cavity

*Hao Liu, Ziqiang Xu, University of Electronic Science and Technology of China, China; Anyong Qing, Southwest Jiaotong University, China*

**FR-A1.1A.7** **10:40**

### A Low-Profile Compact Circular Patch Antenna with Monopole-like Radiation Pattern

*Neelakantam Venkatarayalu, Woei Seng How, Singapore Institute of Technology, Singapore*

**FR-A1.1A.8** **11:00**

### A Wideband Concurrently Dual-Circularly Polarized Simultaneous Transmit and Receive (STAR) Antenna

*Lina Ma, Jingyun Lu, Changzhan Gu, Junfa Mao, MoE Key Laboratory of High-Speed Electronic System Design and EMC, China*

**FR-A1.1A.9** **11:20**

### Design of Miniaturized Differential Antenna Using Gradient Planar Slow-Wave Structure

*Meini Wang, Min Tang, Zijian Shao, Junfa Mao, Shanghai Jiao Tong University, China*



## Reflector and Reflectarray Antennas II

Session Co-Chairs: Sajjad Taravati, University of Toronto; Su Yee Aye, National University of Singapore

**FR-A1.2A.1** **08:20**

### Nonreciprocal-Beamsteering Reflective Metasurface

*Sajjad Taravati, George V. Eleftheriades, University of Toronto, Canada*

**FR-A1.2A.2** **08:40**

### A New Curvature Based Shaped Reflector Antenna Design Methodology

*Manushanker Balasubramanian, Colin Mussman, Ping L. Werner, Douglas H. Werner, Pennsylvania State University, United States*

**FR-A1.2A.3** **09:00**

### Dynamic Dual-Reflector Antennas for High-Resolution Real-Time SAR Imaging

*Aditya Varma Muppala, Kamal Sarabandi, University of Michigan, Ann Arbor, United States*

**FR-A1.2A.4** **09:20**

### A Novel Miura-Ori Origami Reflectarray Antenna for CubeSat Applications

*Carlos Velez, Abdul-Sattar Kaddour, Stavros Georgakopoulos, Florida International University, United States; Collin Ynchausti, Spencer Magleby, Larry Howell, Brigham Young University, United States*

**FR-A1.2A.5** **09:40**

### Gain Enhancement of Compact AMC-Dual-Band Antenna for WBAN Applications

*Youcef Braham Chaouche, Sirine Ouni, Mourad Nedil, Underground Communications Research Laboratory / University of Quebec at Abitibi-Temiscamingue (UQAT), Canada; Ismail Ben Mabrouk, Durham University, United Kingdom*

**Break** **10:00**

**FR-A1.2A.6** **10:20**

### Reconfigurable Reflectarray Unit Cell using Vanadium Dioxide

*Jordan Ramsey, Kendrick Henderson, Nima Ghalichechian, The Ohio State University, United States*

**FR-A1.2A.7** **10:40**

### A Compact Low SAR Antenna AMC-Backed for WLAN/WBAN Applications

*Sirine Ouni, Youcef Braham Chaouche, Mourad Nedil, Underground Communications Research Laboratory / University of Quebec at Abitibi-Temiscamingue (UQAT), Canada; Ismail Ben Mabrouk, Durham University, United Kingdom*

**FR-A1.2A.8** **11:00**

### Coupling Effects in an L-band Reflector Antenna with Dual-polarization Stacked Patch Feed Array

*Su Yee Aye, Koen Mouthaan, National University of Singapore, Singapore; Sigurd Huber, Gerhard Krieger, German Aerospace Center (DLR), Germany*

**FR-A1.2A.9** **11:20**

### Array Failure Diagnosis and Active Compensation for Intelligent Reflecting Surfaces

*Xiao Yu Li, Mei Song Tong, Tongji University, China*

**FR-A1.2A.10** **11:40**

### Dual-band Reflect-Transmit-Array Antenna with High-Gain and Low-Profile

*Xiaosong Liu, Enlin Wang, Zehong Yan, Xidian University, China*



## Multi-Band Antennas II

Session Co-Chairs: Hongjian Wang, NSSC; Christos Christodoulou, University of New Mexico

**FR-A1.3A.1** **08:20**

Quad Band Corrugated Horn and Smooth-Wall Profiled Horn as Reflector Antenna Feeds

*Kwok Kee Chan, Kwok Kee Chan Holdings Inc., Canada*

**FR-A1.3A.2** **08:40**

Novel Slot Array Mechanical Reconfiguration Approach Based on Accordion Structure and Micro-actuator

*Jack Eichenberger, Nima Ghalichechian, The Ohio State University Electroscience Lab, United States*

**FR-A1.3A.3** **09:00**

A Stretchable Liquid Metal Antenna Array

*David Hensley, Christos Christodoulou, Nathan Jackson, University of New Mexico, United States*

**FR-A1.3A.4** **09:20**

Compact Multi-frequency Feed Horn for Radiometer

*Hongjian Wang, NSSC, China*

**FR-A1.3A.5** **09:40**

Design of a Dual-Band Folded Patch PIFA Antenna Using Characteristic Mode Analysis

*Sheng-Lin Rao, Qiang-Ming Cai, Xin Cao, Yuyu Zhu, Jun Fan, Southwest University of Science and Technology, China; Mulin Liu, Tongyu Communication Company, China; Lei Han, Air Force Engineering University, China*

**Break** **10:00**

**FR-A1.3A.6** **10:20**

Optimized Design of a Dual-Band PIFA Antenna Based on Genetic Algorithm

*Wen Jie Liu, Jing Rui Wang, Mei Song Tong, Tongji University, China; Yun Jing Zhang, Soochow University, China*

**FR-A1.3A.7** **10:40**

A Compact and Dual-Band CRLH Based Monopole Antenna

*Xu Xu Yuanheng, Manoj Prabhakar Mohan, M Faeyz Karim, Nanyang Technological University, Singapore*

**FR-A1.3A.8** **11:00**

Compact Dual-Band Microstrip Patch Antenna With Suppression of Parasitic High Order Modes

*Qun Li, Shaoqiu Xiao, Sun Yat-sen University, China*

**FR-A1.3A.9** **11:20**

Dual-Band Aperture-Shared Antenna Array with Low Blockage Effect

*Sheng Jie Yang, Xiu Yin Zhang, South China University of Technology, China*

**FR-A1.3A.10** **11:40**

A Multiband Dual-Polarized Shared-Aperture Antenna Array

*Donglin He, Yikai Chen, Shiwen Yang, University of Electronic Science and Technology of China, China*



## Microstrip Antennas and Printed Devices

Session Co-Chairs: Satish Sharma, San Diego State University; Maria Pour, University of Alabama in Huntsville

**FR-UB.1A.1** **08:20**

### Dual Band Antenna Systems with Harmonic Suppression and Enhanced Bandwidth

*Brinta Chowdhury, Abdullah Eroglu, North Carolina A&T State University, United States*

**FR-UB.1A.2** **08:40**

### A Compact Dual-Band Bowtie Antenna for RF and ISM bands Operation

*Sainind Naik, Maria Pour, University of Alabama in Huntsville, United States; Curtis Hill, Ian Small, NASA Marshall Space Flight Center, United States*

**FR-UB.1A.3** **09:00**

### A Novel Dual-Band Outlined Elliptical Dipole Antenna for Passive Energy Harvesting

*Jonathan Marquardt, Maria Pour, University of Alabama in Huntsville, United States; Curtis Hill, Ian Small, National Aeronautics and Space Administration, United States*

**FR-UB.1A.4** **09:20**

### A Compact Antenna System for Spatial Combining of Multiple Pseudorandom Waveforms

*A. Kaleo Roberts, Kamal Sarabandi, University of Michigan, United States*

**FR-UB.1A.5** **09:40**

### Uniplanar and Compact Tri-Band Double-Stub Tuner with Embedded MTM-EBGs

*Braden Smyth, Ashwin Iyer, University of Alberta, Canada*

**Break** **10:00**

**FR-UB.1A.6** **10:20**

### Effective Permittivity and Dielectric Loss in a Microstrip Transmission Line with Anisotropic Substrate and Isotropic Superstrate

*Andrey Kobayakov, Aramais Zakharian, Corning Inc., United States*

**FR-UB.1A.7** **10:40**

### Radar Antenna Gain Improvement Using an Integrated In-Package Dielectric Rod Superstrate

*Mohammad Omid Bagheri, Hajar Abedi, George Shaker, University of Waterloo, Canada*

**FR-UB.1A.8** **11:00**

### In-Package Integrated Dielectric Lens Paired with a MIMO mm-Wave Radar for Corridor Gait Monitoring

*Hajar Abedi, Plinio Morita, Jennifer Boger, Alexander Wong, George Shaker, University of Waterloo, Canada*

**FR-UB.1A.9** **11:20**

### An Efficient Wideband 94 GHz On-Chip Air-Cavity Backed Planar Inverted-F Antenna

*Sanghoon Lee, John Gressler, Georgia Institute of Technology, United States; Kirti Dhawaj, India Institute of Technology, Delhi, India*

**FR-UB.1A.10** **11:40**

### An Advantage of Sensitivity to Identify Circulating Tumor Cell Derived by Primary Lesion From Using Ring Resonator Type of Electrode with Oscillator Device

*Masaya Sakamoto, Futoshi Kuroki, National Institute of Technology, Kure College, Japan; Shota Sora, Tohoku University, Japan*



## Metamaterials and Metasurfaces

Session Co-Chairs: Nader Engheta, University of Pennsylvania; Mario Junior Mencagli, University of North Carolina at Charlotte

**FR-UB.2A.1** **08:20**

### Squeezing Electromagnetic Waves with Reflectionless Metastructures

*Mohamad Fazeli, Kristina Moralić, Mario Junior Mencagli, University of North Carolina at Charlotte, United States*

**FR-UB.2A.2** **08:40**

### Aperture Synthesis Using Cavity-backed Mode-converting Metasurfaces

*Faris Alsolamy, Anthony Grbic, University of Michigan, United States*

**FR-UB.2A.3** **09:00**

### All-Dielectric Additively Manufactured Polarization Converters

*Steve Young, Anthony Grbic, University of Michigan, United States*

**FR-UB.2A.4** **09:20**

### Nonreciprocity via Interaction of Electromagnetic Waves with Swift Electron Beams

*Asma Fallah, Yasaman Kiasat, Miguel Camacho, Nader Engheta, University of Pennsylvania, United States; Mario Silveirinha, University of Lisbon, Portugal*

**FR-UB.2A.5** **09:40**

### Inverse-designed material structures combined with tunable MZI networks for applications in forward-scattering problems

*Vahid Nikkhah, Dimitrios Tzarouchis, Nader Engheta, University of Pennsylvania, United States; Ahmad Hoorfar, Villanova University, United States*

**Break** **10:00**

**FR-UB.2A.6** **10:20**

### Gradient Metasurfaces for Dual-polarization Beam Steering

*Matthew Trusnovic, Kristy Hecht, Kristina Moralić, Jeremy Helms, Mario Junior Mencagli, University of North Carolina at Charlotte, United States*

**FR-UB.2A.7** **10:40**

### Design and Optimization of Conformal 3D Metasurfaces for Far Field Beamforming

*Jordan Budhu, Luke Szymanski, Anthony Grbic, University of Michigan, United States*

**FR-UB.2A.8** **11:00**

### Design of Nonlinear device for limiting optical intensity by topology optimization

*Vahid Nikkhah, Nader Engheta, University of Pennsylvania, United States; Mario Junior Mencagli, University of North Carolina at Charlotte, United States*

**FR-UB.2A.9** **11:20**

### Nonreciprocity in Structures with Nonlinear Epsilon-Near-Zero (ENZ) Materials

*Diego Solis, Nader Engheta, University of Pennsylvania, United States*

**FR-UB.2A.10** **11:40**

### Presence of Dispersion in Linear Time-Varying Media

*Diego Solis, Nader Engheta, University of Pennsylvania, United States; Raphael Kastner, Tel-Aviv University, Israel*





## Quantum Technology Related to Electromagnetics

Session Co-Chairs: Weng Chew, Purdue University; Dong-Yeop Na, Purdue University

- FR-SP.1A.1** **08:20**  
**The Validity of Radiation Gauge**  
*Jie Zhu, Dong-Yeop Na, Thomas Roth, Weng Chew, Purdue University, United States*
- FR-SP.1A.2** **08:40**  
**Engineering Reflective Intelligence Surface by Quantum Adiabatic Evolution**  
*Charles Ross, Qi Jian Lim, Zhen Peng, University of Illinois at Urbana-Champaign, United States; Gabriele Gradoni, University of Nottingham, United Kingdom*
- FR-SP.1A.3** **09:00**  
**Full-Wave Computation of the Spontaneous Emission Rate of a Transmon Qubit**  
*Thomas Roth, Weng Chew, Purdue University, United States*
- FR-SP.1A.4** **09:20**  
**Diagonalization of the Hamiltonian for EM Fields in Absorbing/Dispersive/Inhomogeneous Media**  
*Dong-Yeop Na, Weng Cho Chew, Purdue University, United States*
- FR-SP.1A.5** **09:40**  
**Entanglement Mediated by Long-Lived Phonon Polaritons**  
*Jay A. Berres, George W. Hanson, University of Wisconsin-Milwaukee, United States*
- Break** **10:00**
- FR-SP.1A.6** **10:20**  
**Towards Solution of Integral Equations in Electromagnetics on Quantum Computers**  
*Christopher Phillips, Vladimir Okhmatovski, University of Manitoba, Canada*
- FR-SP.1A.7** **10:40**  
**Casimir Force: Vacuum Fluctuation, Zero-Point Energy, and Computational Electromagnetics**  
*Tian Xia, Alibaba, China, China; Phil Atkins, KLA Corp, United States; Wei Sha, Zhejiang University, China; Weng Cho Chew, Purdue University, United States*
- FR-SP.1A.8** **11:00**  
**Planar Phased Array Design for Quantum Free Space Optical Communications**  
*Nicola Anselmi, Paolo Rocca, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy; Francesco Morichetti, Andrea Melloni, Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Italy*
- FR-SP.1A.9** **11:20**  
**Quantum Inverse Scattering – A Proof-of-Concept**  
*Giacomo Oliveri, Alessandro Polo, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*
- FR-SP.1A.10** **11:40**  
**Thinned Antenna Array Synthesis Through Quantum Fourier Transform**  
*Paolo Rocca, Alessandro Polo, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*



## Novel Methods and Algorithms for Microwave Biomedical Applications

Session Co-Chairs: Xiong Wang, ShanghaiTech University; Maokun Li, Tsinghua University; Zhun Wei, Zhejiang University

**FR-SP.2A.1** **08:20**

### Melanoma Cancer Detection using Microwave Radar Imaging Technique

*Vincent Patriarco, Mahsa Khamechi, Abas Sabouni, Wilkes University, United States*

**FR-SP.2A.2** **08:40**

### Detection of Dental Caries using Millimeter Wave Antenna

*Ian Petro, Mahsa Khamechi, Abas Sabouni, Wilkes University, United States*

**FR-SP.2A.3** **09:00**

### Bone Density Measurement using Microwave Tomography Technique

*Jonathan Lesko, Mahsa Khamechi, Abas Sabouni, Wilkes University, United States*

**FR-SP.2A.4** **09:20**

### Identification of individuals through a new Gait Recognition Method

*Wassila Dib, Khalida Ghanem, Center for Development of Advanced Technologies, Algeria; Amina Ababou, University of Sciences and Technologies Houari Boumediene, Algeria; Mourad Nedil, University of Quebec at Abitibi-Temiscamingue (UQAT), Canada; Björn Eskofier, Friedrich-Alexander University Erlangen-Nuernberg, Germany*

**FR-SP.2A.5** **09:40**

### A Deep Learning Approach for Brain Hemorrhage Detection based on Microwave-induced Thermoacoustic Tomography

*Chenzhe Li, Xiong Wang, ShanghaiTech University, China*

**Break** **10:00**

**FR-SP.2A.6** **10:20**

### Multiplicative-Regularized Bases-Expansion Subspace Optimization Method for Electrical Impedance Tomography

*Zheng Zong, Zhun Wei, Zhejiang University, China*

**FR-SP.2A.7** **10:40**

### Enhanced Born Approximation for Wave Equations

*Zekui Jia, Rui Guo, Maokun Li, Fan Yang, Shenheng Xu, Tsinghua University, China*

**FR-SP.2A.8** **11:00**

### Microwave Hyperthermia Guided by Compressive Thermoacoustic Tomography

*Xiong Wang, ShanghaiTech University, China*

**FR-SP.2A.9** **11:20**

### Compressive Thermoacoustic Tomography for Imaging Small Animals

*Baosheng Wang, Lejia Zhang, Xiong Wang, ShanghaiTech University, China*

**FR-SP.2A.10** **11:40**

### Machine Learning-Based Approaches For Breast Cancer Detection in Microwave Imaging

*Humza Sami, Mahnoor Sagheer, Kashif Riaz, Muhammad Qasim Mehmood, Muhammad Zubair, Information Technology University (ITU), Pakistan*



## Millimeter-Wave, Terahertz and Optical Antennas I

Session Co-Chairs: Yilong Lu, Nanyang Technological University; Amit Singh, Indian Institute of Technology Jammu

**FR-A5.1A.1** **08:20**

### Compound GRIN Lens Fanbeam Antenna for Wide-angle Scanning

*Nicolas Garcia, Jonathan Chisum, University of Notre Dame, United States*

**FR-A5.1A.2** **08:40**

### Truncated Phase Reversal Fresnel lens Antenna for mm-Wave Applications

*Yazan Al-Alem, Yahia Antar, The Royal Military College of Canada, Canada; Syed Sifat, Ahmed Kishk, Concordia University, Canada*

**FR-A5.1A.3** **09:00**

### Terahertz Dielectric Waveguide based on Silicon-on-Insulator Technology

*Seyed Ali Hosseini Farahabadi, Milad Entezami, Hadi Amarloo, Safieddin Safavi-Naeini, University of Waterloo, Canada*

**FR-A5.1A.4** **09:20**

### Terahertz Signal Generation Measurements in Photoconductive Antennas using Time Domain Spectroscopy System

*Jose Santos Batista, Magda El-Shenawee, University of Arkansas, United States*

**FR-A5.1A.5** **09:40**

### Compact High-Gain Dual-Band Antenna for Full-Duplex Terahertz Communication in CubeSat Mega-Constellations

*Ali Alqaraghuli, Arjun Singh, Josep Jornet, Northeastern University, United States*

**Break** **10:00**

**FR-A5.1A.6** **10:20**

### A GSG-Excited Ultra-Wideband 103-147 GHz Stacked Patch Antenna on Flexible Printed Circuit

*Md Hedayatullah Maktoomi, Zisong Wang, Payam Heydari, Hamidreza Aghasi, University of California, Irvine, United States; Huan Wang, Qualcomm Inc, United States; Soheil Saadat, MFLEX Inc., United States*

**FR-A5.1A.7** **10:40**

### High Efficiency Efficiency Antenna Integrated Electro-Optic modulator for Sensing Applications

*Abe Akhijat, John Volakis, Florida International University, United States*

**FR-A5.1A.8** **11:00**

### A Study of Plasmons in Optical Nano-Antennas

*Maicol Cárdenas Hernández, Eduardo Rodríguez Araque, Cafam University Foundation, Colombia*

**FR-A5.1A.9** **11:20**

### Mm-Wave Phase Shifters and Beamforming Networks With Integrated Microfluidic Actuation

*Jonas Mendoza, Gokhan Mumcu, University of South Florida, United States*

**FR-A5.1A.10** **11:40**

### Hemispherical Luneburg Lens for Wide Angle Beam Scanning in the Ka-band

*Ravi Kumar Arya, National Institute of Technology Delhi, India; Prashant Chaudhary, University of Delhi South Campus, India; Abdelkhalek Nasri, Raj Mittra, University of Central Florida, United States*



## Inverse Scattering and Imaging I

Session Co-Chairs: Stavros Vakalis, Michigan State University; Maryam Hajebi, University of Hormozgan

- FR-A4.1A.1** **08:20**  
**Impact of Time-Bandwidth Product on Active Incoherent Millimeter-Wave Imaging**  
*Stavros Vakalis, Jeffrey Nanzer, Michigan State University, United States*
- FR-A4.1A.2** **08:40**  
**Investigating the Use of Matching Metasurfaces in Microwave Imaging**  
*Ziqi Liu, Puyan Mojabi, University of Manitoba, Canada*
- FR-A4.1A.3** **09:00**  
**Application of Microwave Imaging in Detecting Valuable Ores**  
*Beichen Duan, Erin Bobicki, Sean Hum, University of Toronto, Canada*
- FR-A4.1A.4** **09:20**  
**Feasibility Analysis for Active Manipulation of Electromagnetic Fields in Free Space**  
*Chaoxian Qi, Jiefu Chen, Neil Jerome Egarguin, Daniel Onofrei, University of Houston, United States*
- FR-A4.1A.5** **09:40**  
**An Efficient ESM with Focus Stacking Technique for 3D Radiation Source Localization**  
*Bowen Luo, Qiang-Ming Cai, Shuaihua Ren, Xin Cao, Yuyu Zhu, Yi Yu, Jun Fan, Southwest University of Science and Technology, China; Lei Han, Air Force Engineering University, China*
- Break** **10:00**
- FR-A4.1A.6** **10:20**  
**Study on the Degrees of Freedom of Scattered Fields in Nonlinear Inverse Scattering Problems**  
*Zhichao Lin, Rui Guo, Maokun Li, Fan Yang, Shenheng Xu, Tsinghua University, China; Aria Abubakar, Schlumberger, United States*
- FR-A4.1A.7** **10:40**  
**A Scalable Deep Learning Model for Arbitrary Transmitter Configurations in Inverse Scattering**  
*Karthik Girija Ramesan, Prasanta Kumar Ghosh, Indian Institute of Science, India*
- FR-A4.1A.8** **11:00**  
**A Hybrid Structural Constraint Approach for Enhancing Electromagnetic Inversion through Acoustic Inversion**  
*Yuyue Zhang, Zhiqin Zhao, Zaiping Nie, University of Electronic Science and Technology of China, China*
- FR-A4.1A.9** **11:20**  
**Coherence Factor-Based Delay-Multiply-And-Sum Image Reconstruction Algorithm**  
*Sisi Hao, Jianying Li, Xujing Yu, Yao Feng, Northwestern Polytechnical University, China*
- FR-A4.1A.10** **11:40**  
**Use of Compressive Sensing in Quantitative Profiling of Non-Sparse Subsurface Scenarios**  
*Maryam Hajebi, University of Hormozgan, Iran; Ahmad Hoorfar, Villanova University, United States*



## Metamaterial Absorbers, RCS Reduction and Cloaking I

Session Co-Chairs: Amir Zaghlool, CCDC U.S. Army Research Lab and Virginia Tech; Zhi-Yuan Zong, Nanjing University of Science and Technology

**FR-A2.1A.1** **08:20**

### Scattering Reduction Metasurfaces Using Circular Inter-Digitated Self-Phased Elements

*Quang Nguyen, Theodore Anthony, U.S. CCDC Army Research Lab, United States; John Hodge, Virginia Tech, United States; Amir Zaghlool, U.S. CCDC Army Research Lab and Virginia Tech, United States*

**FR-A2.1A.2** **08:40**

### A Wave Matrix Approach to Designing Azimuthally-Varying Cylindrical Metasurfaces

*Chun-Wen Lin, Anthony Grbic, University of Michigan, United States*

**FR-A2.1A.3** **09:00**

### A Low-RCS and Low-ECC Transparent Meta-Radomes Based on a Conductive Nanocomposite

*Liang Zhu, Pai-Yen Chen, university of illinois at Chicago, United States*

**FR-A2.1A.4** **09:20**

### Modeling and Analysis of Carbon Nanotube Dimer Embedded in A Lossy Dielectric Slab

*Sumitra Dey, Ahmed M Hassan, University of Missouri-Kansas City, United States*

**FR-A2.1A.5** **09:40**

### Ultra-thin broadband absorber using active non-Foster devices and FSS-magnetic material

*Wei Hu, Southwest Minzu University, University of Electronic Science and Technology of China, China; Weiwei Gu, Daniele Insera, Yongjun Huang, Guangjun Wen, University of Electronic Science and Technology of China, China*

**Break** **10:00**

**FR-A2.1A.6** **10:20**

### Frequency-Selective Structure With One Reflection Band And Two-sided Absorption Bands

*Yifei Gao, Huixian Liu, Qingxin Guo, Communication university of China, China*

**FR-A2.1A.7** **10:40**

### An Optically Transparent Glass Absorber using a Multi-Fractal Ring Structure for Ka-band

*Suha Chang, Youngno Youn, Cheonga Lee, Daehyeon Kim, Wonbin Hong, Pohang University of Science and Technology, Korea (South); Byoungwan Kang, Hyengcheul Choi, Choankon Kim, Corning Precision Materials, Korea (South)*

**FR-A2.1A.8** **11:00**

### Dual-Polarization Broadband Reconfigurable Rabsorber with High Selective Passband

*Wenyu Li, Jianxun Su, Zengrui Li, Communication University of China, China; Guanghong Liu, Information Science Academy of China Electronic, China*

**FR-A2.1A.9** **11:20**

### A Novel Miniaturized Dual-polarized Dual-passband Frequency Selective Rabsorber

*Jiangcheng Ge, Wen Jiang, Tao Hong, Shuxi Gong, Xidian University, China*

**FR-A2.1A.10** **11:40**

### A Novel Design of Wide-Band Dual-Polarization Reconfigurable Frequency Selective Surface

*Hai-Ruo Cao, Xiao-Han Yang, Zhi-Yuan Zong, Wen Wu, Nanjing University of Science and Technology, China*



## Modeling, Optimization and Machine Learning I

Session Co-Chairs: Ting-Yen Shih, University of Idaho; Feng Han, Xiamen University

**FR-A3.3A.1** **08:20**

**Non-invasive Aqueous Glucose Monitoring using Microwave Sensor with Machine Learning**  
*Saeed Bamratraf, Omar Ramahi, University of Waterloo, Canada; Maged Aldhaeabi, Hadhramout University, Yemen*

**FR-A3.3A.2** **08:40**

**Generative Adversarial Network-Based Design of Dielectric Resonator Antenna for mmWave 5G Applications**  
*Mingdian Liu, Meng Lu, Jiming Song, Iowa State University, United States; Hui Zhang, Communication University of China, China*

**FR-A3.3A.3** **09:00**

**Low Cost Spatial Processing for 5G Interference Mitigation and Capacity Improvement**

*Tsotne Kvelashvili, Toan Vo Dai, Aly Fathy, Ozlem Kilic, University of Tennessee, Knoxville, United States; Robab Kazemi, University of Tabriz, Iran*

**FR-A3.3A.4** **09:20**

**Directional Modulation Using Amplitude and Phase Pattern Dynamics of a Single Antenna**  
*Amer Abu Arisheh, Jason Merlo, Jeffrey Nanzer, Michigan State University, United States*

**FR-A3.3A.5** **09:40**

**An Application Programming Interface (API) for Machine-Learning-Based Non-Foster Circuit Synthesis**  
*Qianyi Li, Ting-Yen Shih, University of Idaho, United States*

**Break** **10:00**

**FR-A3.3A.6** **10:20**

**Development of a Practical Ray-Tracing Program for Propagation Modeling**  
*Zhengqing Yun, Magdy F. Iskander, University of Hawaii at Manoa, United States*

**FR-A3.3A.7** **10:40**

**Effective Numerical Modeling of Packaged mm-Wave Automotive Radars**  
*Lucas Newton, Maruf Hossain, Niru Nahar, Kubilay Sertel, Ohio State University & ElectroScience Laboratory, United States; Alebal Arage, Prabin Shrestha, General Motors, United States*

**FR-A3.3A.8** **11:00**

**Counterfeit Chip Detection via Electromagnetic Emissions From Host Circuit Boards**  
*Jiaqing Lu, Yagmur Ozturk, Cem Kesici, Kubilay Sertel, Shane Smith, Jin-Fa Lee, The Ohio State University, United States*

**FR-A3.3A.9** **11:20**

**Machine Learning Based Design of Ku Band Ridge Gap Waveguide Slot Antenna Loaded with FSS for Satellite Internet Applications**

*Mohammed Farouk Nakmouche, Diaa E.Fawzy, Izmir University of Economics, Turkey; Mohammed Cherif Derbal, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue, Canada; A.M.M.A Allam, German University in Cairo, Egypt; Shoukry I Shams, Concordia University, Canada; Mahmoud Elsaadany, Ghyslain Gagnon, Ecole de Technologie Supérieure, Canada*



## Propagation, Scattering, Imaging and Remote Sensing II

Session Co-Chairs: Yuan Fang, University of Southern California; Jiefu Chen, University of Houston

**FR-UB.3A.1** **08:20**

**A New Microwave Imaging System to Characterize the Dielectric Behavior of Organic Soil for Radar Remote Sensing Applications**

*Kazem Bakian-Dogaheh, Yuan Fang, Alireza Tabatabaenejad, Mahta Moghaddam, University of Southern California, United States*

**FR-UB.3A.2** **08:40**

**Active Interferometric Millimeter-Wave Imaging Using a Sparse Linear Array with Rotational Dynamics**

*Daniel Chen, Jeffrey Nanzer, Michigan State University, United States*

**FR-UB.3A.3** **09:00**

**Interferometric Angle Estimation Using Space-Time Modulation and Distributed Arrays**

*Stavros Vakalis, Jeffrey Nanzer, Michigan State University, United States*

**FR-UB.3A.4** **09:20**

**Towards Classification of Harmonic Micro-Doppler Signatures via a Convolutional Neural Network**

*Neda Nourshamsi, Jeffrey Nanzer, Michigan State University, United States*

**FR-UB.3A.5** **09:40**

**Combined L1-L2 norm based Level Set Variational Born Iterative Method for Microwave Imaging**

*Yuan Fang, Kazem Bakian-Dogaheh, Mahta Moghaddam, University of Southern California, United States*

**Break** **10:00**

**FR-UB.3A.6** **10:20**

**An Efficient Progressive Transfer Learning for Low-Frequency Data Prediction in Subsurface Imaging**

*Yuchen Jin, Yuan Zi, Xuqing Wu, Jiefu Chen, University of Houston, United States; Wenyi Hu, Advanced Geophysical Technology, United States*

**FR-UB.3A.7** **10:40**

**Contrast Source Inversion Based Object Reconstruction Buried in Multi-layered Background for Microwave Subsurface Imaging**

*Yoshihiro Yamauchi, Shouhei Kidera, University of Electro-Communications, Japan*

**FR-UB.3A.8** **11:00**

**Polarimetry Effect in Three-dimensional Contrast Source Inversion for Microwave Breast imaging**

*Peixian Zhu, Hayatomomaru Morimoto, Shouhei Kidera, University of Electro-Communications, Japan*

**FR-UB.3A.9** **11:20**

**Installed Radar Performance Modelling and Direction of Arrival Estimation for Optimum Radar Placement**

*Maruf Hossain, Lucas Newton, Niru Nahar, Kubilay Sertel, The Ohio State University, United States; Alebel Arage, Prabin Shrestha, General Motors, United States*



## Electromagnetic Metrology and Antenna Applications

Session Co-Chairs: Oscar Quevedo-Teruel, KTH Royal Institute of Technology; Stephen M Hanham, University of Birmingham

**FR-UA.1P.1** **14:00**

### Dual-Components Magnetic Probe for Electromagnetic Interference Measurement

*Ze-Kai Hu, Xing-Chang Wei, Zhejiang University, China*

**FR-UA.1P.2** **14:20**

### Ferrite Core Loaded Low-Profile VHF/UHF Antenna for RCS Reduction

*Geonyeong Shin, Ick-Jae Yoon, Chungnam National University, Korea (South); Hyun Kim, Youngwan Kim, IIG NEX 1, Korea (South)*

**FR-UA.1P.3** **14:40**

### Broadside Radiation from Radially Periodic Structures

*Dejian Zhang, Xiaojiao Deng, Hua Geng, Xiaoping Zheng, Tsinghua University, China; Davide Comite, Alessandro Galli, Paolo Burghignoli, Sapienza University of Rome, Italy; Paolo Baccarelli, Roma Tre University, Italy*

**FR-UA.1P.4** **15:00**

### Geodesic Half Maxwell Fish-Eye Lens Antenna for Rapid Beam Scanning

*Shiyi Yang, Qiao Chen, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden; Nelson J.G. Fonseca, European Space Agency, Netherlands*

**FR-UA.1P.5** **15:20**

### Computational Investigation of the DTU-ESA 12 GHz VAST12 Validation Standard Antenna to Identify Features Contributing to the Radiated Field

*Mustafa Murat Bilgic, Andreas Ericsson, Per Heighwood Nielsen, Tonny Rubæk, TICRA, Denmark; Javier Fernandez Alvarez, Jeppe Majlund Bjarstorp, Kyriakos Kaslis, Olav Breinbjerg, Technical University of Denmark, Denmark*

**Break** **15:40**

**FR-UA.1P.6** **16:00**

### DOA estimation for co-prime array with mixed noise via a normalized covariance matrix

*Zhao Jun, Gui Renzhou, Tongji University, China; Dong Xudong, Nanjing University of Aeronautics and Astronautics, China*

**FR-UA.1P.7** **16:20**

### Comparison of Characteristic Impedance Calibration Methods for Transverse Electromagnetic (TEM) Cell at Standards and Calibration Laboratory (SCL)

*Hau Wah Lai, Chi Kin Ma, Shing Lung Yang, Cho Man Tsui, Standards and Calibration Laboratory, Hong Kong SAR of China*

**FR-UA.1P.8** **16:40**

### Improvement in Vertical Positioning with GPS Receiver Clock Steered by Precise Time Reference

*Shilpa Manandhar, Yu Song Meng, Agency for Science, Technology and Research (A\*STAR), Singapore*

**FR-UA.1P.9** **17:00**

### Toward Reliable Bone Water Content Estimation via Terahertz spectroscopy

*Suzanna Freer, Cong Sui, Liam M Grover, Stephen M Hanham, Miguel Navarro-Cia, University of Birmingham, United Kingdom*

**FR-UA.1P.10** **17:20**

### Gas detection using a terahertz leaky-wave Antenna

*Dejian Zhang, Xiaojiao Deng, Geng Hua, Xiaoping Zheng, Tsinghua University, China*





## Microstrip Antennas and Circuits II

Session Co-Chairs: Yasuo Morimoto, AGC Inc.; Neelakantam Venkatarayalu, Singapore Institute of Technology

**FR-A1.1P.1** **14:00**

### E-band Wide-Angle Multi-Beam Shaped Transmitarray

*Lizhao Song, Peiyuan Qin, Yingjie (Jay) Guo, University of Technology Sydney, Australia*

**FR-A1.1P.2** **14:20**

### Compact Third-order Dual-band Bandpass Filter With High Selectivity and Independently Controllable Bandwidths

*Xiaodong Cui, Fan Zhang, Yi Zhang, Zhipeng Wang, Yuege Xiao, Jun Xu, University of Electronic Science and Technology of China, China*

**FR-A1.1P.3** **14:40**

### A Flush-Surface Antenna for the 5G mmW Band

*Yasuo Morimoto, Takeshi Motegi, AGC Inc., Japan; Hirohito Hattori, Toyota Motor Corporation, Japan*

**FR-A1.1P.4** **15:00**

### Effects due to Corporate Feed Network in a 16×16 Element 24GHz Patch Antenna Array

*Neelakantam Venkatarayalu, Jun Wei Wong, Singapore Institute of Technology, Singapore; Hangzhao Ray Fang, ST Engineering, Singapore; Geok-Ting Toh, Technical University of Munich, TUM Asia, Singapore*

**FR-A1.1P.5** **15:20**

### Compact Single-Layer Dual-Patch Antenna Fed by Dual Strips for 5G Millimeter-wave Applications

*Lei Wang, Jin Shi, Nantong University, China*

**Break** **15:40**

**FR-A1.1P.6** **16:00**

### A Novel Partially Reflective Layer for Improving the Performance of X-Band Printed Antennas

*Abdelhalim Chaabane, Université 8 Mai 1945 Guelma, Algeria; Lamine Mohamed Abdelghani, CEMT INRS, Canada; Hussein Attia, King Fahd University of Petroleum and Minerals, Saudi Arabia*

**FR-A1.1P.7** **16:20**

### Circular Complementary Split Ring Resonator Rotation for Millimeter Wave Microstrip Patch Antenna

*Norsaidah Muhamad Nadzir, Mohamad Kamal A. Rahim, Noor Asniza Murad, UTM, Malaysia; Himdi Mohamed, University of Rennes 1, France*

**FR-A1.1P.8** **16:40**

### Design and Simulation Study of E Shaped Slotted Microstrip Patch Antenna by HFSS for 5G applications

*Azzama Talukder, Ehtesanul Islam, Ahsanullah University of Science and Technology, Bangladesh*

**FR-A1.1P.9** **17:00**

### A High Gain Switchable Dual CP Wideband Rectangular Spiral Microstrip Antenna for mmWave Applications

*Mazen Almalki, Saad Alhuwaimel, King Abdulaziz for Science and Technology, Saudi Arabia*

**FR-A1.1P.10** **17:20**

### Star-Shaped Supershaped Patch Antenna for 5G

*Guilherme Martins, Pedro Pinho, Instituto Superior de Engenharia de Lisboa, Portugal; Caroline Loss, FibEnTech Research Unit, Portugal*



## Reflector and Reflectarray Antennas III

Session Co-Chairs: Jakob R. de Lasson, TICRA; Su Yee Aye, National University of Singapore

**FR-A1.2P.1** **14:00**

### A 12 m2 Ka-band Reflector Antenna for SAR Earth Observation Missions

*Su Yee Aye, Koen Mouthaan, National University of Singapore, Singapore; Sigurd Huber, Gerhard Krieger, German Aerospace Center (DLR), Germany*

**FR-A1.2P.2** **14:20**

### A Multifunctional Transmission/Reflection Element With Two Transmission Bands

*Bing Wang, Zhiyuan Zong, Wen Wu, Dagang Fang, Nanjing University of Science and Technology, China*

**FR-A1.2P.3** **14:40**

### Reflectarray Antenna with High Efficiency and Low Side Lobe

*Shota Takino, Sanshiro Shigemitsu, Shigeru Makino, Kanazawa Institute of Technology, Japan; Hiromasa Nakajima, Michio Takikawa, Mitsubishi Electric Corporation, Japan*

**FR-A1.2P.4** **15:00**

### New Scanning-Spot Beam Reflectarray Antenna Design

*Yusuke Kaimori, Shota Takino, Sanshiro Shigemitsu, Shigeru Makino, Kanazawa Institute of Technology, Japan; Hiromasa Nakajima, Michio Takikawa, Mitsubishi Electric Corporation, Japan*

**FR-A1.2P.5** **15:20**

### Shaped-Beam Reflectarray Antenna Optimized at Multiple Frequency

*Sanshiro Shigemitsu, Syota Takino, Shigeru Makino, Kanazawa Institute of Technology, Japan; Hiromasa Nakajima, Michio Takikawa, Mitsubishi Electric Corporation, Japan*

**Break** **15:40**

**FR-A1.2P.6** **16:00**

### A Dual-layer Ku/Ka Dual-Band Shared-Aperture Reflectarray Antenna Based on Structure-Reuse Technique

*Yan Liu, Yu Jian Cheng, Yong Fan, University of Electronic Science and Technology of China, China*

**FR-A1.2P.7** **16:20**

### Van Atta Arrays Exploited Towards Flying UAV Position Detection

*Adnan Nadeem, Noshawan Shoaib, National University of Sciences and Technology, Pakistan; David Chatzichristodoulou, RF and Microwave Solutions LTD, Cyprus; Loukia Vassiliou, Agricultural Research Institute, Nicosia, Cyprus; Photos Vryonides, Symeon Nikolaou, Frederick Research Center, Nicosia, Cyprus*

**FR-A1.2P.8** **16:40**

### Some Observed Outcomes of the Shape Synthesis of Dual-Band Transmitarray Elements

*Abdullah Aljanah, Prince Sattam University, Saudi Arabia; Eqab Almajali, University of Sharjah, United Arab Emirates; Derek McNamara, University of Ottawa, Canada*

**FR-A1.2P.9** **17:00**

### Polarization-Insensitive Circular Reflectarray for Satellite Applications in Ka-band

*Ali Ali, Mohsen Khalily, Ali Araghi, Rahim Tafazolli, University of Surrey, United Kingdom*

**FR-A1.2P.10** **17:20**

### Large European Deployable Reflector: RF Modeling and Measurement Correlation

*Jakob R. de Lasson, Cecilia Cappellin, TICRA, Denmark; Maurizio Lori, HPS, Germany; Alexander Geise, Christian Hunscher, Airbus, Germany; Leri Datashvili, Nikoloz Maghaldadze, LSS, Germany; Jean-Christophe Angevain, Martin Suess, Alexander Ihle, Gonçalo Rodrigues, ESA-ESTEC, Netherlands*



Friday, December 10  
FR-A1.3P

14:00 - 15:40  
Melati Ballroom 4103

## Multi-Band Antennas III

Session Co-Chairs: Chaoyun Song, Heriot-Watt University; Hai-Han Sun, Nanyang Technological University

**FR-A1.3P.1**

**14:00**

**Dual-Band Transmitter Array Consisting of Unit Cells with Asterisk and Cross Dipole Elements Separated by Ring Elements**

*Shiro Okuno, Syota Shimizu, Hiroyuki Deguchi, Mikio Tsuji, Doshisha University, Japan*

**FR-A1.3P.2**

**14:20**

**Design of an L/S Band Co-Aperture Antenna Array with High Isolation**

*Xiaoming Chen, Aoyun Meng, Dajiang Li, Ming-Chun Tang, Chongqing University, China*

**FR-A1.3P.3**

**14:40**

**Dual-Band Base Station Antenna Array with Suppressed Cross-Band Mutual Scattering**

*Hai-Han Sun, Yee Hui Lee, Nanyang Technological University, Singapore; Bevan Jones, Jay Guo, University of Technology Sydney, Australia*

**FR-A1.3P.4**

**15:00**

**Dual Band 4-Port MIMO Antenna for Bluetooth/5G Applications**

*Rakesh N. Tiwari, Binod Kumar Kanaujia, Jawaharlal Nehru University, India; Prabhakar Singh, Galgotias University, India; Pradeep Kumar, University of KwaZulu-Natal, South Africa*

**FR-A1.3P.5**

**15:20**

**Wideband Low-Profile Patch Antennas Using High Dielectric Fluids and Hybrid Metal Structure**

*Chaoyun Song, Lei Wang, George Goussetis, Heriot-Watt University, United Kingdom; Xiantao Yang, Yi Huang, University of Liverpool, United Kingdom*



Friday, December 10  
FR-A1.4P

16:00 - 17:40  
Melati Ballroom 4103

## Antenna Arrays and Circuits

Session Co-Chairs: Jiro Hirokawa, Tokyo Institute of Technology; Lin Zhou, Nanyang Technological University

**FR-A1.4P.1**

**16:00**

**Numerical Design of Planar Switching Matrices with an Arbitrary Number of Beams using Two-way Couplers**

*Jiro Hirokawa, Tokyo Institute of Technology, Japan; Nelson J. G. Fonseca, European Space Agency, Netherlands*

**FR-A1.4P.2**

**16:20**

**RF Based Real Time Human Motion Sensing**

*William Taylor, Ahmad Taha, Kia Dashtipour, Qammer H Abbasi, Muhammad Ali Imran, University of Glasgow, United Kingdom; Syed Aziz Shah, Coventry University, United Kingdom*

**FR-A1.4P.3**

**16:40**

**Reconfigurable Beamforming Array for Far Field Wireless Power Transfer Applications**

*Adnan Nadeem, Noshawan Shoaib, National University of Sciences and Technology, Pakistan, Pakistan; David Chatzichristodoulou, RF and Microwave Solutions LTD, Cyprus; Chris Loakimidis, Open University of Cyprus, Cyprus; Photos Vryonides, Symeon Nikolaou, Frederick Research Center, Nicosia, Cyprus*

**FR-A1.4P.4**

**17:00**

**Circularly Polarized Dipole Antenna fed by Dual Quadrature Hybrid Couplers**

*Heesu Wang, Ikmo Park, Ajou University, Korea (South)*

**FR-A1.4P.5**

**17:20**

**Coexistence-Mode Composite Right/Left-Handed Transmission Line and Its Application for Folded C-Type SIW**

**Butler Matrix**

*Qiang Sun, Yong-Ling Ban, University of Electronic Science and Technology of China, China*



## Mobile, PCS and Vehicular Antennas

Session Co-Chairs: Mathieu Mercier, Microwave Vision Group (MVG); Jin Huang, Chalmers University of Technology

**FR-A5.1P.1** **14:00**

### Should SAR Guidelines Include Variability?

*Khadijeh Masumnia-Bisheh, Tarbiat Modares University, Iran; Cynthia M. Furse, University of Utah, United States*

**FR-A5.1P.2** **14:20**

### Sparse Composite Array with Enhanced Angular Resolution for Automotive Radar Applications

*Yingchu Xu, Yilong Lu, Nanyang Technological University, Singapore*

**FR-A5.1P.3** **14:40**

### Dielectric Radome for Scanning Angle Enhancement of Phased Array Antennas

*Phuong Bui, A\*STAR IHPC, Singapore*

**FR-A5.1P.4** **15:00**

### Finite Element Analysis based Optimized Vehicle Mounted Antenna Deployment

*Siyuan Liang, Xian Jiaotong University, China; Yishun Li, Beijing Information Science and Technology University, China; Chuang Gao, Jinan Communication Section of China Railway Jinan Group Co.,Ltd., China*

**FR-A5.1P.5** **15:20**

### Design of Circularly Polarized End-fire Antenna on Gap Waveguide for Automotive Radar Application

*Jin Huang, Marianna Ivashina, Jian Yang, Chalmers University of Technology, Sweden*

**Break** **15:40**

**FR-A5.1P.6** **16:00**

### Evaluation of Integral Quantities of Over the Air Automotive Antenna Measurements

*Mathieu Mercier, Francesca Mioc, Kim Rutkowski, Alessandro Scannavini, Microwave Vision Group (MVG), Hong Kong SAR of China; Tobias Nowack, Christian Bornkessel, Matthias Hein, Technische Universität Ilmenau, Germany*

**FR-A5.1P.7** **16:20**

### An Omnidirectional Vertical-Polarized C-V2X Antenna with High Gain and Low Profile

*Yi Zhou, Ge Zhao, Mei Song Tong, Tongji University, China; Yun Jing Zhang, Soochow University, China*

**FR-A5.1P.8** **16:40**

### Small Footprint Triangular Shaped HF band NVIS Antenna based on Noise related Parametric Studies

*Shambhu Nath Jha, Thales Belgium, Belgium; Remy Lamey, Thales LAS France SAS, France; Jean-Yves Bernier, Thales Six GTS France, France*

**FR-A5.1P.9** **17:00**

### Study of Different Canonical UHF Antennas Integrated in the Vehicle

*Sally Alsayah, Fabien Ferrero, Robert Staraj, UCA CNRS LEAT, France; Ignacio Gimeno, Renault Software Labs, France*

**FR-A5.1P.10** **17:20**

### A Compact Annular Ring microstrip antenna for Unmanned Aerial Vehicles (UAVs) applications

*Lisa Giampietri, Agostino Monorchio, University of Pisa / RaSS Laboratory CNIT, Italy; Francesco Molesti, Guido Nenna, Free Space SRL, Italy*



## Metamaterials and Wave-Guiding Structures

Session Co-Chairs: Oscar Quevedo-Teruel, KTH Royal Institute of Technology; Mariana Dalarsson, KTH Royal Institute of Technology

### FR-UB.1P.1

14:00

#### Rich Modal Features in Circular Waveguides Containing Tensor Metasurfaces

*Christopher Barker, Nicola De Zanche, Ashwin Iyer, University of Alberta, Canada*

### FR-UB.1P.2

14:20

#### Metamaterial Sierpinski Carpet Antenna with Cross-Slot Superstrate For 5G Applications

*Ashad Karimbu Vallappil, Mohamad Kamal A. Rahim, Noor Asniza Murad, Universiti Teknologi Malaysia, Malaysia; Bilal A. Khawaja, Islamic University of Madinah, Saudi Arabia*

### FR-UB.1P.3

14:40

#### Symmetric 8-Channel Power Divider/Combiner Based on a 90° Sector Waveguide

*Ning Li, Xin Cao, Qiangming Cai, Yuyu Zhu, Jun Fan, Southwest University of Science and Technology, China*

### FR-UB.1P.4

15:00

#### The Design of a C-band band pass cavity filter

*Yuepeng Yu, Yanfei Li, Communication University of China, China*

### FR-UB.1P.5

15:20

#### Ultra-Efficient Förster-Type Nonradiative Energy Transfer via Tuning the Permittivity of Complex Dielectric Medium

*Pedro Ludwig Hernandez-Martinez, Abdulkadir C. Yuçel, Nanyang Technological University, Singapore; Hilmi Volkan Demir, Nanyang Technological University, Singapore and Bilkent University, Turkey*

### Break

15:40

### FR-UB.1P.6

16:00

#### Conformal Radome Design Based on a Metasurface Structure with Printed Elements

*Michael Elman, Reuven Shavit, Ben-Gurion University of the Negev, Israel*

### FR-UB.1P.7

16:20

#### Tensor Surface Impedance Model for 3D-Flat Lens Design Based on Metasurface Technology with Printed Elements

*Yarden Tzabari, Reuven Shavit, Ben-Gurion University of the Negev, Israel*

### FR-UB.1P.8

16:40

#### Complementary Split Ring Resonator Based Fluidic Microwave Sensor

*Zolt Szabó, Incze Denissza, Adrienn Lilla Márton, Kristóf Iván, Pázmány Péter Catholic University, Hungary*

### FR-UB.1P.9

17:00

#### Numerical study of TE-wave propagation in waveguides with graded plasmonic obstacles

*Brage B Svendsen, Mariana Dalarsson, KTH Royal Institute of Technology, Sweden*

### FR-UB.1P.10

17:20

#### Double-Wire Fully-Metallic Metamaterial for Broadband Three-Dimensional Meta-lenses Based on Multimodal Bloch Analysis

*Qiao Chen, Hairu Wang, Federico Giusti, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden; Francisco Mesa, Universidad de Sevilla, Spain; Guido Valerio, Sorbonne Universite, France*



Friday, December 10  
FR-A2.1P

14:00 - 17:40  
Peony Ballroom 4501AB

## Metamaterials and Periodic Structures

Session Co-Chairs: Alex Man Hon Wong, City University of Hong Kong; Yakir Hadad, Tel-Aviv University

**FR-A2.1P.1** 14:00

### Wideband High-Gain Open Resonator Antenna Using a Flat Impedance Surface

*Tayyab Ali Khan, Alex Man Hon Wong, City University of Hong Kong, Hong Kong SAR of China*

**FR-A2.1P.2** 14:20

### Terahertz Valley Transport in Photonic Crystal Slab

*Yulin Zhao, Feng Liang, University of Electronic Science and Technology of China, China*

**FR-A2.1P.3** 14:40

### An Accurate Solution to Periodic Grating Structure Scattering Using Nystrom Method with An Over-determined Testing Scheme

*Xuyang Bai, Shurun Tan, Zhejiang University, China*

**FR-A2.1P.4** 15:00

### RCS Reduction of Slot Antenna Array Using Coding Metasurfaces

*Mengyao Li, Zhongxiang Shen, Nanyang Technological University, Singapore*

**FR-A2.1P.5** 15:20

### Orbital Angular Momentum Multiplexing Based on Angle-dispersive Metasurface

*Lijin Xu, Zhiping Yin, Jun Yang, Ying Li, Hefei University of Technology, China*

**Break** 15:40

**FR-A2.1P.6** 16:00

### Design of Metasurface for performance improvement of feed source

*Sujan Shrestha, Hijab Zahra, Syed Muzahir Abbas, Mohsen Asadnia, Macquarie University, Australia*

**FR-A2.1P.7** 16:20

### Interface Waves in Parallel-plate Metasurface Waveguides with Duality Symmetry

*Zhixia Xu, Southeast University, China; Daniel F. Sievenpiper, University of California, San Diego, United States*

**FR-A2.1P.8** 16:40

### Multiplexing Dual Circular-Polarized Vortex Beams by Spin-Decoupled Metasurface

*Jianhua Lin, Xiang Zhang, Qingyuan Zhang, Di Cheng, Weidong Chen, Chang Chen, University of Science and Technology of China, China*

**FR-A2.1P.9** 17:00

### Homogenization and Extreme Fresnel Drag in Spatiotemporally Modulated Wire Medium

*Michael Kreitzer, Yakir Hadad, Tel-Aviv University, Israel*

**FR-A2.1P.10** 17:20

### Mode propagation in glide-symmetric dielectric-filled corrugated waveguides

*Pilar Castillo-Tapia, David Anguiano-Sanjurjo, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden; Francisco Mesa, Universidad de Sevilla, Spain; Alexander Yakovlev, University of Mississippi, United States; Guido Valeria, Sorbonne universite, France*



## Microwave Remote Sensing

Session Co-Chairs: Zi-Liang Liu, National University of Singapore; Shilpa Manandhar, Agency for Science, Technology and Research (A\*STAR)

### FR-UF.1P.1

14:00

#### Investigation on the Relation between Zenith Total Delay and Atmospheric Particulate Matter (PM2.5)

Shilpa Manandhar, Yu Song Meng, Agency for Science, Technology and Research (A\*STAR), Singapore; Yee Hui Lee, Nanyang Technological University, Singapore

### FR-UF.1P.2

14:20

#### Day-ahead Forecasts of Air Temperature

Hewei Wang, Beijing University of Technology, China; Muhammad Salman Pathan, The ADAPT Centre, Ireland; Yee Hui Lee, Nanyang Technological University, Singapore; Soumyabrata Dev, University College Dublin, Ireland

### FR-UF.1P.3

14:40

#### A Simple Method for Visualizing the NVIS Open Channel Based on Ionogram

Varuliantor Dear, Prayitno Abadi, National Institute of Aeronautics and Space of Indonesia, Indonesia; Iskandar Iskandar, Adit Kurniawan, Institute Technology of Bandung, Indonesia; Rezy Pradipta, Boston College, United States

### FR-UF.1P.4

15:00

#### Identification of Detailed Features Located in Highly Similar Structures with Electromagnetic Scattering Data

Zi-Liang Liu, Chao-Fu Wang, National University of Singapore, Singapore

### FR-UF.1P.5

15:20

#### Deeply Sub-Wavelength Position Sensing with a Reverberation-Coded Aperture

Michael del Hougne, Julius-Maximilians-Universität Würzburg, Germany; Sylvain Gigan, Laboratoire Kastler Brossel, France; Philipp del Hougne, CNRS, Univ Rennes, France

### Break

15:40

### FR-UF.1P.6

16:00

#### Monitoring Atmospheric Pollutants From Ground-based Observations

Nicholas Danesi, Mayank Jain, Soumyabrata Dev, University College Dublin, Ireland; Yee Hui Lee, Nanyang Technological University, Singapore

### FR-UF.1P.7

16:20

#### Analyzing the Impact of Meteorological Parameters on Rainfall Prediction

Muhammad Salman Pathan, The ADAPT Centre, Ireland; Jiantao Wu, Soumyabrata Dev, University College Dublin, Ireland; Yee Hui Lee, Nanyang Technological University, Singapore; Jianzhao Yan, Beijing University of Technology, China

### FR-UF.1P.8

16:40

#### Embedding Cyclical Information in Solar Irradiance Forecasting

T. A. Fathima, Independent Researcher, Ireland; Vasudevan Nedumpozhimana, The ADAPT Centre, Ireland; Yee Hui Lee, Nanyang Technological University, Singapore; Soumyabrata Dev, University College Dublin, Ireland

### FR-UF.1P.9

17:00

#### An Interoperable Open Data Portal for Climate Analysis

Jiantao Wu, Huan Chen, Soumyabrata Dev, University College Dublin, Ireland; Fabrizio Orlandi, Declan O'Sullivan, The ADAPT Centre, Ireland; Yee Hui Lee, Nanyang Technological University, Singapore

### FR-UF.1P.10

17:20

#### Automated Climate Analyses Using Knowledge Graph

Jiantao Wu, Huan Chen, Soumyabrata Dev, University College Dublin, Ireland; Fabrizio Orlandi, Declan O'Sullivan, The ADAPT Centre, Ireland; Yee Hui Lee, Nanyang Technological University, Singapore



## Millimeter-Wave, Terahertz and Optical Antennas II

Session Co-Chairs: Yevhen Yashchysyn, Warsaw University of Technology; Derek GRAY, Nagoya Institute of Technology

### FR-A5.2P.1

14:00

#### Enhancement of THz Photoconductive Antenna Gain based on a Photonic Crystal Fiber Substrate

*Haowei Mao, Guizhen Lu, Communication University of China, China*

### FR-A5.2P.2

14:20

#### Ripple suppression in 300GHz band cylindrical lens

*Derek Gray, Kunio Sakakibara, Shuya Suzuki, Ryota Ishihara, Yoshiki Sugimoto, Nobuyoshi Kikuma, Nagoya Institute of Technology, Japan; Yoshihide Yamada, Malaysia-Japan International Institute of Technology, Malaysia; Nurul Huda Abd Rahman, Universiti Teknologi MARA, Malaysia*

### FR-A5.2P.3

14:40

#### Achieving Hemispherical Beam Coverage for a 39 GHz Integrated Lens featuring Double-Elliptical Boundaries through sequential GO and multiple Scattering

*Youngno Youn, Wonbin Hong, Pohang University of Science and Technology, Korea (South)*

### FR-A5.2P.4

15:00

#### Compact polarization transformation in a geodesic Luneburg lens antenna

*Astrid Algaba-Brazález, Lars Manholm, Martin Johansson, Ericsson AB, Sweden; Freysteinn Viðar Viðarsson, Oskar Zetterstrom, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden; Nelson J. G. Fonseca, European Space Agency, Netherlands*

### FR-A5.2P.5

15:20

#### Fourier Optics Analysis of Distributed Absorbers Coupled to Lens based Focal Plane Arrays

*Shahab Oddin Dabironezare, Nuria Llombart, Technical University of Delft, Netherlands; Juho Luomahaara, VTT Technical Research Center of Finland, Finland*

### Break

15:40

### FR-A5.2P.6

16:00

#### Wide Band Wide Scan Quasi-Optical Systems: a Fourier Optics-Geometrical Optics based Analysis

*Shahab Oddin Dabironezare, Andrea Neto, Nuria Llombart, Technical University of Delft, Netherlands; Giorgio Carluccio, NXP Semiconductors, Netherlands*

### FR-A5.2P.7

16:20

#### Study of Bondwire Interconnect for Antenna Applications in W-Band

*Grzegorz Bogdan, Yevhen Yashchysyn, Warsaw University of Technology, Poland*

### FR-A5.2P.8

16:40

#### Geometrical Optics based method for the Analysis and Design of Inhomogeneous Dielectric Lenses

*Matteo Albani, Ilir Gashi, Anastasios Paraskevopoulos, Stefano Maci, University of Siena, Italy*

### FR-A5.2P.9

17:00

#### A Millimeter-Wave Multilayer Lens Antenna for Circularly Polarized Applications

*Samaneh Sadeghi-Marasht, Anding Zhu, University College Dublin, Ireland; Mohammad S. Sharawi, Polytechnique Montreal, Canada*

### FR-A5.2P.10

17:20

#### A Submillimeter-Wave Dual-Band Leaky-Wave Lens Antenna for Cometary Mapping

*Sjoerd Bosma, Maria Alonso-delPino, Darwin Blanco, Nuria Llombart, Delft University of Technology, Netherlands; Sven van Berkel, Cecile Jung-Kubiak, Goutam Chattopadhyay, Jose Siles, Jet Propulsion Laboratory, United States*





## Inverse Scattering and Imaging II

Session Co-Chairs: Kuiwen Xu, Hangzhou Dianzi University; Jorge Alberto Tobon Vasquez, Politecnico di Torino

**FR-A4.1P.1** **14:00**

### Elongated Object Orientation Estimation Based on Deep Neural Networks

*Hai-Han Sun, Yee Hui Lee, Abdulkadir C. Yucel, Nanyang Technological University, Singapore; Genevieve Ow, Mohamed Lokman Mohd Yusof, National Parks Board, Singapore*

**FR-A4.1P.2** **14:20**

### Pixel-based Inversion of Induction Logging Data in Anisotropic Media with Supervised Descent Method

*Xiangyang Sun, Peng Hao, Jun Hu, University of Electronic Science and Technology of China, China*

**FR-A4.1P.3** **14:40**

### Analysis of models to reduce complexity and simulation time of Multilayered Media for Automotive Radar Applications

*Nancy Modi, Jayanta Mukherjee, IIT BOMBAY, India*

**FR-A4.1P.4** **15:00**

### Study on Short-Range 3D Imaging Based on MIMO Circular Synthetic Aperture Radar

*Kai Tan, Xudong Chen, National University of Singapore, Singapore*

**FR-A4.1P.5** **15:20**

### Reconstruction of Penetrable Objects with Magnetic Materials Based on Integral Equation Method

*Ze Yuan Lu, Mei Song Tong, Tongji University, China*

**Break** **15:40**

**FR-A4.1P.6** **16:00**

### Embedding a priori information in inverse scattering problems using deep learning

*Leila Ahmadi, Amir Ahmad Shishegar, Sharif University of Technology, Iran*

**FR-A4.1P.7** **16:20**

### Deep Learning: A Powerful Framework for the Real-Time Solution of Inverse Scattering Problems

*Andrea Massa, Alessandro Polo, Pietro Rosatti, Marco Salucci, ELEDIA@UniTN - University of Trento, Italy; Xudong Chen, National University of Singapore, Singapore; Maokun Li, ELEDIA@TSINGHUA - Tsinghua University, China*

**FR-A4.1P.8** **16:40**

### Early detection of damages in fruits with amplitude-only measurements

*Flora Zidane, Jérôme Lanteri, Claire Migliaccio, Université côte d'azur, France; Julien Marot, Aix-Marseille Université, France*

**FR-A4.1P.9** **17:00**

### Tackling Nonlinearity in Inverse Scattering by Suitable Rewritings of the Basic Equations: Recent Results and Possible Development

*Martina T. Bevacqua, Tommaso Isernia, Università Mediterranea, Italy*

**FR-A4.1P.10** **17:20**

### Hybrid Resolvent Kernel Calibration Technique for Microwave Imaging Systems

*David Rodriguez-Duarte, Cristina Origlia, Jorge Alberto Tobon Vasquez, Francesca Vipiana, Politecnico di Torino, Italy*



Friday, December 10  
FR-A2.2P

14:00 - 17:40  
Peony Ballroom 4403

## Metamaterial Absorbers, RCS Reduction and Cloaking II

Session Co-Chairs: Divitha Seetharamdo, IFSTTAR / University of Lille; Amir Shlivinski, Ben-Gurion University

**FR-A2.2P.1** 14:00

### Electromagnetic Cloak Using Phase Gradient Metasurfaces

*Yufang Wang, Huaqiao University, China; Yuehe Ge, Fuzhou University, China; Zhizhang Chen, Dalhousie University, China*

**FR-A2.2P.2** 14:20

### Mantle Cloak Antenna with Rejection Band at Lower Frequency Side of Operating Frequency

*Thanh Binh Nguyen, Hiroshi Hashiguchi, Naobumi Michishita, Hisashi Morishita, National Defense Academy, Japan; Teruki Miyazaki, Masato Tadokoro, Yokohama Rubber Co., Ltd., Japan*

**FR-A2.2P.3** 14:40

### A Novel Miniaturized Metamaterial Microwave Absorber with Quasi-full-angle Stability

*Yu-di Fan, Er-Ping Li, Tian-wu Li, Zhejiang University, China*

**FR-A2.2P.4** 15:00

### An Ultrabroad Band Absorber Based on Magnetic Absorbing Material for Solving EMC Problems in Chip-Packages

*Jiaqi Xing, Xinglei Liang, Tianwu Li, Hang Jin, Shiyun Zhou, Er-ping Li, Zhejiang University, China*

**FR-A2.2P.5** 15:20

### A Near-Omnidirectional, Low-Profile, Broadband, Metamaterial Absorber Based on Characteristic Mode Analysis

*Ting Shi, Xuesong Yuan, University of Electronic Science and Technology of China, China; Ming-Chun Tang, Chongqing University, China*

**Break** 15:40

**FR-A2.2P.6** 16:00

### Investigation of modal stored energy approach to mantle cloaking of active antenna

*Ozuem Chukwuka, IFSTTAR, France; Divitha Seetharamdo, IFSTTAR / University of Lille, France*

**FR-A2.2P.7** 16:20

### Smart Cloaking Metasurfaces for Next-Generation Antenna Systems

*Stefano Vellucci, Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy; Alessio Monti, Mirko Barbuto, Niccolò Cusano University, Italy*

**FR-A2.2P.8** 16:40

### Electromagnetic scattering reduction using sparse metasurfaces

*François Villamizar, Cédric Martel, Sylvain Bolioli, ONERA / DEMR, Université de Toulouse, France; Fabrice Boust, DEMR, ONERA, Université Paris Saclay, France; Shah Nawaz Burokur, LEME, UPL, Univ Paris Nanterre, France*

**FR-A2.2P.9** 17:00

### Bypassing Rozanov's bound for short-time pulses

*Chen Firestein, Amir Shlivinski, Ben-Gurion University, Israel; Yakir Hadad, Tel-Aviv University, Israel*

**FR-A2.2P.10** 17:20

### Jaumann-like Tuneable Rasorber with Enhanced Angular Stability and Polarisation Insensitivity

*Callum Hodgkinson, Symon Podilchak, University of Edinburgh, United Kingdom; Dimitris Anagnostou, Heriot-Watt University, United Kingdom*



## Modeling, Optimization and Machine Learning II

Session Co-Chairs: Tiantian Yin, National University of Singapore; Peiqin Liu, National University of Singapore

**FR-UB.2P.1** **14:00**

**DeepTDCS: Real-Time Estimation of Currents Induced During Transcranial Direct Current Stimulation via Deep Learning**

*Xiaofan Jia, Sadeed Bin Sayed, Guang-Bin Huang, Abdulkadir C. Yucef, Nanyang Technological University, Singapore; Luis J. Gomez, Purdue University, United States*

**FR-UB.2P.2** **14:20**

**Machine-learning-based optimization method in metasurface Mosaic antennas**

*Peiqin Liu, Ziqi Zhu, Zhi Ning Chen, National University of Singapore, Singapore*

**FR-UB.2P.3** **14:40**

**Optimal Base Station Deployment of TDOA-based Positioning System**

*Ziqi Liu, Siyu Lin, Beijing Jiaotong University, China*

**FR-UB.2P.4** **15:00**

**A Machine Learning Based Traveling Wave Antenna Development Methodology**

*Benjamin Falkner, Hengyi Zhou, Amit Mehta, Swansea University, United Kingdom*

**FR-UB.2P.5** **15:20**

**Dispersion Analysis of Metallic Corrugated Bull-Eye Leaky-Wave Antennas**

*Dejian Zhang, Xiaojiao Deng, Hua Geng, Xiaoping Zheng, Tsinghua University, China; Davide Comite, Alessandro Galli, Paolo Burghignoli, Sapienza University of Rome, Italy; Paolo Baccarelli, Roma Tre University, Italy*

**Break** **15:40**

**FR-UB.2P.6** **16:00**

**Methodology for the Development of Broadband Multilayer Microwave Absorbers**

*Varsha Mishra, Eliana Canicatti, Agostino Monorchio, University of Pisa, Italy*

**FR-UB.2P.7** **16:20**

**Applying neural networks techniques to compute vertical refractivity profiles in maritime environments – Preliminary results**

*Jacques Claverie, Jean Motsch, Academie Militaire de St-Cyr Coëtquidan, France*

**FR-UB.2P.8** **16:40**

**Quantum Electromagnetic Engineering at the ELEDIA Research Center**

*Paolo Rocca, Giacomo Oliveri, Alessandro Polo, Andrea Massa, ELEDIA@UniTN - University of Trento, Italy*

**FR-UB.2P.9** **17:00**

**On the diagnostic of a complex sub-wavelength micro-structure via machine learning tools**

*Peipei Ran, Mohammed Serhir, Dominique Lesselier, Université Paris-Saclay, CNRS, CentraleSupélec, France*

**FR-UB.2P.10** **17:20**

**Ray-tracing model of elliptic geodesic lens antennas**

*Qingbi Liao Liao, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden; Francisco Mesa, Universidad de Sevilla, Spain; Nelson J.G. Fonseca, European Space Agency, Netherlands*



## Radio Communication and Signal Processing Systems II

Session Co-Chairs: Yang Wang, school of Communication and Information Engineering Chongqing University of Posts and Telecommunications; Renzhou Gui, Tongji University

### FR-UC.1P.1

14:00

#### A Dual Power Weighted Clustering Algorithm for Indoor Millimeter-Wave 3D MIMO Channel

*Xi Liao, Chenxi Huang, Yang Wang, School of Communication and Information Engineering Chongqing University of Posts and Telecommunications, China; Jie Zhang, University of Sheffield, United Kingdom*

### FR-UC.1P.2

14:20

#### Direction Finding and Self-Calibration for Bistatic MIMO Radar in the Presence of Direction-Dependent Mutual Coupling

*Shuai Luo, Yuexian Wang, Jianying Li, Northwestern Polytechnical University, China*

### FR-UC.1P.3

14:40

#### Padded Sparse Array for DoA Estimation of Noncircular Signals in the Presence of Unknown Mutual Coupling

*Hangqi Yan, Yuexian Wang, Ling Wang, Northwestern Polytechnical University, China*

### FR-UC.1P.4

15:00

#### Sparse Bayesian Learning for Direct Position Determination with Mutual Coupling

*Fei Ma, Yuexian Wang, Ling Wang, Chuang Han, Northwestern Polytechnical University, China*

### FR-UC.1P.5

15:20

#### A Fast 2D GPR Forward Solver for Convex Objects Based on a Deep Learning Technique

*Qiqi Dai, Yee Hui Lee, Abdulkadir C. Yucef, Nanyang Technological University, Singapore; Genevieve Ow, Mohamed Lokman, National Parks Board, Singapore*

### Break

15:40

### FR-UC.1P.6

16:00

#### Tree Root Positioning in Heterogeneous Soil Environment Using GPR

*Wenhao Luo, Haihan Sun, Yee Hui Lee, Abdulkadir C Yucef, Nanyang Technological University, Singapore; Genevieve Ow, Mohamed Lokman Mohd Yusof, Centre for Urban Greenery & Ecology National Parks Board, Singapore*

### FR-UC.1P.7

16:20

#### Echo data analysis of tunnel hazard detection radar based on compressed sensing

*Renzhou Gui, Xiaomeng Zhao, Jun Zhao, Juan Li, Huilin Zheng, Tianyu Tang, Xiaohong Ji, Hehua Zhu, Wei Wu, Tongji University, China*

### FR-UC.1P.8

16:40

#### Construction on Wireless Link between IoT Sensor Nodes and Gateway for Landslides Prediction System

*Daiya Miyamoto, Yuki Shinhama, Takuma Kinoshita, Subaru Iwaki, Kouta Iwamoto, Masaya Sakamoto, Futoshi Kuroki, National Institute of Technology, Kure College, Japan; Aoi Sakata, Kazuya Miyamoto, Miyamoto Device Development Co., Ltd., Japan*

### FR-UC.1P.9

17:00

#### An On-Chip 2-D DFT Accelerator Ultrasonic Wavefront for Convolutional Neural Networks

*Kok-Hin Teng, Salahuddin Raju, Di Zhu, Lay Keng Jayce Lim, Ssu-Han Daniel Chen, Leong Ching Eva Wai, Jaibir Sharma, En-Yuan Joshua Lee, Jiaqiang Eldwin Ng, Tshun Chuan Kevin Chai, Lal Amit, Institute of Microelectronics, Singapore*

### FR-UC.1P.10

17:20

#### Gravitational Wave Signal Extraction Based on Chirplet Transform

*Renzhou Gui, Xiaomeng Zhao, Jun Zhao, Juan Li, Huilin Zheng, Tianyu Tang, Xiaohong Ji, Hehua Zhu, Wei Wu, Tongji University, China*

## Author and Session Chair Index

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**Reshape electronics' form factor**

**Reshape electronics' performance**

**Reshape electronics' development cycles**



The DragonFly IV is a one-stop fabrication system for Additive Manufacturing Electronics (AME).

It allows customers to employ new levels of resolution of trace, space, and via, seamless design to manufacturing, and process optimization. By transforming the production process from analog to digital, the DragonFly IV advances innovation in the electronics market.

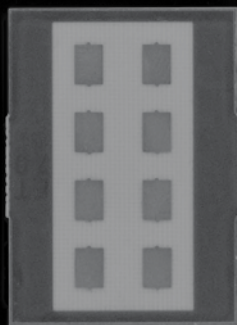
By leveraging the full solution, it allows you to lead the AME market and introduce new levels of electronics' form factor, and performance as well as accelerate electronics' development cycles. The DragonFly IV meets the requirements of future electronic systems in the hearts of high-end devices, like implantable-medical devices, small and micro drones, wearable devices, and many more.

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ELECTROMAGNETIC FIELD  
SIMULATION SOFTWARE



## SHAPING THE FUTURE OF 5G MMWAVE OTA TESTING

- Compact
- Accurate
- Flexible

# StarWave

StarWave combines smart mechanical positioners with plane wave generators to create accurate far-field conditions in a compact system. Composed of hundreds of antenna elements, the PWG has been specifically designed to create a quiet zone within a few meters in front of its radiating surface. Limited DUT movement atop an azimuth-only positioner enables 3D measurements of 5G devices including medium or low gain antennas.



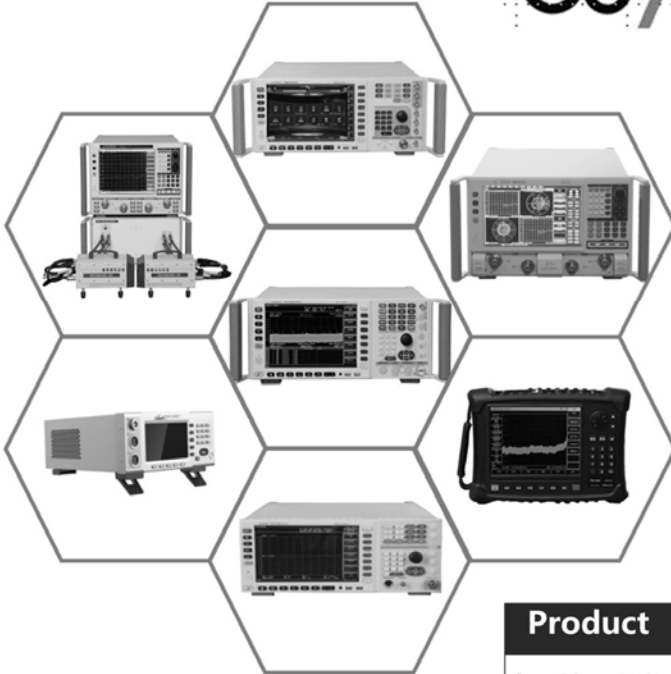
For more information:  
[salesteam@mvg-world.com](mailto:salesteam@mvg-world.com)  
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# Ceyear



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### Product

- Signal Generator
- Spectrum Analyzer
- Network Analyzer
- Power Meter
- Freq. Meter
- Noise Figure

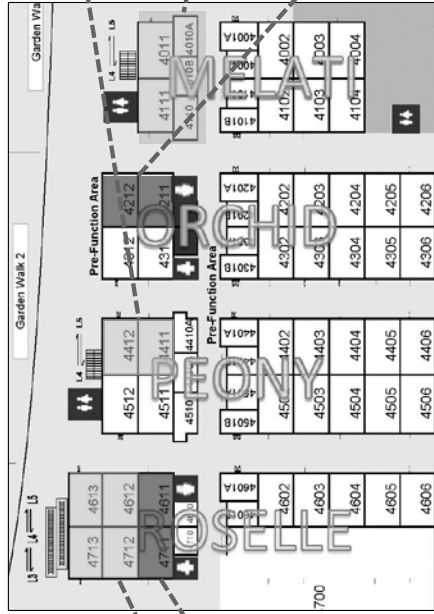
### Key Specifications

- Coaxial to 67 GHz, Waveguide to 750 GHz
- Max signal modulation bandwidth 2 GHz
- Max signal receiving analysis bandwidth up to 550 MHz
- Multi-port, large dynamic range network parameter test

## Level 4 Floorplan, Marina Bay Sands Expo & Convention Centre - 5 December 2021

Zone A	
SC #2 B #3	Peony Junior Ballroom 4411
SC #10	Peony Junior Ballroom 4412
WS #1 B #2	Melati Junior Ballroom

Zone B	
Student Design Contest	Orchid Junior Ballroom 4211, 4212



Tea Break and Lunch Room	
Zone A	Roselle Junior Ballroom 4612, 4613, 4712, 4713
Zone B	Roselle Junior Ballroom 4611, 4711

### Abbreviations

- SC#2: Natural and Metamaterial Beam-steering Antennas
- SC#3: Quantum Maxwell's Equations and Quantum Electromagnetics
- SC#4: Surface Electromagnetics in Antenna Engineering From EEG to Meta-surfaces and Beyond
- WS#1: Recent development of mm-Wave antenna in MIMO Radar systems
- WS#2: Artificial Intelligence inspiring the electromagnetic wave

### Virtual Street Closures (Zoom)

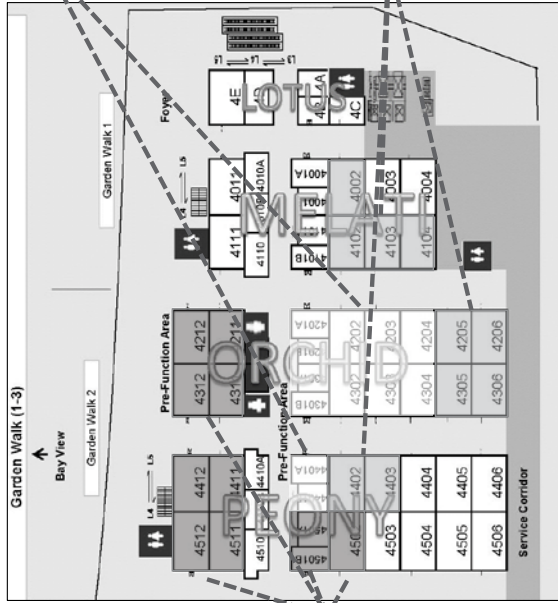
- SC#6: Antennas for 5G, Wi-Fi 6 and Beyond - System aspects and design
- SC#7: Recent Antenna Developments for Space, Deep-Space, and Ground Applications

Zone A
  Zone B

## Level 4 Floorplan, Marina Bay Sands Expo & Convention Centre - 6 to 10 December 2021

Session	Room
Registration	Orchid Ballroom 4201AB to 4301AB
Exhibition	Orchid Ballroom 4202 – 4204 Orchid Ballroom 4302 – 4304
Exhibitors Lunch Room	Peony Ballroom 4401AB

Zone A	
Melati Ballroom 4102 (Virtual Zoom)	
Melati Ballroom 4104	
Melati Ballroom 4103	
Melati Ballroom 4102	
Peony Ballroom 4402	
Peony Ballroom 4403	
Zone A Lunch Room	Orchid Ballroom 4205, 4206, 4305, 4306



Zone B	
Peony Junior Ballroom 4411	
Peony Ballroom 4501AB	
Peony Junior Ballroom 4412	
Peony Junior Ballroom 4512	
Peony Junior Ballroom 4511	
Peony Ballroom 4502 (Virtual Zoom)	
Zone B Lunch Room	Orchid Junior Ballroom 4211, 4212, 4311, 4312

**Legend**  
 Zone A  
 Zone B

**Level 3 Floorplan, Marina Bay Sands Expo & Convention Centre - 6, 8, 9 December 2021**

