2019 IEEE International Symposium on Antennas and Propagation and USNC-URSI National Radio Science Meeting

Final Program

7–12 July 2019
Hilton Atlanta
Atlanta, Georgia, U.S.A.

IEEE

APS

U.R.S.I.

Conference at a Glance

Saturday, July 6
14:00-16:00 Strategic Planning Committee
16:15-17:15 AP-S Meetings Committee
17:15-18:15 JMC Meeting (Closed Session)
18:15-21:30 JMC Meeting, Dinner and Presentations
19:15-21:15 IEEE AP-S Constitution and Bylaws Committee Meeting & Dinner

Sunday, July 7
08:00-10:00 Past Presidents' Breakfast
10:00-18:00 AdCom Meeting
19:30-22:00 Welcome Dessert Reception at the Georgia Aquarium

Monday, July 8
07:00-08:00 Amateur Radio Operators Breakfast
08:00-11:40 Technical Sessions
09:00-18:00 Technical Tour - "An Engineer's Eye View" of the Mercedes Benz Stadium
12:00-13:20 Transactions on Antennas and Propagation Editorial Board Lunch Meeting
13:20-17:00 Technical Sessions
17:00-18:00 URSI Commission A Business Meeting
17:00-18:00 URSI Commission B Business Meeting
17:00-18:00 URSI Commissions C/E (combined) Business Meeting

Tuesday, July 9
07:00-08:00 AP Magazine Staff Meeting
07:00-08:00 APS 2020 Committee Meeting
07:00-08:00 Industrial Initiatives
07:00-08:00 Membership Committee Meeting
07:00-08:00 Student Design Contest (Set-Up - Closed to Others)
07:00-08:00 Technical Committee on Antenna Measurement
08:00-11:40 Student Paper Competition
08:00-11:40 Technical Sessions
08:00-09:30 Student Design Contest (Demo for Judges - Closed to Others)
08:30-14:00 Standards Committee Meeting
09:30-12:00 Student Design Contest (Demo for Public)
09:40-11:00 Student Design Contest Judges Meeting
12:00-13:20 Distinguished Lecturer Lunch
12:00-13:15 Women in Engineering – Lunch and Speaker, Dawn Tilbury
12:00-13:00 Student Design Contest (Luncheon for Judges and Teams)
12:00-13:00 Young Professionals' Committee Meeting
13:20-17:00 Technical Sessions
16:00-18:00 Interactive Forum Sessions
16:00-17:00 Future Symposia Meeting
18:45-22:00 Students and Young Professionals Experience "The Coke Side of Life" at the World of Coca Cola

Wednesday, July 10
07:00-08:00 Student Paper Competition Judges Committee Breakfast
07:00-08:00 Technical Committee On Antenna Measurements
07:30-09:30 Publications Committee Breakfast Meeting
08:00-11:40 A Discussion on the State of CEM Research: Reflections and Outlooks
08:00-11:40 Technical Sessions
09:00-13:00 Student Tour - NSI-MI Facility and Testing Chambers
10:00-11:40 Antennas for 5G and Future Networks: Perspectives and Opinions from Industry and Academia
12:00-13:20 Reviewers' Lunch
13:00-16:00 FCC Amateur Radio License Exam
13:20-17:00 Technical Sessions
17:00-18:00 URSI Commission F Business Meeting
17:00-18:00 URSI Commission K Business Meeting
18:00-19:15 Awards Presentation
19:30-22:30 Celebratory Dinner

Thursday, July 11
06:45-07:45 APS History Committee
08:00-11:40 Technical Sessions
08:00-09:00 Exbhitor Breakfast in Exhibit Hall
09:00-18:00 Technical Tour - "An Engineer's Eye View" of the Mercedes Benz Stadium
12:00-15:00 Chapter Activities Committee Luncheon
12:00-13:20 AWPL Editors' Lunch Meeting
12:00-13:20 Education Committee
12:00-13:20 IEEE Press Liaison Meeting & Lunch
13:00-16:00 FCC Amateur Radio License Exam
13:20-17:00 Technical Sessions
16:00-18:00 Interactive Forum Sessions
18:30-21:00 MGA/NTDC/SIGHT Dinner Meeting
19:00-22:00 USNC-URSI Strategic Planning Meeting

Friday, July 12
08:00-11:40 Technical Sessions
13:20-17:00 Technical Sessions

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Chairs' Welcome

Welcome to the 2019 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting!

This year's combined symposium and meeting event are being held in Atlanta, Georgia at the Hilton Atlanta Hotel located in the heart of the city and within walking distance to several local attractions, restaurants and venues. The Hilton is easily accessible via MARTA from Hartsfield-Jackson International Airport and a covered pedestrian sky-bridge connects the hotel to the MARTA station and the Peachtree Center Mall. Nearby attractions include the Center for Civil and Human Rights, the Centennial Olympic Park, the Georgia Aquarium, the World of Coca-Cola, the College Football Hall of Fame, the Martin Luther King Jr. National Historic Site and the CNN Center. A short cab ride from the hotel are the vibrant neighborhoods of Midtown, Virginia Highlands and Buckhead, with fine dining, shopping, museums and cultural events taking place every summer.

Atlanta is a city rich in history and robust with heritage. From its role in the American Civil War and Sherman's destructive march through Atlanta streets, Georgia's capital has been a place wrought with history-making events. Later, as Martin Luther King, Jr. made Atlanta the home of the Civil Rights Movement, this hub of the Southeast once again took center stage in events that would alter the course of history.

Today Atlanta is a thriving metropolis with Southern charm and world-class sophistication. Atlanta is also home to many professional sports teams including the Atlanta Braves baseball team, the Atlanta Falcons football team, the Atlanta Hawks basketball team and the Atlanta United soccer team. Both the Braves and Atlanta United have home games during the July symposium. Technical tours for Mercedes Benz Stadium are being scheduled, too!

This year's technical program includes a wide range of technical sessions, workshops, and short courses, as well as numerous exhibits. It also has a number of activities dedicated specifically to students and young professionals.

This event is the premier international forum for the exchange of ideas on state-of-the-art research in antennas and propagation and radio science. Through a range of technical and social activities, it provides the opportunity to interact with the world's leading experts in antennas and propagation and radio science from academia, industry, and government.

We welcome you to join us for an exciting program in Atlanta in July 2019!

General Co-Chairs
John Papapolymerou
Michigan State University

Manos Tentzeris
Georgia Institute of Technology

Sessions at a Glance — Monday

Location	Morning		Afternoon	
Ballroom C	MO-SP.1A: Low-Cost Phased Array Technology		MO-SP.1P: Application of Machine/Deep Learning and Uncertainty Quantification Techniques in Computational Electromagnetics	
Ballroom D	MO-SP.2A: Emerging Technologies for Biomedical Applications		MO-SP.2P: Space-Time Modulated Metamaterials	
Ballroom A	MO-UB.1A: Metamaterials		MO-A1.1P: Broadband Antennas	
Ballroom B	MO-A5.1A: Antennas for 5G I		MO-A5.1P: Antennas for 5G II	
Room 204/205	MO-A1.1A: Beam Forming, Angle of Arrival and Pattern Synthesis		MO-A1.2P: Reflectarray Design and Applications	
Room 206/207	MO-A1.2A: Dielectric Resonator Antennas		MO-A1.3P: Novel Reconfigurable Antennas and Arrays	
Room 209/210	MO-A5.2A: Additively Manufactured Antennas and Structures		MO-A1.4P: Slot Antennas	
Room 213/214	MO-A2.1A: Electromagnetic Measurements and Material Characterization I		MO-A2.1P: Electromagnetic Measurements and Material Characterization II	
Room 203	MO-A5.3A: Millimeter-wave and Terahertz Antenna Design and Optimization		MO-UB.1P: THz, Millimeter-Wave and Nanoscale EM	MO-A5.2P: Terahertz Sensing Applications
Room 302	MO-A1.3A: Leaky-Wave and Travelling-Wave Antennas		MO-UB.2P: Antenna Array I	
Room 303	MO-A1.4A: Broadband Antennas for 5G systems	MO-A2.2A: Analysis of Metamaterials and Metasurfaces	MO-A5.3P: Biomedical Applications of Electromagnetics I	
Room 304	MO-A4.1A: Remote Sensing		MO-A4.1P: Scattering, Diffraction and RCS	
Room 305	MO-A3.1A: Transient Simulations		MO-UB.3P: Time-Domain Methods	
Room 211	MO-UB.2A: Frequency Selective Surfaces and Filters	MO-A1.5A: Spiral Antennas	MO-UB.4P: Frequency Domain Methods	
Room 212	MO-UB.3A: Antenna Theory and Design I		MO-UB.5P: Antenna Theory and Design II	MO-UB.6P: Antenna Theory and Arrays

Sessions at a Glance — Tuesday

Location	Morning		Afternoon	
Ballroom C	TU-SP.1A: Memorial Session for Dr. R. C. Hansen		TU-SP.1P: Cybersecurity and Electromagnetic Systems: From DC to Daylight and from Wireless to Wired	
Ballroom D	TU-SP.2A: International Collaborations on Next-Generation Radio Astronomical Instruments		TU-SP.2P: Metasurfaces in Antenna Applications	
Ballroom A	TU-UB.1A: Cognitive Radio I		TU-A5.1P: RFID Systems and Applications	
Ballroom B	TU-A5.1A: 5G MIMO Antenna Technology		TU-A5.2P: Millimeter-wave Antennas	
Room 204/205	TU-A2.1A: Metasurfaces for Beam Shaping		TU-UB.1P: Wireless Communications	
Room 206/207	TU-A1.1A: Material and Structural Antenna Reconfigurability		TU-A1.1P: Pattern Reconfigurable Antennas	
Room 209/210	TU-A1.2A: Reflector Designs and Applications		TU-A5.3P: Recent Advances in 4G and 5G Antennas for Mobile Devices	
Room 213/214	TU-A2.2A: Theoretical Electromagnetics I		TU-A2.1P: Frequency Selective Surfaces: Applications	
Room 203	TU-A5.2A: Terahertz Antennas		TU-A1.2P: Antenna Feeds and Matching Circuits I	
Room 302	TU-UB.2A: Antenna Array II		TU-UB.2P: Antenna Array III	
Room 303	TU-A5.3A: Biomedical Applications of Electromagnetics II		TU-A5.4P: Biomedical applications of Electromagnetics III	
Room 304	TU-A3.1A: Hybrid Methods I	TU-UB.3A: Hybrid Methods II	TU-A3.1P: Finite Element Methods	TU-A3.2P: High Frequency and Asymptotic Techniques
Room 305	TU-A3.2A: Computational Methods for Coupling and Scattering		TU-A3.3P: Computational Electromagnetics I	
Room 211	TU-A2.3A: THz and Optical Metamaterials	TU-A5.4A: Additively Manufactured Antennas	TU-A5.5P: Educational Advances	TU-UA.1P: High-Frequency and Millimeter Wireless Metrology
Room 212	TU-A4.1A: Imaging and Scatterer Characterization		TU-A4.1P: Imaging Methods and Systems	

Interactive Forum – Tuesday

Location	Afternoon
Tuesday, July 9, Salon West	
Boards 1-5	TUP-A4.1P: Millimeter-wave Propagation
Boards 6-15	TUP-A4.2P: Propagation and Scattering in Complex and Random Media
Boards 16-19	TUP-A4.3P: Propagation in Tunnel-like Environments
Boards 21-30	TUP-A4.4P: Wave Propagation in Atmospheric Environment
Boards 31-35	TUP-A4.5P: Wave Propagation in Indoor Environment
Boards 36-46	TUP-A4.6P: Wave Propagation in Urban and Suburban Environments

Sessions at a Glance — Wednesday

Location	Morning		Afternoon	
Ballroom C			WE-SP.1P: Time-Domain Computational Methods for Complex Electromagnetic and Multiphysics Problems	
Ballroom D	WE-SP.1A: Optically Transparent Antennas		WE-SP.2P: Design and Integration Aspects of Beyond 5G Communications for Mobile Devices	
Ballroom A	WE-A1.1A: Broadband/Ultra Wideband Antennas and Systems I		WE-A1.1P: Broadband/Ultra Wideband Antennas and Systems II	
Ballroom B	WE-A1.2A: IoT, 5G and mm-Wave Antennas and Components		WE-A1.2P: Microstrip Antennas, Circuits and Design I	
Room 204/205	WE-A1.3A: Multi-band Antennas I		WE-A1.3P: Multi-band Antennas II	
Room 206/207	WE-A1.4A: Frequency Reconfigurable and Tunable Antennas		WE-A1.4P: Reconfigurable Arrays	
Room 209/210	WE-A5.1A: Vehicular Antennas and Electromagnetics		WE-A5.1P: Electromagnetic Energy Harvesting	
Room 213/214	WE-A2.1A: Wide- and Dual-Band Frequency Selective Surfaces		WE-A2.1P: Electromagnetic Band Gap Structures	
Room 203	WE-A1.5A: Antenna Feeds and Matching Circuits II		WE-A2.2P: Metasurfaces and Transmit/Reflect Arrays	
Room 302	WE-A1.6A: Array System Technologies		WE-A1.5P: Broadband Arrays	
Room 303	WE-A5.2A: Biomedical Applications of Antennas		WE-UK.1P: Implantable and Ingestible Devices	WE-UK.2P: Biomedical Applications
Room 304	WE-A4.1A: Methods of Inverse Scattering		WE-UB.1P: Fast Methods	WE-A3.1P: High Performance Computing
Room 305	WE-A3.1A: Optimization methods in EM designs		WE-UB.2P: Integral Equation Methods I	
Room 211	WE-UB.1A: MIMO Antennas and Systems	WE-UB.2A: EBG, UWB and RFID based Antennas	WE-UF.1P: Point-to-Point Propagation Effects	
Room 212	WE-UB.3A: Microstrip Antennas and Printed Devices	WE-A2.2A: Theoretical Electromagnetics II	WE-A1.6P: Antenna Feeds and Matching Circuits III	WE-UE.1P: Interference and Environmental Effects

Sessions at a Glance — Thursday

Location	Morning		Afternoon	
Ballroom C	TH-SP.1A: Advanced DGTD and FVTD Methods		TH-SP.1P: Innovative Reconfigurable and Multifunction Antenna Arrays	
Ballroom D	TH-SP.2A: Driving Forward: Advances in Propagation Modeling for Wireless Systems		TH-SP.2P: Antennas and RF Systems for Inteference Mitigation and Spectrum Management	
Ballroom A	TH-A1.1A: Multi-band antennas for Mobile Communications		TH-A1.1P: Broadband, Wideband and High-Gain Printed Antennas	
Ballroom B	TH-A2.1A: Nanoelectromagnetics		TH-A1.2P: Antennas for 5G and Wireless Applications	
Room 204/205	TH-A2.2A: Cloaking/RCS Reduction and Absorption		TH-A1.3P: Electrically Small Antennas	
Room 206/207	TH-A1.2A: Microstrip Antenna Arrays I		TH-A1.4P: Application of Microstrip and Printed Antennas	
Room 209/210	TH-A1.3A: Adaptive, Active and smart antennas		TH-A5.2P: Advances in Radar, Massive and Multiuser MIMO Antenna Systems	
Room 213/214	TH-A1.4A: Antennas from Tesla to Today		TH-A2.1P: Metastructures for Antennas	
Room 203	TH-A2.3A: Topics in Metamaterials and Metasurfaces		TH-A2.2P: Space-Time and Tunable Metastructures	
Room 302	TH-A1.5A: Slot Arrays I		TH-UB.1P: EM Interaction and Coupling	
Room 303	TH-UA.1A: Bioeffects and medical applications	TH-UK.1A: Human-body Interactions with Antennas and other Electromagnetic Devices	TH-A3.1P: Sensing and Imaging in Challenging Environments	
Room 304	TH-A4.1A: Novel Radar Techniques	TH-A4.2A: Inverse Scattering and Imaging	TH-A3.2P: Finite-Difference Time-Domain Methods	
Room 305	TH-A3.1A: Integral Equation Methods II		TH-A3.3P: Integral Equation Methods III	
Room 211	TH-UB.1A: Theoretical Electromagnetics III	TH-UB.2A: Guided Wave and Waveguiding Structures	TH-UA.2P: EM-field metrology	TH-UA.3P: Microwave to Sub-millimeter Measurements/Standards
Room 212	TH-A5.1A: Novel Energy Harvesting Techniques	TH-UC.1A: Communication Systems	TH-A4.1P: Engineered Scattering Surfaces	TH-UB.2P: Propagation Phenomenon and Effects

Interactive Forum – Thursday

Location	Afternoon
Thursday, July 11, Salon West	
Boards 1-9	THP-A1.1P: Antenna Theory I
Boards 11-20	THP-A1.2P: Antenna Theory II
Boards 21-29	THP-A1.3P: Antennas in Theory and Practice
Boards 31-38	THP-UF.1P: Microwave Remote Sensing
Boards 41-50	THP-UF.2P: Propagation and Remote Sensing in Complex and Random Media

Sessions at a Glance — Friday

Location	Morning		Afternoon	
Ballroom C	FR-SP.1A: Recent Advances in Multi-Material Additive Manufacturing for Antennas and Microwave Devices		FR-SP.1P: UWB Antenna Technologies for Radar	
Ballroom D	FR-SP.2A: Antenna Innovations and Open Challenges for Small Satellites and CubeSats		FR-SP.2P: Topological Electromagnetics	
Ballroom A	FR-A5.1A: Ultra-wideband Components and Systems		FR-A1.1P: Microstrip Antenna Analysis and Design	
Ballroom B	FR-A1.1A: Circularly Polarized Patch and Printed Antennas		FR-A1.2P: Reconfigurable Reflectarrays	
Room 204/205	FR-A1.2A: Mutual Coupling in Antenna Arrays		FR-A2.1P: Novel Metasurfaces and Applications	
Room 206/207	FR-A5.2A: Elements and Arrays for Sensing and Measurement		FR-A5.1P: 3D Printed Antennas and Structures	
Room 209/210	FR-A5.3A: Wireless Power Transfer		FR-A1.3P: Radiators and their Array Integration	
Room 213/214	FR-A2.1A: Design of Metamaterials and Metasurfaces		FR-A2.2P: Tunable and Reconfigurable Frequency Selective Surfaces	
Room 203	FR-UA.1A: Antennas		FR-A5.2P: Sub-6 GHz MIMO Antenna Design	FR-A1.4P: Polarization Reconfigurable Antennas
Room 302	FR-A5.4A: Cognitive Radio II	FR-A5.5A: On-Chip Antennas		
Room 303	FR-A5.6A: Chamber Technology for MIMO Antenna Measurements	FR-A5.7A: Antennas for RFID applications		
Room 304	FR-UC.1A: Target Detection and Tracking			
Room 305	FR-A3.1A: Computational Electromagnetics II			
Room 211	FR-A1.3A: Microstrip Antenna Arrays II	FR-A1.4A: Microstrip Antennas, Circuits and Design II	FR-A1.5P: Slot Arrays II	FR-A1.6P: Array Hardware Systems
Room 212	FR-UB.1A: Imaging, Scattering and Remote Sensing			

Registration

The on-site Registration Desk is located on the **Lobby Level across from the Marketplace**. The Registration Desk may be reached by phone at 817-554-5378 during the regular operating hours shown below.

Registration will be open during the following hours:

Sunday, July 7.....07:00 – 18:30 (Badge pick-up only: 18:30–20:30)
Monday, July 8.....07:00 – 17:00
Tuesday, July 9.....07:00 – 18:00
Wednesday, July 10.....07:00 – 18:00
Thursday, July 11.....07:30 – 18:00
Friday, July 12.....07:30 – 17:00

Devotions

Room 301 is available for Devotions from 07:00–08:00 Monday, July 8 through Friday, July 12.

Speaker Preparation Room

Room 311 is the Speaker Preparation Room and is available from 08:00–17:00 daily Monday, July 8–Friday, July 12. The room contains a computer identical to those used in the presentation rooms. The speakers may use this room and equipment to test presentations prior to the scheduled presentation.

Internet Access

Wireless internet access (Wi-fi) is provided to all participants throughout the meeting space and lobby areas at the Hilton Atlanta. Attendees can connect to the **`APS 2019`** network. The access password is **`ieeeaps2019`**.

If you are staying at the Hilton Atlanta, please note that the complimentary access from your guest room will be different, and you should follow the instructions noted there.

Morning and Afternoon Refreshment Break Locations

Please note on Monday, July 8 and Friday, July 12, morning and afternoon breaks (at 09:40 and 15:00 respectively) will be held on **Level 2 in the Grand Ballroom and Salon Foyers**. Tuesday – Thursday, July 9 – 11, the breaks will be held in the **Salon East on the Exhibit Hall show floor**. Remember, too, that on Tuesday and Thursday, beginning at 16:00, there will be Poster Session Receptions in **Salon West**.

Meeting and Event Schedule

Saturday, July 6

14:00-16:00	Strategic Planning Committee	Room 214
16:15-17:15	AP-S Meetings Committee	Salon East
17:15-18:15	JMC Meeting (Closed Session)	Salon East
18:15-21:30	JMC Meeting, Dinner and Presentations	Salon East
19:15-21:15	IEEE AP-S Constitution and Bylaws Committee Meeting & Dinner	Room 214

Sunday, July 7

08:00-10:00	Past Presidents' Breakfast	Salon West
10:00-18:00	AdCom Meeting	Salon East
19:30-22:00	Welcome Dessert Reception	Georgia Aquarium

Monday, July 8

07:00-08:00	Amateur Radio Operators Breakfast	Crystal Ballroom A
09:00-18:00	Technical Tour: "An Engineer's Eye View" of the Mercedes Benz Stadium	Depart from Hilton Atlanta
12:00-13:20	Transactions on Antennas and Propagation Editorial Board Lunch Meeting	Crystal Ballroom A/F
17:00-18:00	URSI Commission A Business Meeting	Room 211
17:00-18:00	URSI Commission B Business Meeting	Room 212
17:00-18:00	URSI Commissions C/E (combined) Business Meeting	Room 209/210

Tuesday, July 9

07:00-08:00	APS 2020 Committee Meeting	Crystal Ballroom C
07:00-08:00	AP Magazine Staff Meeting	Crystal Ballroom A
07:00-08:00	Industrial Initiatives	Crystal Ballroom B
07:00-08:00	Technical Committee on Antenna Measurement	Room 312
07:00-08:00	Membership Committee Meeting	Room 306
07:00-08:00	Student Design Contest (Set-Up - Closed to Others)	Level 2 Foyer
08:00-11:40	Student Paper Competition	Level 2 Foyer
08:00-09:30	Student Design Contest (Demo for Judges - Closed to Others)	Level 2 Foyer
08:30-14:00	Standards Committee Meeting	Room 307
09:30-12:00	Student Design Contest (Demo for Public)	Level 2 Foyer
09:40-11:00	Student Design Contest Judges Meeting	Room 306
12:00-13:20	Distinguished Lecturer Lunch	Room 301
12:00-13:15	Women in Engineering – Lunch and Speaker, Dawn Tilbury	Crystal Ballroom A/F
12:00-13:00	Student Design Contest (Luncheon for Judges and Teams)	Crystal Ballroom B
12:00-13:00	Young Professionals' Committee Meeting	Crystal Ballroom C
16:00-17:00	Future Symposia Meeting	Crystal Ballroom C
18:45-22:00	Students and Young Professionals Experience "The Coke Side of Life"	World of Coca-Cola

Wednesday, July 10

07:00-08:00	Student Paper Competition Judges Committee Breakfast	Crystal Ballroom A
07:00-08:00	Technical Committee On Antenna Measurements	Room 312
07:30-09:30	Publications Committee Breakfast Meeting	Crystal Ballroom C
08:00-11:40	Special Session Panel: A Discussion on the State of CEM Research	Grand Ballroom C
09:00-13:00	Student Tour - NSI-MI Facility and Testing Chambers	Depart from Hilton Atlanta
10:00-11:40	Special Session Panel: Antennas for 5G and Future Networks	Grand Ballroom D
12:00-13:20	Reviewers' Lunch	Salon West
13:00-16:00	FCC Amateur Radio License Exam	Room 208
17:00-18:00	URSI Commission F Business Meeting	Room 211
17:00-18:00	URSI Commission K Business Meeting	Room 212
18:00-19:15	Awards Presentation	Grand Ballroom A-D
19:30-22:30	Celebratory Dinner	Salon West

Thursday, July 11

06:45-07:45	APS History Committee	Crystal Ballroom C
08:00-09:00	Exbhitor Breakfast in Exhibit Hall	Salon East
09:00-18:00	Technical Tour - "An Engineer's Eye View" of the Mercedes Benz Stadium	Depart from Hilton Atlanta
12:00-15:00	Chapter Activities Committee Luncheon	Crystal Ballroom A/F
12:00-13:20	AWPL Editors' Lunch Meeting	Crystal Ballroom C
12:00-13:20	IEEE Press Liaison Meeting & Lunch	Room 301
12:00-13:20	Education Committee	Crystal Ballroom B
13:00-16:00	FCC Amateur Radio License Exam	Room 208
18:30-21:00	MGA/NTDC/SIGHT Dinner Meeting	Crystal Ballroom A/F
19:00-22:00	USNC-URSI Strategic Planning Meeting	Room 301

Special Session Panels

A Discussion on the State of CEM Research: Reflections and Outlooks

Wednesday, July 10, 08:00 - 11:40, Grand Ballrooom C

Organizers & Discussion Moderators

Prof. Balasubramaniam Shanker (Michigan State University, US) and Prof. Marinos Vouvakis (University of Massachusetts Amherst, US)

Format

Two five-member round tables with discussion moderators

Topic

This special session will delve into a vigorous discussion on the current state of computational electromagnetics (CEM) research but also attempt to flesh-out potential research directions and opportunities in the area. We aim to foster a discussion on what new CEM capabilities are necessary to tackle emerging engineering or scientific applications and shed light on limitations of current state of art as we (as a society) grapple with increasingly rich electromagnetic environments.

We have invited a diverse group of world-renowned researchers, some of whom are CEM visionaries, accomplished EM developers, as well as leaders in cutting-edge and emerging engineering design disciplines that make use or will need advanced computational capabilities. The discussions will be organized into two round table, one before coffee break and one after that.

In addition to addressing questions posed by the moderators, the round tables will devote significant time in addressing questions from the audience.

Round Table 1 (first half of the session)

Prof. W.-C. Chew (Purdue University, US)

Prof. E. Michielssen (University of Michigan, US)

Dr. D Dault (US Air Force Research Lab, CREATE RF Group, US)

Prof. S. Maci (University of Siena, Italy)

Prof. M. Swaminathan (Georgia Institute of Technology, US)

Round Table 2 (second half of the session)

Prof. J.-F. Lee (The Ohio State University, US)

Prof. J. M. Jin (University of Illinois Urbana-Champaign, US)

Prof. Y. Rahmat-Samii (University of California Los Angeles, US)

Prof. C. Caloz (Ecole Polytechnic Montreal, Canada)

Prof. A. Neto (Technical University of Delft, The Netherlands)

Antennas for 5G and Future Networks: Perspectives and Opinions from Industry and Academia

Wednesday, July 10, 10:00 - 11:40, Grand Ballrooom D

IEEE Standards Overview

SC-2: IEEE-AP Standards Overview

Vikass Monebhurrun, Vince Rodriguez, Lars Foged

Sunday, July 7, 08:00 - 17:00

Location: Room 209/210

We have observed that many AP-S members are not familiar with the AP-S standards, recommendations and guides. Therefore, the Antennas & Propagation Standards Committee (APS/SC) is holding this short course to raise awareness of these documents. The important ones are related to terms and definitions (e.g. continuous misuse of "return loss"), antenna, RCS and near-field measurements.

Short Courses

Full Day

SC-1: Base Station Antennas for 5G - System aspects, design and verification

Claes Beckman and John Sanford

Sunday, July 7, 08:00 - 17:00

Location: Room 206

This short course gives the participants an overview of the application, implementation, design and verification of base station antennas for 5G. In particular it is aimed at microwave, RF- and antenna engineers in the wireless area, but also useful for researchers looking for relevant research topics and system engineers needing a deeper understanding of the antenna component of their system.

The course explains underlying theoretical and practical implementation aspects of base station antennas in mobile communication networks of today and in 5G networks but discusses also their design, requirements and verification.

Half Day (Morning)

SC-3: Fully-Polarimetric Phased Array Far Field Modeling

Joseph Hucks

Sunday, July 6, 08:00 - 12:00

Location: Room 211

In this tutorial, the methods used in industry by the instructor to model phased arrays, with all the effects of polarization in the far field, will be taught. Maxwell's equations and their time-harmonic general solutions in the far field will be reviewed. First cut and general element patterns with arbitrary polarization will be discussed and developed, together with the very useful Ludwig-3 polarization basis. The effects of mutual coupling among phased array elements will also be summarized. As the array elements need to be translated and rotated into their desired positions and orientations, the effect of translations and rotations on far field patterns is discussed, with an introduction to rotation matrices and a brief excursion into tensor algebra to better understand the components of the rotation matrix. The relationship between quaternions and rotation matrices is also given. The general formula for the far field electric field of a general 3D phased array with arbitrary elements is developed. Examples with identical elements in the same orientation in either an arbitrary 3D array, or the more common rectangular planar array are discussed, together with the associated array factors. Conformal arrays are briefly discussed in the context of specification of their orientation. Basic elements of beamsteering and beamforming are discussed at the end. The course will be taught at a level that may be followed by those with a background in basic electromagnetics and linear algebra

SC-4: Effective Medium Theories Backward in Time: From the 21st to the 19th Century - Non-Asymptotic and Nonlocal Approximations, Finite Samples, Interface Boundaries

Igor Tsukerman

Sunday, July 7, 08:00 - 12:00

Location: Room 212

Electromagnetic metamaterials are artificial periodic structures engineered to control the propagation of waves and to achieve physical effects not attainable in natural materials – high-frequency magnetism, negative refraction, strong absorption, lensing, cloaking, and more. Research in metamaterials started three decades ago, if not earlier, and exploded in the 2000s as a quest for "perfect lenses," "perfect absorbers," etc. But, as the field of metamaterials matured, it became clear that ideal devices were not realizable because of losses, finite lattice cell sizes, and other factors. Undoubtedly, however, "imperfect" materials and devices will continue to be developed, and we can therefore expect a growing need for more sophisticated methods of their analysis and, more specifically, for accurate homogenization theories valid for any composition and size of the lattice cell.

The objective of homogenization (effective medium theory) is to describe a composite structure in terms of effective parameters accurately representing reflection, transmission and propagation of waves on the scale coarser than the lattice cell size.

The course introduces a homogenization methodology valid in both electrostatics and electrodynamics and applicable to an arbitrary size and composition of the lattice cell. Nonlocal effects can be included in the model, making order-of-magnitude accuracy improvements possible. We then travel backward in time and explore the connection between the new framework and the classical 19th – early 20th century theories of Clausius-Mossotti, Lorenz-Lorentz, Maxwell Garnett.

A particularly challenging problem for future research is to determine what effective material tensors are attainable for given constituents of a metamaterial with their given properties, and how the lattice cell could be designed to produce such tensors. For example, what is the maximum effective permeability achievable? Bounds for effective parameters are currently known only for relatively simple settings, such as static dielectric permittivity of mixtures with two ingredients. The methodology developed in this course may help to make progress toward solving a much broader set of problems of this kind. This methodology can also be extended to other areas – for example, acoustics or eddy current problems in laminated cores of electric machines.

SC-5: Beam Forming/Steering With Natural and Metamaterial Antennas and Fixed Beam Forming with Metaplates

Hisamatsu Nakano

Sunday, July 7, 08:00 - 12:00

Location: Room 213/214

The main disadvantage with forming a beam in a specific direction using an array antenna is that it requires multiple radiation elements, phase shifters, and signal processing circuits. The size, weight, and cost of such an antenna prohibit its use in modern portable transceivers. This short course describes how to overcome such issues, presenting recent progress in beamforming antennas. The course is composed of three chapters.

Chapter 1 describes beam-forming antennas that are fabricated using conventional natural materials. Each antenna is composed of a main radiation element and parasitic elements. A detailed discussion of beam forming in 2, 4, and 16 directions is presented. The presentation reveals the reconfigurablity of the antenna characteristics, and includes the radiation pattern, input impedance, and gain, when the beam is steered around the antenna axis. Note that the radiation from these antennas is linearly polarized (LP).

Chapter 2 introduces circularly polarized (CP) beam-forming metamaterial antennas that can steer their beam in both the azimuth and elevation planes. The antenna height is chosen to be extremely small: on the order of lambda/100 at the operating frequency. This makes these antennas suitable for installation on the surface of moving objects, such as vehicles and satellites.

Chapter 3 presents high-gain antennas with a beam that can be tilted in specific directions. It is emphasized that these antennas do not use phase shifters; each antenna is composed of a single radiation source and N (= 1, 2, 3) inhomogeneous loop-based metaplates, which are placed above the radiation source. The mechanism for forming a tilted beam is explained and radiation beams with a tilt angle of 30 and 60 degrees from the zenith are demonstrated.

Half Day (Afternoon)

SC-6: Application of Deep Learning in Computational Electromagnetics

Maokun Li

Sunday, July 7, 13:00 - 17:00

Location: Room 209/210

In recent years, research in deep learning techniques has attracted much attention. With the help of big data technology, massive parallel computing, and fast optimization algorithms, deep learning has greatly improved the performance of many problems in the speech and image research. In this short tutorial, the presenter hopes to share some of his learnings in deep learning techniques, and discuss the potential and feasibility of applying deep learning in computational electromagnetics. The presenter hopes to explore the characteristics, feasibility, and challenges of deep learning methods in the field of computational electromagnetics through some preliminary research on solving Poisson's equation, array antenna synthesis, electromagnetic imaging, etc.

SC-7: Origami-inspired shaped reconfigurable tunable RF structures using additive manufacturing technologies

Syed Abdullah Nauroze, Manos Tentzeris, Glaucio Paulino, H. Jerry Qi, Stavros V. Georgakopoulos, Sungjoon Lim

Sunday, July 7, 13:00 - 17:00

Location: Room 211

The proliferation of wireless market has driven the demand of smart RF systems with multi-functional sensing, energy harvesting and communication modules that can readily reconfigure their electromagnetic response depending on changes in their environment. This requires low-cost, compact, flexible and reconfigurable RF components that can be printed on-demand and scaled-to-large numbers. However, current systems are inadequate to meet these demands which can be largely attributed towards use of - 1) subtractive manufacturing technologies (SMTs) and 2) conventional tunability schemes that become non-linear and complicated as structure size increases.

Traditional SMTs are complicated, require specialized clean room environment and can only realize planar RF modules with high fabrication cost & time and moderate achievable performance. Moreover, their planar configuration can only support finite tunability mechanisms that can be broadly categorized into changing material properties, using complex electronics or micro-electromechanical (MEMS) structures. These techniques are typically power hungry, laborious, expensive with limited (discrete-state) tunability range making them impractical as the size of the structure increases. In comparison, mechanical tuning mechanisms features superior power handling capability, quality factor, linearity and wide-band (continuous range) tunability but their bulky size, heavy weight and low switching/tuning speed has restricted their use in modern communication systems.

The hidden link between the two approaches are smart 4D origami-inspired RF structures; that are designed to mimic nature's wisdom of self-assemblage and shape-reconfiguration in a well-studied and controlled manner to achieve tunability through shape-morphing.

SC-8: Unbalanced Fed Ultra Low Profile Inverted L Antenna and Functional Antennas

Mitsuo Taguchi

Sunday, July 7, 13:00 - 17:00

Location: Room 212

Due to the development of wireless communication technology, low profile, high gain, multiband, or wideband antennas are desired. This short course presents an unbalanced fed ultra low profile inverted L (ULPIL) antenna and the functional antennas composed of ULPIL antenna. At first, the principle of impedance matching is discussed by comparing with that in the inverted F antenna. Then the design of following functional antennas are presented.

SC-9: Surface Electromagnetics in Antenna Engineering: From EBG to Meta-surfaces and Beyond

Yahya Rahmat-Samii, Fan Yang

Sunday, July 7, 13:00 - 17:00

Location: Room 213/214

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.

WS-1: The Forward Transmission Matrix (FTM) Method for Solving Microwave Circuits and Finding Surface Current Distributions

Omar F. Siddiqui

Sunday, July 7, 13:00 - 17:00

Location: Room 207

In the classical Electromagnetics textbooks, the microwave devices such as circulators, couplers, and filters are solved by non-systematic approaches such as even-odd mode analysis. Hence an electrical engineering student coming from the conventional circuit theory background encounters difficulties in understanding and solving microwave circuits. In this paper, we propose a modified node voltage analysis method in which the circuit branches are represented by their forward transmission matrices so that the electromagnetic wave propagation is taken care of. The Kirchhoff's current rule, tailored for high frequencies, is applied to formulate the simultaneous node voltage equations which are subsequently solved by matrix inversion. Voltages and currents and the resulting S-parameters can then be calculated. From the node currents, a 2D voltage or current surface distribution can also be generated that can reveal the underlying propagation mechanisms for different microwave (non-radiating) circuits. Examples include filters, couplers, duplexers, and other novel designs.

In this workshop, I will present a systemic approach of solving voltages and currents for selected circuit designs from recently published papers. I will provide MATLAB codes for these circuits which can be further modified to be used in any other circuit design.

In the examples that I will provide from my own papers, the FTM method results strengthened the paper presentation and hence contributed to their acceptance in renowned journals such as IEEE Transactions on Microwave theory and techniques, Applied Physics Letters, and IEEE Access.

Social Events

Welcome Reception at the Georgia Aquarium

The Steering Committee has chosen a spectacular venue for the AP-S 2019 Welcome Reception, the Georgia Aquarium in Downtown Atlanta, the largest aquarium in the US. The Aquarium contains more than one hundred thousand animals, representing 700 species of fish and other sea creatures with notable specimens include whale sharks, beluga whales, California sea lions, bottlenose dolphins, and manta rays. Georgia Aquarium is a scientific institution that entertains and educates, features exhibits and programs of the highest standards, and offers engaging and exciting guest experiences that promote the conservation of aquatic biodiversity throughout the world.

NEWLY ADDED – A SPECTACULAR DOLPHIN SHOW! LOVED BY LOCALS AND TOURISTS ALIKE! Don't miss the amazing bottlenose dolphins, and see how graceful, athletic and intelligent they are, as well as the relationships they have with their trainers. The show begins at 20:15, and theatre doors open at 19:45. Remember to consider the "splash zone" at Dolphin Coast, when selecting your seat!

Date: Sunday, July 7

Reception: Doors open at 19:30. Please note that this is a Dessert Reception, and that guests are asked to have dinner at their leisure prior to arriving at the Aquarium.

Transportation: Shuttle Bus transportation will run between the Hilton Atlanta beginning at 19:00.

Fee: Complimentary for AP-S 2019 registered attendees and their guests. Delegates must indicate attendance during registration in order to receive a ticket.

Women in Engineering - Lunch and Speaker

Join the AP-S WIE for a special luncheon and speaker, **Dawn Tilbury**, Assistant Director to the Directorate for Engineering at the NSF and Professor at the University of Michigan. This event is open to all conference participants, but pre-registration is required. The scopes of interest of the WIE include increasing the participation of women within IEEE, gathering and disseminating information regarding the status of women, and initiatives for, by and on behalf of women in engineering and science.

Date: Tuesday, July 9

Time: 12:00 - 13:15

Location: Crystal Ballroom A/F

Fee: Advance registration is required, and there is a $20.00 fee for the two-course, plated lunch. Please indicate your choice of entrée salad – vegetarian or with beef.

Students and Young Professionals Experience "The Coke Side of Life" at the World of Coca Cola

The World of Coca-Cola (WOCC) is one of Atlanta's best tourist attractions. This year, AP-S 2019 Students and Young Professionals are invited to join this social activity at the museum, where you can experience the history of the world's most famous beverage brand at the dynamic, multimedia home of the 134-year-old secret formula for Coca-Cola. Get closer than ever before to the vault containing the secret recipe, view more than 1,200 never-before-displayed artifacts and get a behind-the-scenes look at the bottling process. Take a trip around the world in a thrilling 4-D movie experience and tempt your taste buds with more than 100 beverages from around the world. Remember, Coca Cola is...the "Official Soft Drink of Summer!"

Date: Tuesday, July 9
Time: 17:45 departure from the Hilton Atlanta
Location: 121 Baker Street NW
Fee: Advanced registration is required. $20.00 for Students and Young Professionals; only a limited number of tickets are available for advisors at $25.00.

Reviewers' Lunch

The Reviewers' Lunch is open to all reviewers of the last year for the APS Transactions and Journals.

Date: Wednesday, July 10
Time: 12:00 - 13:20
Location: Salon West
Fee: Complimentary for all registered attendees, who participated in the APS Transactions and Journals review process during the last year. Advance registration is required. Please indicate your choice of entrée – chicken or vegetarian.

Awards Presentation

Please join the Antennas and Propagation Society's Awards Committee, as they honor the distinguished accomplishments of the society's professional community. This year's IEEE Electromagnetics Award will be presented to Rick Ziolkowski, Professor Emeritus of Electrical and Computer Engineering at The University of Arizona. 2019 IEEE AP-S Fellows are recognized during this awards event. NOTE the format, introduced during the 2016 event, as the awards will be presented during a special evening session at the Hilton Atlanta, to be followed by the Celebratory Banquet, which is a ticketed event. The Awards Presentation is open to all conference registrants and their guests, but advance registration is required

Date: Wednesday, July 10
Time: 18:00 - 19:15
Location: Grand Ballroom A–D
Fee: There is no fee to attend the Awards Presentation, but advance registration is required. If you wish to join the awards recipients during this event, please register to attend.

Celebratory Banquet

This evening's Celebratory Banquet will take place in Salon West at the Hilton Atlanta. It is open to all conference registrants and their guests, and it requires a separate ticket purchase. A three-course plated dinner and wine will be served, and you'll enjoy live music.

Date: Wednesday, July 10
Time: 19:30 - 22:30
Location: Salon West
Fee: $70 (Advance Rate): $90 (On-Site Rate *)
* Please note that a limited number of tickets will be available for sale at the On-Site Rate.

Companion Program

Companion Program hosts Judy Long, Sue Stone and Joanne Wilton will be onsite in the Companion Suite (Rooms 309-310) to welcome registered companions for breakfast each morning.

For additional information or any questions, please contact either of the co-chairs via e-mail:
SueLStone@hotmail.com
jjwilton@mindspring.com
judimlong@swbell.net

Amateur Radio at IEEE AP-S/URSI 2019

Radio Amateurs are encouraged to display their call sign on their conference badge! In 2015, APS held the first-ever Amateur Radio breakfast meeting. Given the very favorable response, we continued these initiatives, now bringing us to our 5th Annual Amateur Radio Breakfast. Our efforts are supported by the Education and SIGHT Committees.

Welcome to Atlanta 2019, and further expansion of this special interest group.

ARRL will be publishing stories about our Amateur Radio activities at IEEE AP-S/URSI 2019. These activities will include:

FCC Amateur Radio License Exam Session - Wednesday, July 10 and Thursday, July 11

Volunteer Examiners from Boston will be onsite to administer FCC Amateur Radio License Exams to registered attendees of the 2019 AP-S/URSI Symposium. There are three FCC amateur radio license classes - Technician, General and Extra. On your application, which we recommend you complete in advance, you will be able to make your selection.

Note that there is no longer a Morse code requirement. The web sites `http://www.kb6nu.com/study-guides/` and `https://hamexam.org` are evaluable sources of study information.

If you plan to sit for the exam, please note that you will need the following:

An NCVEC Form 605. Do not use the FCC Form 605. The form must have your FCC registration number on the form. The form may be downloaded here - `http://www.ncvec.org/downloads/ncvec605.pdf`

To obtain a FRN, please go to `https://www.fcc.gov/help/getting-fcc-registration-number-frn-universal-licensing-system-uls`.

At the exam, please present a legal photo ID (driver's license or a passport). If no photo ID is available, bring two original forms of identification. No photocopies will be accepted. These may include a non-photo ID/driver's license, birth certificate (must be a certified copy), local library card, local utility bill, bank statement or other business correspondence that specifically names you, or a postmarked envelope addressed to you, with your current mailing address, as it appears on your Form 605.

If you are testing for an upgrade, bring either the original and a copy of your current license, or the original and a copy of the certificate of successful completion of an examination from a previous session.

Two (2) #2 pencils, with erasers, and a pen.

A calculator with the memory erased and formulas cleared is allowed. You may not bring any written notes or calculations into the exam session. Slide rules and logarithmic tables are acceptable, as long as they're free of notes and formulas. Cell phone must be silenced or turned off during the exam session and the phones' calculator function may not be used. In addition, iPhones, iPads, Androids, smartphones, Blackberry devices and all similar electronic devices with a calculator capability, may NOT be used.

An advantage to taking the test at the symposium...no fee will be charged.

Date:	Wednesday, July 10
Time:	13:00 - 16:00
Location:	Room 208
Fee:	Complimentary, but advance registration is required.
Date:	Thursday, July 11
Time:	13:00 - 16:00
Location:	Room 208
Fee:	Complimentary, but advance registration is required.

Amateur Radio Operators Breakfast

The Amateur Radio Breakfast Meeting is open to all conference participants who hold an amateur radio call sign, but pre-registration is required. The intent of the gathering is to gather support for APS student, outreach, SIGHT and educational activities involving amateur radio.

Date:	Monday, July 8
Time:	07:00 - 08:00
Location:	Crystal Ballroom A
Fee:	Complimentary, but advance registration is required. An amateur radio license is also required for attendance.

Amateur Radio special event station — Tuesday–Thursday, July 9–11

The Amateur Radio special event station will be set up at Booth 73 in the Exhibit Hall in Salon West. Please drop by to see the station in operation. Other Amateur Radio demonstrations will be held throughout the week in and around the symposium venue. For more information, please contact Dave Michelson, VA7DM at `davem@ece.ubc.ca`.

2019 IEEE AP-S Field Awards

Distinguished Achievement Award

George V. Eleftheriades, University of Toronto

"For pioneering contributions to metamaterials and metasurfaces, and their applications to antennas and sub-diffraction imaging".

Chen-To Tai Distinguished Educator Award

Douglas H. Werner, The Pennsylvania State University

"For exemplary achievements in higher education as an inspiring teacher and mentor, and for innovative contributions to advancing knowledge in electromagnetics."

John Kraus Antenna Award

Daniel Sievenpiper, University of California, San Diego

"For the creation and development of artificial impedance surfaces used in antenna design and scattering control"

Lot Shafai Mid-Career Award

Eva Antonino Daviu, Universitat Politècnica de València (Spain)

"For her contribution to the systematic design of antenna systems for practical applications using characteristic modes and promoting access of women to engineering"

Harrington-Mittra Computational Electromagnetics Award

Chi Hou Chan, City University of Hong Kong

"For fundamental contributions to fast solutions of integral equations using FFT with applications to scattering, antennas and interconnect structures in homogeneous and layered medium"

Donald G. Dudley, Jr. Undergraduate Teaching Award

Eng Leong Tan, Nanyang Technological University

"For excellence in teaching, student mentoring, and the development of mobile technologies and computational methods for electromagnetics education"

2019 IEEE AP-S Paper Awards

Sergei A. Schelkunoff Transactions Prize Paper Award

Francisco S. Cuesta, Ihar A. Faniayeu, Viktar S. Asadchy, and Sergei A. Tretyakov

"Planar broadband Huygens' metasurfaces for wave manipulations." IEEE Transactions on Antennas and Propagation 66, no. 12 (2018): 7117-7127.

Harold A. Wheeler Applications Prize Paper Award

Kenneth W. Brown

"Far-Field Antenna Pattern Measurement Using Near-Field Thermal Imaging." IEEE Transactions on Antennas and Propagation 66, no. 3 (2018): 1488-1496.

R. W. P. King Paper Award

Brandon W. Dowd and Rodolfo E. Diaz

"FDTD simulation of very large domains applied to radar propagation over the ocean." IEEE Transactions on Antennas and Propagation 66, no. 10 (2018): 5333-5348.

Piergiorgio L. E. Uslenghi Letters Prize Paper Award

Casimir Ehrenborg and Mats Gustafsson

"Fundamental bounds on MIMO antennas," IEEE Antennas and Wireless Propagation Letters 17, no. 1 (2018): 21-24.

Edward E. Altschuler AP-S Magazine Prize Paper Award

Rick W. Kindt and John T. Logan

"Benchmarking Ultrawideband Phased Antenna Arrays: Striving for Clearer and More Informative Reporting Practices." IEEE Antennas and Propagation Magazine 60, no. 3 (2018): 34-47.

2019 AP-S Fellows

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Special Sessions

MO-SP.1A: Low-Cost Phased Array Technology

Organizers: Jeffrey Herd and Paolo Rocca

MO-SP.2A: Emerging Technologies for Biomedical Applications

Organizers: Asimina Kiourti and Erdem Topsakal

MO-SP.1P: Application of Machine/Deep Learning and Uncertainty Quantification Techniques in Computational Electromagnetics

Organizers: Luis Gomez and Abdulkadir Yucel

MO-SP.2P: Space-Time Modulated Metamaterials

Organizers: Christophe Caloz and Zoé-Lise Deck-Léger

TU-SP.1A: Memorial Session for Dr. R. C. Hansen

Organizers: Jennifer Bernhard and William Liles

TU-SP.2A: International Collaborations on Next-Generation Radio Astronomical Instruments

Organizers: David Davidson and Karl F. Warnick

TU-SP.1P: Cybersecurity and Electromagnetic Systems: From DC to Daylight and from Wireless to Wired

Organizer: Johnson Wang

TU-SP.2P: Metasurfaces in Antenna Applications

Organizers: Stefano Maci and Sergei Tretyakov

WE-SP.1A: Optically Transparent Antennas

Organizers: James Schaffner, Zachary Silva, Hyok Song and Christopher R. Valenta

WE-SP.1P: Time-Domain Computational Methods for Complex Electromagnetic and Multiphysics Problems

Organizers: Yang Liu and Ali E. Yilmaz

WE-SP.2P: Design and Integration Aspects of Beyond 5G Communications for Mobile Devices

Organizers: Wonbin Hong and Rod Waterhouse

TH-SP.1A: Advanced DGTD and FVTD Methods

Organizers: Jian-Ming Jin and Jamesina Simpson

TH-SP.2A: Driving Forward: Advances in Propagation Modeling for Wireless Systems

Organizers: Christopher R. Anderson and Zhen Peng

TH-SP.1P: Innovative Reconfigurable and Multifunction Antenna Arrays

Organizers: Nicola Anselmi and Paolo Rocca

TH-SP.2P: Antennas and RF Systems for Inteference Mitigation and Spectrum Management

Organizers: Anthony (Tony) Triolo and Ryan Westafer

FR-SP.1A: Recent Advances in Multi-Material Additive Manufacturing for Antennas and Microwave Devices

Organizers: Geoff Brennecka and Payam Nayeri

FR-SP.2A: Antenna Innovations and Open Challenges for Small Satellites and CubeSats

Organizers: Nacer Chahat and Joshua Kovitz

FR-SP.1P: UWB Antenna Technologies for Radar

Organizers: Jay McDaniel and F. Rodriguez-Morales

FR-SP.2P: Topological Electromagnetics

Organizers: Ali Hassani Gangaraj and Francesco Monticone

AP-S Student Paper Competition Interactive Forum

Presentations for finalists will be in the Level 2 Foyer on Tuesday, July 9, 08:00–11:40.

Finalists

A Dual-band Strain Sensor Based On Pop-up Half Wavelength Dipole Antenna
Shaghayegh Soltani, Paul S. Taylor, John C. Batchelor, University of Kent, United Kingdom

A Machine Learning Based 77 GHz Radar Target Classification for Autonomous Vehicles
Xiuzhang Cai, Kamal Sarabandi, University of Michigan, United States

An Improved Model for Static Field Micro-Particle Components on a Printed Transmission Line
Nasim Soufizadeh-Balaneji, David Rogers, Benjamin D. Braaten, North Dakota State University, United States

Design of a Characteristic-Mode-Based Fully-Planar Antenna for Indoor In-Band Full-Duplex Radios
Qianyi Li, Ting-Yen Shih, University of Idaho, United States

How to Phase Antenna Arrays and Metasurfaces of Arbitrarily Oriented and Polarized Elements?
Hossein Mehrpour Bernety, David Schurig, University of Utah, United States

Metagrating-Inspired Approach for Suppressing Reflections in H-Plane Waveguide Bends
Liran Biniashvili, Ariel Epstein, Technion - Israel Institute of Technology, Israel

Multiphysics Modeling of Crosstalk Effect in Graphene-Encapsulated Cu Nano-Interconnects
Shuzhan Sun, Dan Jiao, Purdue University, United States

Polarization-independent and broadband THz coherent perfect absorber based on black phosphorus bifacial metasurfaces
Tianjing Guo, Christos Argyropoulos, University of Nebraska-Lincoln, United States

Spread-Spectrum Camouflaging based on Time-Modulated Metasurface
Xiaoyi Wang, Christophe Caloz, Polytechnique Montréal, Canada

Wideband Omnidirectional Circularly Polarized Antenna for Millimeter-Wave Applications Using Printed Artificial Anisotropic Polarizer
Chen Ding, Kwai-Man Luk, State Key Laboratory of Terahertz and Millimeter Waves, China

Honorable Mentions

A Compact Efficient D-Band Micromachined On-Chip Differential Patch Antenna for Radar Applications
Wael Ahmad, Maciej Kucharski, Herman Ng, IHP - Leibniz-Institut für innovative Mikroelektronik, Germany; Dietmar Kissinger, Ulm University, Germany

A Dual-polarized FSS on a Single Substrate using Highly-coupled Interlayer Inductance
Youngno Youn, Wonbin Hong, Pohang University of Science and Technology (POSTECH), Korea (South)

A Fast Macromodeling Approach to Simulate Complex Electromagnetic Surfaces
Utkarsh Patel, Piero Triverio, Sean Hum, University of Toronto, Canada

A Low-Profile Wideband Connected Slot Array for Wide-Angle Scanning
Yan Li, Shaoqiu Xiao, Bing-Zhong Wang, University of Electronic Science and Technology of China, China

A Multi-Level Reconstruction Algorithm for Electrical Capacitance Tomography Based on Modular Deep Neural Networks
Elizabeth Chen, Costas Sarris, University of Toronto, Canada

A Tri-Band Dual-Polarized Slot-Ring Antenna for Array Design
Junyi Huang, Xun Gong, University of Central Florida, United States

A Tri-band Shared-Aperture Antenna for Wi-Fi MIMO and Beam-Scanning Wi-Gig Applications
Yanran Ding, Yujian Cheng, University of Electronic Science and Technology of China (UESTC), China

A Well-Conditioned Differential Surface Admittance Formulation for Modeling Penetrable Media
Shashwat Sharma, Piero Triverio, University of Toronto, Canada

A Wideband Frequency Beam Scanning Antenna Based on the Spoof Surface Plasmon Polaritons
Jun Wang, Zhang-Cheng Hao, Southeast University, China; Lei Zhao, China University of Mining and Technology, China

Adaptive Beamforming in High-Interference Environments Using a Software-Defined Radio Array
Daniel Gaydos, Payam Nayeri, Randy Haupt, Colorado School of Mines, United States

An Efficient Design Approach for Wideband Tightly Coupled Antenna Arrays
Wenyang Zhou, Yikai Chen, Shiwen Yang, University of Electronic Science and Technology of China, China

An Independently Tunable Uniplanar Dual Band Band-Stop Frequency Selective Surface

Nibirh Jawad, Loïc Markley, University of British Columbia, Canada

Approximation of Reflectarray Cross-Polarization Response Using A Hybrid FEM-PO Method

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

Augmented Unit Cells for Realizing TM-Polarized Huygens' Metasurfaces

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

Design of a Planar Wideband Yagi-Uda Antenna for Millimeter Wave SAR Imaging Application

Yuan Gao, Mohammad Ghasr, Reza Zoughi, Missouri University of Science and Technology, United States

Dual-Linear or Dual-Circular Polarized Slot Excited ME-Dipole Antenna with Single-Layer Feeding

Nadeem Ashraf, Ahmed Kishk, Abdel Razik Sebak, Concordia University, Canada

Enabling High Efficiency Bandwidth Electrically Small Antennas through Direct Antenna Modulation

Jean Paul Santos, Foad Fereidoony, Yuanxun Ethan Wang, University of California, Los Angeles, United States

Fast and Accurate Near-Field to Far-Field Transformation Using an Adaptive Sampling Algorithm and Machine Learning

Rezvan Rafiee Alavi, Rashid Mirzavand, Pedram Mousavi, University of Alberta, Canada

Flexible W-Band Rectifiers for 5G-powered IoT Autonomous Modules

Aline Eid, Jimmy Hester, Bijan Tehrani, Manos Tentzeris, Georgia Institute of Technology, United States

Frequency Independent Method for RCS Reduction of Dihedral Corners Using Metasurfaces

Anuj Modi, Constantine Balanis, Craig Birtcher, Arizona State University, United States

Full Wave Solutions of Multiple Scattering Using 3D Vector Cylindrical Wave Expansions In Foldy-Lax Equations

Huanting Huang, Leung Tsang, University of Michigan, United States; Kung-Hau Ding, Air Force Research Laboratory, United States

Full-duplex Near-infrared Communication via Spatiotemporally-modulated Array Antennas

Mohammad Mahdi Salary, Hossein Mosallaei, Northeastern University, United States

Generalized Tensor FDTD Method for Sloped Plasmonic Interfaces

Qiming Zhao, Costas Sarris, University of Toronto, Canada

Graphene metasurface based tunable double split ring resonator for far infrared frequency region

Vishal Sorathiya, Shobhitkumar Patel, Marwadi Education Foundation, India

Low Angle Scanning Phased Arrays With Greater Than 50:1 Bandwidth

Alexander D. Johnson, Elias A. Alwan, John L. Volakis, Florida International University, United States

Massive MIMO Beamforming on a Chip

Christopher Merola, University of Massachusetts, United States; Marinos Vouvakis, University of Massachusetts Amherst, United States

Measuring GPS Transmit Antenna Pattern Using On-Orbit Receivers

Tianlin Wang, Christopher Ruf, Bruce Block, University of Michigan, United States; Andrew O'Brien, Ohio State University, United States

Microfluidic Switches with Integrated Actuation for Mm-Wave Beam-Steering Arrays

Enrique González, Gokhan Mumcu, University of South Florida, United States

Modified Floquet Scattering Matrix Method for Solving N-path Networks

Cody Scarborough, Anthony Grbic, University of Michigan, United States

Novel Electromagnetic Scattering Model for Carbon Nanotube Composites using the Multilayer Green's Function Approach

Sumitra Dey, Deb Chatterjee, University of Missouri-Kansas City, United States; Edward J. Garboczi, National Institute of Standards and Technology, United States; Ahmed M. Hassan, University of Missouri-Kansas City, United States

Physics-Oriented Statistical Analysis of Information Transmission in Wave-Chaotic Environments

Shen Lin, Zhen Peng, University of New Mexico, United States

Serrodyne frequency translation using time-modulated metasurfaces

Zhanni Wu, Anthony Grbic, University of Michigan, United States

Sinuous Antenna Design for UWB Radar

Dylan Crocker, Sandia National Laboratories, United States; Waymond Scott, Georgia Institute of Technology, United States

The Huygens' Box Antenna: Metasurface-Based Directive Antenna Beam-Steering with Dramatically Reduced Elements

Kayode A. Oyesina, Alex M. H. Wong, City University of Hong Kong, China

Transmission Line Models of Planar Slot Antennas

Ralph van Schelven, Daniele Cavallo, Andrea Neto, Delft University of Technology, Netherlands

Two-Port, Common Aperture, High-Isolation, Dual-Polarized Sub-Millimeterwave Antenna System Based on Spatial Power Divider

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

Ultra-compact wave-based solvers for fractional-calculus equations

Aobo Chen, Francesco Monticone, Cornell University, United States

Wideband Printed Antenna Arrays for 5G Mobile Applications

Wei Jian Foo, Kubilay Sertel, Ohio State University, United States

Student Design Contest

The annual IEEE Antennas and Propagation Society (AP-S) Student Design Contest engages teams of undergraduate and graduate students to design practical devices and systems related to antennas and propagation, defined by an annual call for proposals. Teams are composed of a minimum of 50% undergraduates and are mentored by AP-S members.

This year's topic was to propose a setup that characterizes/demonstrates the properties of an antenna system and provide educational material to explain these properties.

Each team prepared a proposal for the contest that was evaluated by a college of reviewers to narrow the field to six finalist teams. The finalists (in alphabetical order) are:

GUC - German University in Cairo (Egypt)
Title: DIY antenna characterization system using universal UHF RFID hemispherical dome
Members: Monica Wasfy William, Nada Khaled Sayed Abdelhadi, Samar Abdelatty Sayed Elmeadawy, Yasmine Abdalla Zaghloul
Faculty Advisor: Hany Fathy Hammad

KnowAntenna - Universidade de Aveiro (Portugal)
Title: DIY antenna characterization setup
Members: Lucas Leitão, Manuel Neves, Guilherme Maniezo, Tânia Ferreira, Francisco Pinto
Faculty Advisor: João Nuno Matos, Armando Rocha

Team ACE - Brigham Young University (USA)
Title: Fast Antenna Pattern Measurements with Multipath Suppression
Members: Enoch Boekweg, Travis Bonner, Sean Crawford, Jacob Holtom, Shelby Larsen
Faculty Advisor: Karl Warnick

UNAL-APS- National University of Colombia (Colombia)
Title: UNAL-APS- National University of Colombia (Colombia)
Members: Cristian Felipe Cadavid Insuasti, Sebastián Chavez Martínez, Julian Navarrete Rubio, Leonardo Pérez
Faculty Advisor: John Jairo Pantoja Acosta
Levano, Nathaly Elisabeth Ruiz Solano

UNM - University of New Mexico (USA)
Title: Novel and Instructive Antenna Measurement Method
Members: Ralph Gesner, Arjun Gupta, John Argyres, Daniel Feaster, Delaney Heileman
Faculty Advisor: Christos Christodoulou

WPS-UTRGV - University of Texas Rio Grande Valley (USA)
Title: Electromagnetic Metasurface for Wireless Power System
Members: Tito Espino, Luis de la Garza, Daniel Salazar
Faculty Advisor: Nantakan Wongkasem

Patrons

AP-S/URSI 2019 is pleased to welcome our Gold patrons: Raytheon, Georgia Tech Research Institute and NSI-MI; and Bronze patrons: AVL Technologies and Honeywell. In addition, we thank the Johns Hopkins Applied Physics Laboratory for supporting a poster sesson reception. Thank you for your support of AP-S/URSI 2019!

All attendees are invited to visit the patrons at their booths in the exhibition hall.

Gold Patrons

Raytheon

Georgia Tech Research Institute

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Bronze Patrons

AVL TECHNOLOGIES

Honeywell

Poster Session Reception Patron

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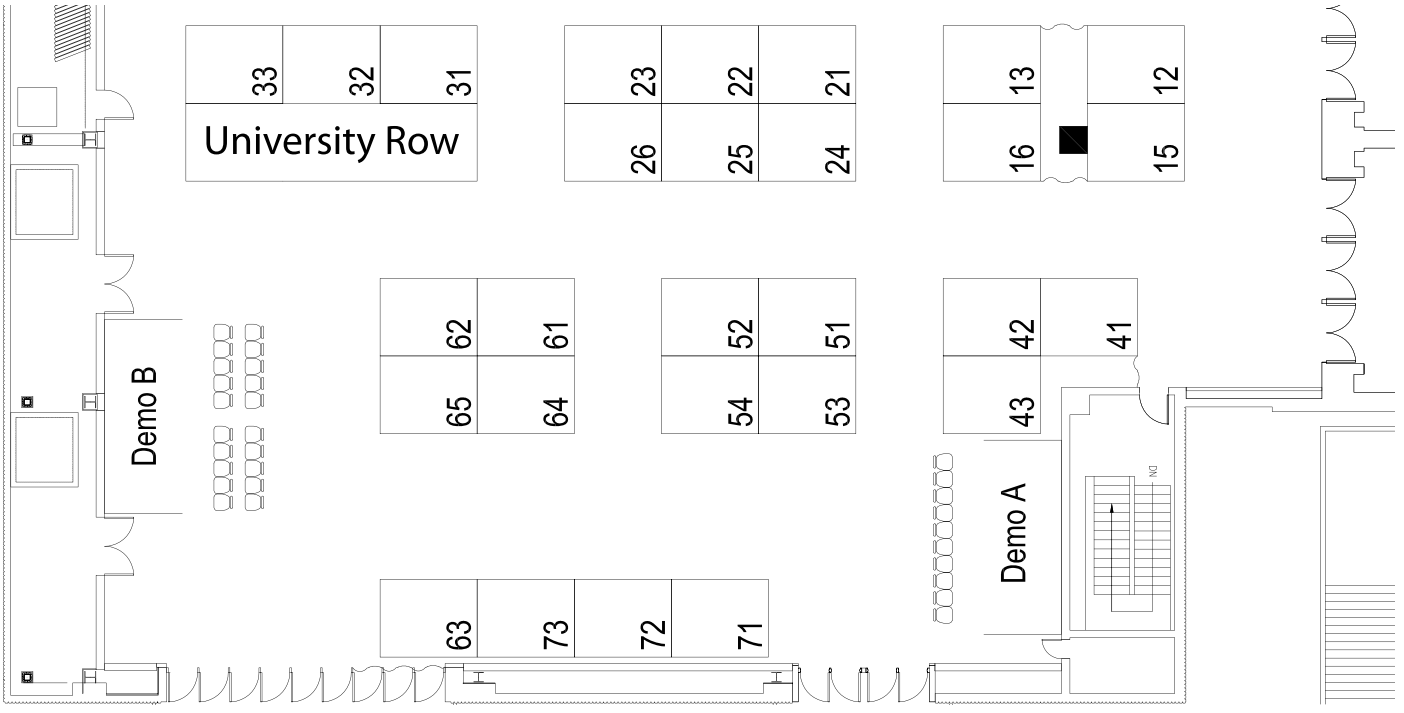
APPLIED PHYSICS LABORATORY

Exhibitors

The Steering Committee of the 2019 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting would like to thank the following exhibitors for their participation.



Booth	Exhibitor Name
Booth 12	Next Phase Measurements
Booth 13	412 TW Benefield Anechoic Facility (BAF)
Booth 15	Georgia Tech Research Institute
Booth 16	Copper Mountain Technologies
Booth 21	Everbeing Int'l Corp.
Booth 22	Antenom Antenna Technologies
Booth 23	NSI-MI Technologies
Booth 24	TICRA
Booth 25	Comsol, Inc.
Booth 26	NSI-MI Technologies
Booth 31	Raytheon
Booth 32	Haleakala R&D Inc
Booth 33	Remcom, Inc.
Booth 41	IMST GmbH
Booth 42-43	MVG | Microwave Vision Group
Booth 51	WIPL-D

Booth	Exhibitor Name
Booth 52	Wiley
Booth 53	HRL Laboratories
Booth 54	Virginia Diodes Inc.
Booth 61	Altair Engineering, Inc
Booth 62	Amazon.com Inc
Booth 63	Delta Sigma Company
Booth 64	Antenna Measurement Techniques Association, Inc.
Booth 65	Fraunhofer USA Inc. Center for Coatings and Diamond Technologies
Booth 71	IEEE Electromagnetic Compatibility Society
Booth 72	IEEE Microwave Theory and Techniques Society
Booth 73	ARRL/North Fulton Amateur Radio League
Univ. Row	Johns Hopkins University Applied Physics Laboratory
Univ. Row	Michigan State University

Exhibition Location and Hours

Exhibits are located in Salon East, on the 2nd floor of the Hilton Atlanta, and are open to all attendees according to the following schedule:

Tuesday, July 9 ..... 09:00–18:00
Wednesday, July 10 ..... 09:00–18:00
Thursday, July 11 ..... 09:00–15:00

	412 TW Benefield Anechoic Facility (BAF) 412 TW Benefield Anechoic Facility (BAF) at the Air Force Test Center, Edwards AFB The BAF provides a robust RF T&E infrastructure to ensure system survivability and mission effectiveness for the DoD, industry and allies. The largest anechoic test facility (264ft L x 250ft W x 70ft H) provides a secure "virtual open-air RF range within four walls" – a valuable tool providing test engineering applied to the development and the T&E of RF systems. We conduct Antenna Pattern, EW/IO, Survivability, Electromagnetic Interoperability and Electromagnetic Environmental Effects (E3) tests. The uniquely large and well-equipped BAF offers a highly flexible and scalable indoor antenna range and test capability for installed and uninstalled antenna systems across a wide spectrum. The large and well-equipped facility, with its positioners, turntable, hoist and integrated measurement equipment, offers a unique and extremely wide and flexible test capability. It has proven beneficial for the test of antennas as individual antennas to antenna systems integrated on large aircraft across a wide frequency spectrum and geometries. The indoor facility also provides a secure facility for special programs or other activities affected by regulatory restrictions (such as GPS outdoor testing). Visit us at our Booth #13. (http://www.edwards.af.mil/Units/772nd-Test-Squadron/) https://www.edwards.af.mil/Units/772nd-Test-Squadron/
Altair	Altair Engineering, Inc Altair is a leading provider of enterprise-class engineering software enabling innovation, reduced development times, and lower costs through the entire product lifecycle from concept design to in-service operation. Our simulation-driven approach to innovation is powered by our integrated suite of software which optimizes design performance across multiple disciplines encompassing structures, motion, fluids, thermal management, electromagnetics, system modeling and embedded systems, while also providing data analytics and true-to-life visualization and rendering. https://www.altair.com/
amazon	Amazon.com Inc Amazon Project Kuiper is a long-term initiative to launch a constellation of Low Earth Orbit satellites that will provide low-latency, high-speed broadband connectivity to unserved and underserved communities around the world. https://www.amazon.jobs/en/teams/projectkuiper
	Antenom Antenna Technologies Anten'it is the game-changing product of Antenom Antenna Technologies. Anten'it has metal and dielectric cells that are used to teach, design and build many antenna types at different frequencies. http://www.antenit.com
	ARRL/NORTH FULTON AMATEUR RADIO LEAGUE The North Fulton Amateur Radio League, in conjunction with the American Radio Relay League, will provide demonstrations of and information on the amateur radio hobby.Two amateur radio licensing exam sessions will also be offered. Numerous prizes related to operating an amateur radio station and related technologies will be given away. http://nfarl.org
COMSOL	Comsol, Inc. COMSOL Multiphysics® is a software environment for the modeling and simulation of any physics-based system with the ability to account for multiphysics phenomena. Optional add-on modules add discipline-specific tools for mechanical, fluid, electromagnetics, and chemical simulations, as well as CAD interoperability. Founded in 1986, COMSOL has U.S. offices in Burlington, MA; Los Angeles, CA; and Palo Alto, CA, in addition to numerous international offices and distributors. Additional information is available at www.comsol.com. https://www.comsol.com/
	Copper Mountain Technologies Copper Mountain Technologies develops innovative and robust RF test and measurement solutions for engineers worldwide. We specialize in the creation of solutions that enable RF and Microwave engineers to extend their reach through access to lab-grade instrumentation at affordable prices. Copper Mountain Technologies' world-class metrology and engineering resources work as an extension of your team. Copper Mountain Technologies is based in Indianapolis, IN. Copper Mountain Technologies began by developing telecom, RF & MW components, and test instrumentation for the European and Asian markets. Today, we provide VNAs for clients in close to 100 countries around the world. Our VNAs include an RF measurement module and a software application that runs on an external PC laptop or tablet and connects to the measurement hardware via USB interface. Users can take advantage of the latest operating systems, processing power, larger displays, and reliable performance of an external PC while realizing a lower total cost of ownership and simplified maintenance. The result is a faster, more effective test process that fits into the modern workspace. Our creative approach earned us the 2015 Frost & Sullivan Global Leadership in Innovation Award and the 2017 Frost & Sullivan Global USB VNA Product Leadership Award. http://www.coppermountaintech.com
DELTA SIGMA COMPANY	Delta Sigma Company DSC began operations in January of 1990 in Hesperia, California. In July of 1997, we moved to Kennesaw, Georgia to be closer to the F-22 Raptor team which had moved from Palmdale, CA to Marietta, GA. We have over 40 years' worth of experience in-house for all kinds of specialized LO (low observables) testing. We have built everything from the antenna to the cal target, radar, data collection & processing software, RF section, pylon elevator, pylon, multi-axis target positioner, target, and motion controls for moving parts in/on the target. Since 2000, we have primarily focused on developing complex automated systems to replace manual aircraft manufacturing stations and eliminate bottlenecks in station cycle time. We understand machine vision, lasers, servos, precision motion control, and dozens of other technologies that can be applied to aircraft manufacturing. At DSC, we engineer all of our own designs and software and build all of our machines in-house from the ground up, resulting in a fully 100% custom automation solution for the customer. http://www.deltasigmacompany.com
EVERBEING EVERBEING INT'L CORP.	Everbeing Int'l Corp. Everbeing is a world leading manufacturer of probe stations and micropositioners based in Taiwan. A probe station is an interface machine between testers and sample devices. With 27 years of history, we strive in producing reliable, precise, user-friendly products with affordable prices. Our inventory includes a broad range of probing accessories such as tips and tip holders. Our solutions cater to vast range of measurement applications which can be tailored to your specific needs. http://www.everbeingprober.com

Fraunhofer USA	Fraunhofer USA Inc. Center for Coatings and Diamond Technologies The Fraunhofer Center for Coatings and Diamond Technologies (CCD) offers diamond-related products including: doped and undoped diamond materials (NCD, PCD, SCD), boron doped diamond (BDD) electrodes, BDD microelectrode arrays (MEA), finished and semi-finished diamond products and diamond-like carbon (DLC) coatings. Contract research and development services are performed in the life science, advanced manufacturing, alternative energy, micro-electro-mechanical system, homeland-security, and defense sectors for companies ranging from start-ups to large businesses. Fraunhofer CCD is an ISO9001 certified operation. http://ccd.fraunhofer.org
Georgia Tech Research Institute	Georgia Tech Research Institute At GTRI, we develop advanced technology solutions and large-scale system prototypes to address the most difficult problems in national security, economic development, and overall human betterment. The Georgia Tech Research Institute (GTRI) is the nonprofit, applied research division of the Georgia Institute of Technology (Georgia Tech). Founded in 1934 as the Engineering Experiment Station, GTRI has grown to more than 2,000 employees supporting eight laboratories in over 20 locations around the country, and performs more than $350 million of problem-solving research annually for government and industry. Each day, GTRI's science and engineering expertise is used to turn ideas into workable solutions for our customers. We take the best ideas, often co-developed with our Georgia Tech academic partners, and turn them into systems applications that provide a significant technological advantage over other approaches. GTRI's renowned researchers combine science, engineering, economics, policy and technical expertise to solve complex problems for the U.S. federal government, state and industry. We develop highly effective, practical solutions that we put into action. As a non-profit research institute, we are an objective partner who delivers workable solutions and manufacturable products. Our highly specialized laboratories and interdisciplinary research centers allow us to bring the right mix of talent, experience and creativity to every project. https://www.gtri.gatech.edu/
	Haleakala R&D Inc Haleakala R&D is devoted to the research, development, prototyping, and commercialization of plasma antennas, plasma frequency selective surfaces, plasma wave guides, plasma coaxial cables, and plasma MRI/PET. http://www.ionizedgasantennas.com
HRL LABORATORIES	HRL Laboratories Research Laboratory http://www.hrl.com
EMC SOCIETY®	IEEE Electromagnetic Compatibility Society The IEEE Electromagnetic Compatibility (EMC) Society is the world's largest organization dedicated to the development and distribution of information, tools and techniques for the prevention and containment of electromagnetic interference. EMC is increasingly important in many emerging technologies including wireless 5G and IoT, autonomous vehicles, and smart grid, to name a few. The Society's field of interest includes standards, measurement techniques and test procedures, instrumentation, equipment and systems characteristics, interference control techniques and components, education, computational analysis, and spectrum management, along with scientific, technical, industrial, professional or other activities that contribute to this field. Explore the many benefits of EMC Society membership, from being part of the Young Professionals as well as having access to many Standards resources and Distinguished Lecturers. You can be engaged at the global and/or local Chapter level. The EMC Society has over 80 regional chapters in the Americas, Asia and Europe. Join today and give your career a much-needed boost. http://www.emcs.org
MTT-S®	IEEE Microwave Theory and Techniques Society The IEEE Microwave Theory and Techniques Society (MTT-S) is a transnational society with more than 10,500 members and 190 chapters worldwide. Our society promotes the advancement of microwave theory and its applications, including RF, microwave, millimeter-wave, and terahertz technologies. For more than 60 years, the MTT-S has worked to advance the professional standing of its members and enhance the quality of life for all people through the development and application of microwave technology. As we enter into an exciting future, our mission is to continue to understand and influence microwave technology and to provide a forum for all microwave engineers. The MTT-S will continue to be the global focus for the promotion of the RF and microwave engineering profession, by advancing and distributing knowledge and supporting professional development. https://www.mtt.org
IMST	IMST GmbH IMST is a competence center and professional development house for antennas, high-frequency circuits, wireless modules, and complete communications systems. We provide individualized support to any customer during every phase of product development, from initial consulting to series production. IMST has the added resources of critical partnerships in the commercial marketplace and in the publicly sponsored research sector. http://www.imst.de
APL JOHNS HOPKINS APPLIED PHYSICS LABORATORY	Johns Hopkins University Applied Physics Laboratory For more than 70 years, the Johns Hopkins University Applied Physics Laboratory (APL) has provided critical contributions to critical challenges with systems engineering and integration, technology research and development, and analysis. Our scientists, engineers, and analysts serve as trusted advisors and technical experts to the government, ensuring the reliability of complex technologies that safeguard our nation's security and advance the frontiers of space. We also maintain independent research and development programs that pioneer and explore emerging technologies and concepts to address future national priorities. Founded in 1942 to aid a country at war, we provide solutions to national security and scientific challenges with systems engineering and integration, research and development, and analysis. Throughout our seven decades of service, we have focused on practical applications of our research in a wide range of scientific and technological fields; today, our four main sponsored areas of work include air and missile defense, asymmetric operations, force projection, and space science. Additionally, we continue to honor our enduring commitment to work with and inspire future generations of scientists, engineers, and researchers. http://www.jhuapl.edu
College of Engineering MICHIGAN STATE UNIVERSITY	Michigan State University https://ece.msu.edu/

	MVG | Microwave Vision Group 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 & Defense, Automotive, and EMC&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, & Rainford EMC. The result is an unrivaled spectrum of key technologies and system building blocks for antenna measurement and EMC activities. 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. 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. http://www.mvg-world.com
	Next Phase Measurements Next Phase Measurements (NPM) is a California-based US company with a management team comprised of pioneers in the industry, recognized all over the world, having over 100 man-years of experience in antenna measurements. NPM is the distributor and Value-Added Reseller (VAR) across both American continents for Antenna Systems Solutions, a leading supplier of antenna measurement systems to the worldwide Aerospace, Defense, Commercial, Automotive, Wireless, Academic and Research markets. http://www.npmeas.com
	NSI-MI Technologies With over 1000 systems sold worldwide, NSI-MI Technologies offers a comprehensive range of industry leading microwave test systems. These systems cover antennas, radomes and RCS and our unique blend of mechanical, RF and software engineering capabilities allow us to customize test systems to offer specialized solutions. NSI-MI supports the aerospace/defense, automotive, wireless and academic industries. Our wide range of products also allow us to offer solutions for material, production line or general automated component testing. Our global presence enables us to offer the highest quality service and support to ensure long term use of all test products supplied. We also offer extensive in-house test and measurement facilities covering frequencies from 250 MHz to 110 GHz. http://www.nsi-mi.com
	Raytheon Raytheon provides state-of-the-art electronics, mission systems integration and other capabilities in the areas of sensing; effects; and command, control, communications and intelligence systems; as well as a broad range of mission support services. https://www.raytheon.com/
	Remcom, Inc. Remcom provides electromagnetic simulation and 3D wireless prediction software for analyzing complex EM problems and antenna propagation. Visit our booth to see XFdtd's new ESD simulation features: utilize ESD simulator waveforms, define the dielectric strength of materials, and easily locate weaknesses in their ESD design. In addition, we'll be demonstrating our integrated solutions for end-to-end RF and 5G wireless design, including MIMO and array design, 5G urban small cells, fixed wireless access, and more. http://www.remcom.com
	TICRA TICRA is the world's leading supplier of antenna modeling software for antenna industries, including spacecraft manufacturers and space agencies, earth-station antenna suppliers, defence industries and research institutions. With 45 years of experience in developing trusted solutions for the space industry, TICRA provides highly accurate EM simulation software for reflector antennas and related feed systems. Our expert engineers are available to customers through software support and consultancy services. http://www.ticra.com
	Virginia Diodes Inc. VDI manufactures state-of-the-art test and measurement equipment for mm-wave and THz applications. These products include Vector Network Analyzer, Spectrum Analyzer and Signal Generator Extension Modules that extend the capability of high performance microwave measurement tools to higher frequencies. VDI's component products include detectors, mixers, frequency multipliers and custom systems for reliable operation at frequencies between 50 GHz and 2 THz. https://www.vadiodes.com/en/
	Wiley Wiley, a global company, helps people and organizations develop the skills and knowledge they need to succeed. Our online scientific, technical, medical, and scholarly journals, combined with our digital learning, assessment and certification solutions help universities, societies, businesses, governments, and individuals increase the academic and professional impact of their work. http://www.wiley.com
	WIPL-D WIPL-D with its high performance and high quality software products WIPL-D Pro, WIPL-D Pro CAD and Microwave Pro enables users worldwide to perform fast and accurate high-frequency simulations of antenna systems, microwave circuits and components, scatterers and EMC problems on today's conventional computers. WIPL-D allows engineers to quickly generate new designs optimally specified and economically viable. WIPL-D stuff provides superb customer support and technical expertise within very short response-period and quick turn-around, making WIPL-D a valuable cooperator to the users. http://www.wipl-d.com

Interactive Exhibition — Demonstration Program Summary

The exhibit hall will feature an Interactive Exhibition program. The Industrial Initiative Committee (IIC), a standing committee of the IEEE Antennas and Propagation Society chaired by Lars Jacob Foged, created the Interactive Exhibition program. The Interactive Exhibition allows exhibitors to demonstrate software and hardware in the exhibition hall. You will find hardware and software demonstrations in special demo stations in the exhibit hall during exhibit hours. Following is the list of demonstrations.

Demonstrations Held in Demo Station 1

Tuesday, July 9, 13:30 – 15:00

Altair

Hybrid Computational Techniques for Design and Placement Studies of Airborne Antennas using Altair Feko

With growing communications, nowadays there are increasingly sophisticated antenna systems with associated electronics aboard aircrafts. Advances in electromagnetic (EM) simulations have significantly improved the design process for such systems, resulting in reduced testing time and costs. In this demonstration, we will showcase hybrid computational techniques that are becoming popular to analyze and optimize antenna designs as well as antenna placement on airborne platforms. Hybrid solutions that combine, both full wave and asymptotic solutions can facilitate simulation of airborne antenna problems with less computational resources, but at the same time providing required accuracy. While full wave solutions (FEM/FDTD/MoM/MLFMM) are accurate, they are computationally expensive when applied to electrically large structures such as aircrafts. While asymptotic solutions (PO/RL-GO/UTD) may provide an alternative, they may not be suitable for modeling complex antenna geometries while mounted on the aircraft. For this demonstration, we will use commercial EM simulation tool, Altair Feko. Feko incorporates various hybrid solutions that combine, FEM/MoM/MLFMM, MoM/PO, MLFMM/PO, MoM/RL-GO and MoM/UTD, which allows for efficient analysis of airborne antennas. During the demonstration, a brief overview of hybrid computational methods will be presented. Use of these methods for different airborne antennas will be demonstrated.

Presenter: Dr. C. J. Reddy, Vice President-Business Development, Altair

Wednesday, July 10, 10:30–12:00

WIPL-D

New Generation of 3D EM Simulation Tools - ULTRA Higher Order Bases in WIPL-D

The aim of the presentation is to demonstrate the new generation of basis functions implemented in WIPL-D software package. Classic polynomial higher order basis functions defined over quadrilaterals are regularly used with patches of maximum edge up to 2λ and expansion order up to 8. In this presentation we will demonstrate that these limits can be significantly extended if max-ortho bases are implemented by introducing the new concept of implementation of max-ortho HOBFs, which is based on representation of max-ortho HOBFs in terms of Legendre polynomials. Numerical results demonstrate effective usage of patches up to 20 λ and expansion orders up to 61.

Significance of ultra-high order bases is demonstrated in the case of p-refinement, where decreasing of absolute error (e.g. down to 0.0001 dB for RCS) with increasing the order of bases will be presented. On the other hand the number of unknown coefficients and simulation time for electrically large problems is significantly reduced.

Presenter: Prof. Branko Kolundzija, WIPL-D

Demonstrations Held in Demo Station 2

Tuesday, July 9, 10:30–12:00

HRL Laboratories and Eastman Kodak Company

Transparent Antenna Appliques

Today's world is more connected than ever with the Internet of Things (IoT) becoming more of a reality and less of an abstract concept, driving the proliferation of antennas. Designers and engineers have been working to hide these antennas in plain sight, but as the number of antennas increases creative options for antenna placement require new antenna designs and form

factors. Recently, there has been a recognition that the fabrication of optically transparent antennas would expand placement options to windows, displays, lighting and other glass surfaces.

We will demonstrate and discuss thin-film 4G-LTE and WiFi antenna appliques on polyethylene terephthalate (PET) with high transparency (>80%), low haze (<1.2%), and excellent antenna performance. This was a collaboration among Kodak, HRL, and General Motors and while the initial work presented here was focused on automotive application, the stage is set for future advances into the transparent antenna market. New designs for other communication bands are in progress and Kodak's manufacturing facility enables volume production of any transparent antenna pattern.

Presenters: Carolyn Ellinger, Kodak, and Jim Schaffner, HRL

Tuesday, July 9, 13:30–15:00

Johns Hopkins University / Applied Physics Lab

Johns Hopkins University / Applied Physics Lab Introduction and Example Projects

The Johns Hopkins University / Applied Physics Lab (JHU/APL) is a non-profit, University Affiliated Research Center (UARC) located in suburban Maryland that supports numerous US Government agencies by solving their most complex problems. In this presentation, staff members from the Air and Missile Defense Sector (AMDS) will provide an overview of JHU/APL, including its history, and discuss a few of the current efforts related to antennas and propagation that highlight the type of work that we perform for our sponsors.

Presenter: Michael Newkirk, Johns Hopkins University

Wednesday, July 10, 10:30–12:00

Compass Technology Group, LLC

Microwave Material Measurements with a Table Top Fixture

Whether the application is antenna substrates, radomes, microwave components or electromagnetic interference (EMI) absorption, knowing the dielectric and magnetic properties of materials is an important part of microwave design. This hardware tutorial will show how to conduct free space characterization of materials at microwave frequencies. Specifically, a table top system based on wide band spot probes, along with a vector network analyzer will demonstrate the performance characteristics of different microwave materials. The procedures for determining intrinsic permittivity and permeability will be described, including calibration and mathematical inversion methods.

Presenter: John W. Schultz, Compass Technology Group

Wednesday, July 10, 13:30–15:00

Antenom Antenna Technologies

Normal Mode Helix Antenna Design Experiment - A Real Hands-On Training "Build your antennas with your Hands"

The specialty of this demonstration is that the participants will design, build and measure their antennas in front of a network analyzer.

This demonstration starts with calculating theoretical dimensions for designing a normal mode helix antenna for a specific frequency. The participants will design their helix antennas via Anten'it Antenna Training Kits. They will follow the guidelines in the experiment sheets. The participants will then measure their antennas in front of a network analyzer and iterate their design by adding or removing new cells. Participants can also see the effect of building the helix antenna over a dielectric core instead of air.

This demonstration provides teaching and learning design of a normal mode helix antenna design.

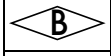
Presenter: Umut Bulus, Antenom Antenna Technologies

Presentation Listing Explanation

Session Code Legend

Code	D	–	TT	.	N	M
Explanation	Day	–	Track	.	Ordinal	Time
Possible Values	MO TU WE TH FR (Add P for Interactive Forum)	–	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	.	2nd 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

Low-Cost Phased Array Technology

Session Co-Chairs: Paolo Rocca, ELEDIA Research Center, University of Trento; Jeffrey Herd, MIT Lincoln Laboratory; Robert Mailloux, ELEDIA Research Center, University of Trento

MO-SP.1A.1 **08:00**

Rigid-Flexible Antenna Array (RFAA) for Cost-Effective Deployable Scanning Apertures

William Moulder, Rabindra Das, MIT Lincoln Laboratory, United States

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

MARS CALL EARTH: A NOVEL ARRAY ANTENNA DESIGN FOR FUTURE PLANETARY MISSIONS

Yahya Rahmat-Samii, University of California, Los Angeles, United States

MO-SP.1A.3 **08:40**

Millimeter-wave technology for 5G applications An industry view on current issues and challenges

Roberto Flamini, Christian Mazzucco, Renato Lombardi, Huawei Technologies, Italy

MO-SP.1A.4 **09:00**

Modular Phased Array Design Through a Tile-Dimension Tapering Approach

Nicola Anselmi, Dipartimento di Ingegneria Navale, Elettrica, Elettronica e delle Telecomunicazioni (DITEN- University of Genoa), Italy; Paolo Rocca, Andrea Massa, ELEDIA Research Center (ELEDIA@ UniTN – University of Trento), Italy

MO-SP.1A.5 **09:20**

GaN-on-Si with CMOS Integration for Advanced, Low Cost Phased Arrays

Christopher Galbraith, Chang-Lee Chen, Ryan Johnson, Richard Molnar, Jeffrey Knecht, Shireen Warnock, Donna-Ruth Yost, Matthew Cook, Corey Stull, Jeffrey Daulton, WeiLin Hu, Gianni Pinelli, Jeffrey Herd, Craig Keast, MIT Lincoln Laboratory, United States

Break **09:40**

MO-SP.1A.6 **10:00**

Wideband Printed Antenna Arrays for 5G Mobile Applications

Wei Jian Foo, Kubilay Sertel, Ohio State University, United States

MO-SP.1A.7 **10:20**

Expanding the Capability of Printed Circuit Board (PCB) Based AESA Tile Radar for Civil and Defense Applications

Douglas Carlson, Daniel Kramer, Nicholas Ahlquist, Alan Noll, MACOM Technology Solutions, United States

MO-SP.1A.8 **10:40**

High-Efficiency Low-Profile Feeds for UWB Arrays

Christopher Merola, University of Massachusetts, United States; Rick Kindt, Naval Research Laboratory, United States; Marinos Vouvakis, University of Massachusetts Amherst, United States

MO-SP.1A.9 **11:00**

An X-band, Mechanically Beam Steerable Lens Antenna Exploiting Risley Prism

Zongtang Zhang, Hung Luyen, John Booske, Nader Behdad, University of Wisconsin-Madison, United States

MO-SP.1A.10 **11:20**

A 1-bit Reconfigurable Reflectarray Element with Independent Dual-band Phase Controlling Capability

Hongjing Xu, Shenheng Xu, Fan Yang, Maokun Li, Tsinghua University, China

Emerging Technologies for Biomedical Applications

Session Co-Chairs: Asimina Kiourti, Ohio State University; Erdem Topsakal, Virginia Commonwealth University

MO-SP.2A.1 **08:00**

Single-coil Dual-band Transmitting Antenna Design for Wireless Capsule Endoscopic Communication

Yunxiao Peng, Kazuyuki Saito, Koichi Ito, Chiba University, Japan

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

Harmonics-Enabled Antenna Alignment for High-Efficiency Wireless Power Transfer

Yongxin Guo, National University of Singapore, Singapore; Hao Zhang, National University of Singapore Suzhou Research Institute, China

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

Characterization of Microchamber Arrays for Targeted Drug Delivery

Yang Hao, Ahsan Noor Khan, Henry Giddens, Gleb Sukhorukov, Queen Mary University of London, United Kingdom

MO-SP.2A.4 **09:00**

Implantable Titanium Nitrite Antenna for Continuous Glucose Monitoring

Ryan Green, Ryan Assi, Jessica Shaffer, Madeline Hays, Shanze Eshai, Lynn Secondo, Vitaliy Avrutin, Nastassja Lewinski, Erdem Topsakal, Virginia Commonwealth University, United States

MO-SP.2A.5 **09:20**

Compact Dual-Band PIFA Based on a Slotted Radiator for Wireless Biomedical Implants

Nikta Pournoori, Shubin Ma, Lauri Sydänheimo, Leena Ukkonen, Tampere University, Finland; Yahya Rahmat-Samii, University of California, Los Angeles, United States; Toni Björninen, Tampere University, Finland

Break **09:40**

MO-SP.2A.6 **10:00**

Computational Modeling of Current Flow in the Bipolar Cell Pathways of Degenerated Retina

Pragya Kosta, Kyle Loizos, University of Utah, United States; Ege Iseri, Javad Paknahad, Gianluca Lazzi, University of Southern California, United States

MO-SP.2A.7 **10:20**

Matching Considerations for Wireless, Batteryless Brain Implants to High Impedance Electrodes

Katrina Guido, Asimina Kiourti, Ohio State University, United States

MO-SP.2A.8 **10:40**

Magnetic Induction-based Human Activity Recognition (MI-HAR)

Negar Golestani, Mahta Moghaddam, University of Southern California, United States

MO-SP.2A.9 **11:00**

Design of an Interstitial Microwave Applicator for 3D Printing Antennas in the Body

Kaitlin Hall, Cynthia Furse, University of Utah, United States

MO-SP.2A.10 **11:20**

Cadaver Measurement Results Using Ultra-flexible Electro-textile MRI RF Coil

Daisong Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

Metamaterials

Session Co-Chairs: Igor Tsukerman, The University of Akron; Alexander Yakovlev, University of Mississippi

MO-UB.1A.1 **08:00**

An Equivalent ABCD-Matrix Approach for Multilayer Wire-Medium-Type Structures

Alexander B. Yakovlev, University of Mississippi, United States; Mario G. Silveirinha, University of Lisbon and Instituto de Telecomunicações, Portugal; George W. Hanson, University of Wisconsin-Milwaukee, United States; Chandra S. R. Kaipa, Independent Researcher, United States

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

Accurate Homogenization of Layered Structures and a Breakdown of Effective Medium Theory

A N M Shahriyar Hossain, Igor Tsukerman, University of Akron, United States; Y. D. Chong, Nanyang Technological University, Singapore

MO-UB.1A.3 **08:40**

Avoiding Imaging Artifacts in Metamaterial Superlenses

Iman Aghanejad, Kenneth Chau, Loïc Markley, University of British Columbia, Canada

MO-UB.1A.4 **09:00**

Digital Metasurfaces Based on Spatio-Temporal Coding

Lei Zhang, Xiao Qing Chen, Shuo Liu, Qian Zhang, Jie Zhao, Jun Yan Dai, Guo Dong Bai, Xiang Wan, Qiang Cheng, Southeast University, China; Giuseppe Castaldi, Vincenzo Galdi, University of Sannio, Italy; Tie Jun Cui, Southeast University, China

MO-UB.1A.5 **09:20**

Nanometre-Scale Fabrication of Optical Metasurfaces Using Helium Ion Milling

Mitchell Semple, Ashwin K. Iyer, University of Alberta, Canada

Break **09:40**

MO-UB.1A.6 **10:00**

2D Flat Lens Antenna Based on Metamaterials Printed Elements

Reuven Shavit, Ben Gurion University of the Negev, Israel

MO-UB.1A.7 **10:20**

Free-space-matched left-handed metamaterials

Juan D. Baena, Ana C. Escobar, Universidad Nacional de Colombia, Colombia; Andrey Sayanskiy, Stanislav B. Glybovski, ITMO University, Russia

MO-UB.1A.8 **10:40**

Nonlocal Metasurfaces Performing Optical Signal Processing on Two-Dimensional Images

Hoyeong Kwon, University of Texas at Austin, United States; Andrea Cordaro, University of Amsterdam, Netherlands; Dimitrios Sounas, Wayne State University, United States; Albert Polman, AMOLF, Netherlands; Andrea Alù, CUNY Advanced Science Research Center, United States

MO-UB.1A.9 **11:00**

Ultra-wideband Non Reciprocal Devices in Space-Time Modulated Transmission Lines

Yakir Hadad, Tel Aviv University, Israel; Amir Shlivinski, Ben Gurion University of the Negev, Israel

MO-UB.1A.10 **11:20**

Influence of NIC Accuracy on Properties of Self-oscillating Antennas and Metasurfaces

Leo Vincelj, Silvio Hrabar, Igor Krois, Ivan Basic, University of Zagreb, Croatia (Hrvatska)

Antennas for 5G I

Session Co-Chairs: Shiban K Koul, IIT Delhi; Ivan Ndip, Fraunhofer-Institut fuer Zuverlaessigkeit und Mikrointegration

MO-A5.1A.1 **08:00**

A Wideband Dual-Polarized End-Fire Antenna Array with A Single-Layer Feed Method

Ao Li, Kwai-Man Luk, City University of Hong Kong, China

MO-A5.1A.2 **08:20**

Millimeter-Wave Compact and High-Performance Two-Dimensional Grid Array for 5G Applications

Syeda Fizzah Jilani, Queen Mary University of London, United Kingdom; Qammer H. Abbasi, University of Glasgow, United Kingdom; Akram Alomainy, Queen Mary University of London, United Kingdom

MO-A5.1A.3 **08:40**

Conformal antennas with pattern diversity for mmWave 5G smartphones

Karthikeya GS, Mahesh P. Abegaonkar, Shiban K. Koul, Indian Institute of Technology, Delhi, India

MO-A5.1A.4 **09:00**

Dual-Linear or Dual-Circular Polarized Slot Excited ME-Dipole Antenna with Single-Layer Feeding

Nadeem Ashraf, Ahmed Kishk, Abdel Razik Sebak, Concordia University, Canada

MO-A5.1A.5 **09:20**

Wide-band slot Antenna on metal bezel for covering 28/39GHz in 5G Communication System

Tai Hwan Choi, Sung Soo Kim, Young Joong Yoon, Yonsei University, Korea (South); Hyungrak Kim, Daelim University College, Korea (South)

Break **09:40**

MO-A5.1A.6 **10:00**

A Triple-band Millimeter Wave SIW Antenna with Dual-Sense Circular Polarization

Huakang Chen, Yu Shao, Yajing Zhang, Changhong Zhang, Zhizhong Zhang, Chongqing University of Posts and Telecommunications, China

MO-A5.1A.7 **10:20**

Integrated Multilayer Yagi Antenna for 5G

Amélia Ramos, Tiago Varum, Instituto de Telecomunicações, Portugal; João Matos, Instituto de Telecomunicações, Universidade de Aveiro, Portugal

MO-A5.1A.8 **10:40**

Cold Plate Design, Fabrication, and Demonstration for High-Power Ka-Band Active Electronically Scanned Arrays

Boris Tomasic, Air Force Research Laboratory, United States; Derek Wisniewski, Robert Schmier, Alpha Omega Electromagnetics, LLC, United States; Thomas Steffen, Gregory Phillips, Defense Engineering Corp., United States

MO-A5.1A.9 **11:00**

Microstrip-Fed Scanning Dipole Antenna Array for 5G Applications

Donia Oueslati, Université Catholique de Louvain, ICTEAM Institute, Belgium; Asim Ghalib, Ravi Kumar Arya, University of Central Florida, United States; Hatem Rmili, King Abdulaziz University, Faculty of Engineering, Saudi Arabia; Raj Mittra, University of Central Florida, United States

MO-A5.1A.10 **11:20**

A Wide Band Meta- Surface Enhancement of Mutual Coupling in SatCom / 5G Antenna Applications

Ibrahim Mohamed, Mahmoud A. Abdalla, Military Technical College, Egypt; Safieddin Safavi-Naeini, University of Waterloo, Canada

Beam Forming, Angle of Arrival and Pattern Synthesis

Session Co-Chairs: Ted Heath, Georgia Tech Research Institute; Joseph Hucks, Georgia Tech Research Institute; Paul Simmons, Georgia Tech Research Institute

MO-A1.1A.1 **08:00**

Directions-of-Arrival Estimation in Linear Sub-Arrayed Array Through Compressive Sensing

Mohammad Abdul Hannan, Paolo Rocca, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

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

AoA Estimation With Practical Antenna Arrays Using Neural Networks

Yuanzhang Xiao, Zhengqing Yun, Magdy Iskander, University of Hawaii at Manoa, United States

MO-A1.1A.3 **08:40**

Optimal Synthesis of Wideband Beamforming Weights for Monopulse Tracking Radar - The Linear Array Case

Le Trong Phuoc Bui, Lorenzo Poli, Paolo Rocca, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

MO-A1.1A.4 **09:00**

Application of Sparse Representation to Beamforming for Direction of Arrival Estimation

Jacob Compaleo, Inder Gupta, Ohio State University, United States

MO-A1.1A.5 **09:20**

Optimal Thinning Techniques of Antenna Phased Arrays for Dual Band Operation

Rotem Gal, Reuven Shavit, Ben Gurion University of the Negev, Israel

Break **09:40**

MO-A1.1A.6 **10:00**

Comparison Between Deterministic and Stochastic Methods for the Synthesis of Aperiodic Arrays

Giulia Buttazzoni, Fulvio Babich, Francesca Vatta, Massimiliano Comisso, University of Trieste, Italy

MO-A1.1A.7 **10:20**

A Generalized Technique to Accurately Predict Conformal Antenna Arrays

Hannah Johnson, George R. Branner, Gregory Nelson, Matt Chun, University of California, Davis, United States; B.P. Kumar, California State University, United States

MO-A1.1A.8 **10:40**

Reduction of the Number of Phase Shifters in Linear Phased Antenna Arrays by using Evolutionary Multi-Objective Optimization

Juan L. Valle, Carlos A. Brizuela, Marco A. Panduro, Center for Scientific Research and Higher Education of Ensenada, Mexico; Alberto Reyna, Autonomous University of Tamaulipas, Mexico

MO-A1.1A.9 **11:00**

Phase-Controlled Beam-Scanning of Arbitrary Antenna Arrays with Far-Field Fixed Nulls

Giulia Buttazzoni, Fulvio Babich, Francesca Vatta, Massimiliano Comisso, University of Trieste, Italy

MO-A1.1A.10 **11:20**

A novel beam-steering method at the carrier frequency with time modulated array

Gang Ni, Chong He, Xian-Ling Liang, Junping Geng, Weiren Zhu, Ronghong Jin, Shanghai Jiao Tong University, China

Dielectric Resonator Antennas

Session Co-Chairs: Dustin Isleifson, University of Manitoba; A. Al-Rawi, Eindhoven University of Technology

MO-A1.2A.1 **08:00**

Band-notched Reconfigurable Rectangular Dielectric Resonator Antenna with Parasitic Elements

Beijia Liu, Jinghui Qiu, Hua Zong, Lifei Bao, Nannan Wang, Shengchang Lan, Harbin Institute of Technology, China

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

Split Ring Loaded Dual-polarized Dielectric Resonator Antennas

Yanxia Liu, Dustin Isleifson, Lotfollah Shafai, University of Manitoba, Canada

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

Differentially Fed CDRA Array with Phase Inverter for High Gain and Reduced Cross Polarization

Md Nazmul Hasan, Sungkyunkwan University, Korea (South); Roy B.V.B Simorangkir, Karu Esselle, Macquarie University, Australia; Saeideh Shad, Boise State University, United States

MO-A1.2A.4 **09:00**

Discussion on Series-Fed Parasitic DRA Array with Low Dielectric Constant Excited by SIW SLOTS

Wael M. Abdel-Wahab, University of Waterloo, Canada; Ying Wang, University of Ontario Institute of Technology, Canada; Safieddin Safavi-Naeini, University of Waterloo, Canada

MO-A1.2A.5 **09:20**

Point-to-Point Dielectric-Horn Integrated Resonator Antenna with Reduced Side-Lobe Level

E. Baldazzi, Sapienza Universita di Roma, Netherlands; Ali Al-Rawi, A. Bart Smolders, Eindhoven University of Technology, Netherlands; R. Cicchetti, Sapienza Universita di Roma, Netherlands; Diego Caratelli, The Antenna Company, Netherlands

Break **09:40**

MO-A1.2A.6 **10:00**

High Gain Ridge Gap Dielectric Resonator Antenna using FSS Superstrates

Mehri Borhani Kakhki, Zahra Mousavirazi, Institut national de la recherche scientifique (INRS), Canada; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

MO-A1.2A.7 **10:20**

Design and Analysis of Stacked Equilateral Triangular DRA for Wide Band Application

Rinki Ghosal, Bhaskar Gupta, Jadavpur University, India

MO-A1.2A.8 **10:40**

Dual-band Rectangular Dielectric Resonator Antenna

Bharathi Anantha, Osmania University, India; Lakshminarayana Merugu, Bharat Institute of Engineering and Technology, India

MO-A1.2A.9 **11:00**

Pattern Reconfigurable Dielectric Resonator Antenna Actuated by Shorted Parasitic Elements

Beijia Liu, Jinghui Qiu, Shengchang Lan, Hua Zong, Nannan Wang, Harbin Institute of Technology, China

Additively Manufactured Antennas and Structures

Session Co-Chairs: Ahmed A. Kishk, Concordia University; Gregory Huff, Pennsylvania State University

MO-A5.2A.1 **08:00**

Slot-Excited Wideband Horn Antenna with Microstrip Line Feeding for Ka-Band Applications

Nadeem Ashraf, Ahmed Kishk, Abdel Razik Sebak, Concordia University, Canada

MO-A5.2A.2 **08:20**

Phased Array Antenna Element with Embedded Cavity and MMIC using Direct Digital Manufacturing

Merve Kacar, University of South Florida, United States; Casey Perkowski, Kenneth Church, Sciperio Inc., United States; Bae-Ian Wu, Air Force Research Laboratory, United States; Jing Wang, University of South Florida, United States; Thomas Weller, Oregon State University, United States; Gokhan Mumcu, University of South Florida, United States

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

Wrist-Worn RFID Antenna Printed on Additive Manufactured Flexible Substrate

João M. Felício, Instituto de Telecomunicações, Portugal; Sérgio A. Matos, Instituto de Telecomunicações/ISCTE-IUL, Portugal; António M. Almeida, Instituto de Telecomunicações/ Instituto Superior Técnico, Portugal; Jorge R. Costa, Instituto de Telecomunicações/ISCTE-IUL, Portugal; Carlos A. Fernandes, Instituto de Telecomunicações/Instituto Superior Técnico, Portugal

MO-A5.2A.4 **09:00**

Additively-Manufactured Cylindrical Array with Snap-fit Connector Integration

Anna Stume, Mark Dorsey, U.S. Naval Research Laboratory, United States; Ozlem Kilic, Catholic University of America, United States; John Valenzi, U.S. Naval Research Laboratory, United States

MO-A5.2A.5 **09:20**

A Novel Diagnostics Method for Determining the Unknown Permittivity Profile of 3D Printed Lenses

Jordan Budhu, Yahya Rahmat-Samii, University of California, Los Angeles, United States

Break **09:40**

MO-A5.2A.6 **10:00**

Additively Manufactured Circular-Linear Polarization Converter using Circular Waveguide

David Mitchell, Nicole Bohannon, Laboratory for Physical Sciences, United States

MO-A5.2A.7 **10:20**

Inkjet Printed Lange Coupler for Antenna Systems

Xuanke He, Manos Tentzeris, Georgia Institute of Technology, United States

MO-A5.2A.8 **10:40**

Electroless Silver Plating of Additive Manufactured Trough Waveguide Mode Transducer and Antenna Structure

Amrita Bal, Anoop Tiwari, Texas A&M University, United States; Gregory Huff, Pennsylvania State University, United States

MO-A5.2A.9 **11:00**

Liquid Waveguide Antenna

Guan-Long Huang, Jia-jun Liang, Tao Yuan, Shenzhen University, China

MO-A5.2A.10 **11:20**

Ka-Band Low-Cost Focused Lens with Frequency-Scanning Features

Shilin Liu, Xianqi Lin, University of Electronic Science and Technology of China, China

Electromagnetic Measurements and Material Characterization I

Session Co-Chairs: Jon Wallace, Lafayette College; Adib Nashashibi, The University of Michigan

MO-A2.1A.1 **08:00**

Permittivity Characterization of Automotive Paint Material at W-Band Frequencies

Adib Nashashibi, Kamal Sarabandi, University of Michigan, United States; Hussein Shaman, Mohammed Aseeri, King Abdulaziz City for Science and Technology, Saudi Arabia

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

Highly Accurate Liquid Permittivity Measurement using Coaxial Lines

Seyed Mirjahanmardi, Omar Ramahi, University of Waterloo, Canada

MO-A2.1A.3 **08:40**

EM Measurements of Glucose-Aqueous Solutions

Ala Eldin Omer, George Shaker, Safieddin Safavi-Naeini, Raed M. Shubair, University of Waterloo, Canada

MO-A2.1A.4 **09:00**

4-40 GHz Permittivity Measurements of Indoor Building Materials

Jonathan Abel, Jon Wallace, Lafayette College, United States

MO-A2.1A.5 **09:20**

Measurement of Dielectric Constants of Liquid Crystals Using Double-Ridged Waveguide Cavity

Chengyong Yu, En Li, University of Electronic Science and Technology of China, China

Break **09:40**

MO-A2.1A.6 **10:00**

Permittivity depth profile measurements of the Antarctic firn layer in the 0.4-2 GHz band

Roberto Olmi, Saverio Priori, Consiglio Nazionale delle Ricerche, Italy; Alberto Toccafondi, Federico Puggelli, University of Siena, Italy

MO-A2.1A.7 **10:20**

Characterization of Biological Tissues Using a Suspended Microstrip Ring Resonator

Nivedita Parthasarathy, Ramesh Abhari, Santa Clara University, United States

MO-A2.1A.8 **10:40**

Characterization of Oils and Oil Mixtures using Terahertz Time-Domain Spectroscopy

Khem Poudel, Seth Floyd, William Robertson, Middle Tennesse State University, United States

MO-A2.1A.9 **11:00**

Microwave performance measurement of InP powder under light irradiation

Yafeng Li, En Li, University of Electronic Science and Technology of China, China

Millimeter-wave and Terahertz Antenna Design and Optimization

Session Co-Chairs: Yang Hao, Queen Mary University of London; Andrea Neto, Delft University of Technology

MO-A5.3A.1 **08:00**

Analyzing Lens Based Focal Plane Arrays using Coherent Fourier Optics

Shahab Oddin Dabironezare, Giorgio Carluccio, Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands

MO-A5.3A.2 **08:20**

Analysis of a Wideband Fabry-Pérot Cavity Antenna at 60 GHz using Grid Impedance Approximation

Ahmad Almutawa, Hamidreza Kazemi, Filippo Capolino, University of California, Irvine, Kuwait; David Jackson, University of Houston, United States

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

Modified Luneburg Lens for THz Beam Steering Applications

Andre Sarker Andy, Queen Mary University of London, United Kingdom; Emma Newton, Sajad Haq, QinetiQ, United Kingdom; Yang Hao, Queen Mary University of London, United Kingdom

MO-A5.3A.4 **09:00**

Finger Blockage Mitigation Method for mmWave Beamforming Mobile Devices

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

MO-A5.3A.5 **09:20**

Dual-band Phased Array Antenna on Metal for mmWave Mobile Application

Junggil Kim, Sung Soo Kim, Young Joong Yoon, Yonsei University, Korea (South); Hyungrak Kim, Daelim University College, Korea (South)

Break **09:40**

MO-A5.3A.6 **10:00**

Leaky Lens Pulsed Photo-Conductive THz Emitters

Alessandro Garufo, Paolo Sberna, Giorgio Carluccio, Delft University of Technology, Netherlands; Juan Bueno, Netherland Institute of Space Research (SRON), Netherlands; Joshua Freeman, David Bacon, Lianhe Li, University of Leeds, United Kingdom; Jochem Baselmans, Netherland Institute of Space Research (SRON), Netherlands; Edmund Linfield, Alexander Davies, University of Leeds, United Kingdom; Nuria Llombart, Andrea Neto, Delft University of Technology, Netherlands

MO-A5.3A.7 **10:20**

E-shaped Nano-antenna with Asymmetric Integrated Dielectric-plasmonic Waveguide

Zahra Manzoor, Missouri University of Science and Technology, United States; Mohammad Ali Panahi, University of California, Los Angeles, United States; Amin Pak, Semnan University, Iran

MO-A5.3A.8 **10:40**

Array Optimization for Maximum Realized Gain in Terahertz Antenna with Lens

Galia Ghazi, Parinaz Sadri-moshkenani, Reza Safian, imec, United States

MO-A5.3A.9 **11:00**

Millimeter-Wave Antenna with Improved Bandwidth and Isolation for MIMO Applications

Chunxu Mao, Pingjuan L. Werner, Douglas H. Werner, Pennsylvania State University, United States

MO-A5.3A.10 **11:20**

Modulating Surface Impdances of Surface Plasmon Polaritons for Leaky Wave Plasmonic Nanoantennas

Yuan-Song Zeng, Shi-Wei Qu, University of Electronic Science and Technology of China, China

Leaky-Wave and Travelling-Wave Antennas

Session Co-Chairs: Rafael Rodríguez Solís, University of Puerto Rico at Mayaguez; David R. Jackson, University of Houston

MO-A1.3A.1 **08:00**

Leaky-Wave Antenna on Holey EBG Based Gap-Waveguide

Maria Soto Medina, Rafael Rodríguez Solís, University of Puerto Rico at Mayaguez, United States

MO-A1.3A.2 **08:20**

Millimeter-Wave Metallic Bull's–Eye Antenna with Wideband Broadside Radiation Characteristics

Glad Dragos, Queen's University, Canada; Brad Jackson, California State University, Northridge, United States; Carlos Saavedra, Queen's University, Canada

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

Periodic Leaky-Wave Antenna with Modified Gielis-Shaped Patch Elements

Vignesh Shanmugam Bhaskar, Eng Leong Tan, King Ho Holden Li, Nanyang Technological University, Singapore

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

A Hybrid Uniform/Periodic Dual-Mode Dielectric Grating Leaky-Wave Antenna

Libin Sun, Tsinghua University, China; Yuanxin Li, Sun Yat-sen University, China; Yue Li, Zhijun Zhang, Zhenghe Feng, Tsinghua University, China

MO-A1.3A.5 **09:20**

Low Cross Polarization Leaky-Wave Antenna Based on SIW-CRLH Transmission Line

Yang Liu, Hongjian Wang, Lifang Zhang, National Space Science Center, Chinese Academy of Sciences, China

Break **09:40**

MO-A1.3A.6 **10:00**

Recent Advances in 1-D Leaky-Wave Antenna Theory

Walter Fuscaldo, Sapienza University of Rome, Italy; David Jackson, University of Houston, United States; Alessandro Galli, Sapienza University of Rome, Italy

MO-A1.3A.7 **10:20**

A Wideband Frequency Beam Scanning Antenna Based on the Spoof Surface Plasmon Polaritons

Jun Wang, Zhang-Cheng Hao, Southeast University, China; Lei Zhao, China University of Mining and Technology, China

MO-A1.3A.8 **10:40**

Microstrip-Fed Endfire Antennas with High Gain and Stable Radiation Pattern

Yuefeng Hou, Yue Li, Zhijun Zhang, Zhenghe Feng, Tsinghua University, China

MO-A1.3A.9 **11:00**

A Novel Conformal Travelling-Wave Circularly Polarized Microstrip Antenna Design

Stanislav Ogurtsov, Slawomir Koziel, Reykjavik University, Iceland

Monday, July 8 08:00 - 09:40
MO-A1.4A Room 303

Broadband Antennas for 5G systems

Session Co-Chairs: Nada Sekeljic, Intel; Daniel Segovia-Vargas, Universidad Carlos III de Madrid

MO-A1.4A.1 **08:00**

5G Broadband Antenna for sub-6 GHz Wireless Applications

Nada Sekeljic, Zhen Yao, Hao-Han Hsu, Intel, United States

MO-A1.4A.2 **08:20**

Design of a Wideband Vivaldi Antenna for 5G Base Stations

Paula Fernandez-Martinez, Sergio Martin-Anton, Daniel Segovia-Vargas, Universidad Carlos III de Madrid, Spain

MO-A1.4A.3 **08:40**

MIMO Antenna for Indoor Low-Band 5G Base Stations

Jaime Molins-Benlliure, Universitat Politècnica de València, Spain; Aníbal Llanga-Vargas, Universidad Nacional de Chimborazo, Ecuador; Dong Kook Park, Korea Maritime and Ocean Univesrity, Korea (South); Miguel Ferrando-Bataller, Marta Cabedo-Fabrés, Universitat Politècnica de València, Spain

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

Analog Beamforming System Using Rotman Lens for 5G Applications at 28 GHz

Essa Mujammami, Abdel Razik Sebak, Concordia University, Canada

MO-A1.4A.5 **09:20**

ISGW Feed Slot-Coupled Magnetoelectric Dipole Antenna For 5G Applications

Huaqiang Zhang, Dongya Shen, Hong Yuan, Yunnan University, China

Monday, July 8 10:00 - 11:40
MO-A2.2A Room 303

Analysis of Metamaterials and Metasurfaces

Session Co-Chairs: Ariel Epstein, Technion - Israel Institute of Technology; Anthony Grbic, University of Michigan

MO-A2.2A.1 **10:00**

Rigorous Analytical Model for Metasurface Microscopic Design with Interlayer Coupling

Shahar Levy, Yaniv Kerzhner, Ariel Epstein, Technion - Israel Institute of Technology, Israel

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

Equivalent Circuit Models and Prony's Analysis of Electromagnetic Designs Using Genetic Programing

Gui Chao Huang, Scott Clemens, Magdy Iskander, Zhenqing Yun, University of Hawaii, United States

MO-A2.2A.3 **10:40**

Modified Floquet Scattering Matrix Method for Solving N-path Networks

Cody Scarborough, Anthony Grbic, University of Michigan, United States

MO-A2.2A.4 **11:00**

Categorizing Metamaterials by using Equivalent Dielectric Approach

Abdelkhalek Nasri, Research Laboratory Smart Electricity & ICT, SEICT, LR18ES44, Tunisia; Raj Mittra, University of Central Florida, United States; Hatem Rmili, King Abdulaziz University, Faculty of Engineering, Saudi Arabia

MO-A2.2A.5 **11:20**

Analysis of Phase Discretization Influence on the Monochromatic Aberrations of Focusing Metasurface Based on Generalized Rayleigh-Sommerfeld Diffraction Theory

Hongjun Chu, Jiaran Qi, Jinghui Qiu, Harbin Institute of Technology, China

Monday, July 8 08:00 - 11:40
MO-A4.1A Room 304

Remote Sensing

Session Co-Chairs: Leung Tsang, University of Michigan; Robert Burkholder, Ohio State University

MO-A4.1A.1 **08:00**

Non-Destructive Dielectric Constant Measurement of Low-Loss Dielectric Slabs Using Wideband Autocorrelation Radiometry

Seyedmohammad Mousavi, Roger De Roo, Kamal Sarabandi, Anthony England, University of Michigan, United States

MO-A4.1A.2 **08:20**

Evaporation Duct Refractivity Inversions from Fixed Transmitter-Fixed Receiver UWB Measurements

Luyao Xu, Caglar Yardim, Robert Burkholder, Ohio State University, United States; Denny P. Alappattu, Qing Wang, Naval Postgraduate School, United States

MO-A4.1A.3 **08:40**

Multiple Scattering Solution of Passive Radiative Transfer Equations Applied to Forests

Maryam Salim, University of Michigan, United States; Shurun Tan, Zhejiang University, China; Leung Tsang, University of Michigan, United States

MO-A4.1A.4 **09:00**

Integrated Water Vapor Estimation through Microwave Propagation Measurements: First Experiment on a Ground-To-Ground Radio Link

Alberto Toccafondi, Federico Puggelli, Matteo Albani, University of Siena, Italy; Luca Facheris, University of Florence, Italy; Fabrizio Cuccoli, CNIT - National Inter-University Consortium for Telecommunications, Italy; Giovanni Macelloni, Francesco Montomoli, National Research Council of Italy (CNR), Italy; Alessio Cucini, Francesco Mariottini, WaveComm S.r.l., Italy; Luigi Volpi, RTW Ride The Wave S.r.l., Italy; Devis Dei, Florence Engineering S.r.l., Italy; Marco Gai, Laboratori Victoria S.r.l., Italy

MO-A4.1A.5 **09:20**

Micro-Doppler Based Detection of Hovering UAVs

Linlin Wang, Yang Li, Ning Zhang, Xinyang Wang, Harbin Institute of Technology, China; Wenxing Wang, CSSC Mariime Technology Co., Ltd, China; Wenbo Ding, Harbin Institute of Technology, China

Break **09:40**

MO-A4.1A.6 **10:00**

Modeling and Measurement of Ducted EM Propagation over the Gulf Stream

Qi Wang, Robert Burkholder, Ohio State University, United States

MO-A4.1A.7 **10:20**

Electromagnetic Scattering from Random Rough Surfaces with Multiple Elevations for GNSS-R Land Applications

Jiyue Zhu, Leung Tsang, University of Michigan, United States

MO-A4.1A.8 **10:40**

Retrieval of Subsurface Properties of Layered Dielectric Structures Using Hybrid Global and Local Optimization

Aslan Etminan, Alireza Tabatabaeenejad, Richard Chen, Mahta Moghaddam, University of Southern California, United States

MO-A4.1A.9 **11:00**

A Machine Learning Based First-Order Sea Clutter Region Extraction Method for HFSWR

Yang Li, Xinyang Wang, Ning Zhang, Harbin Institute of Technology, China; Wenxing Wang, Qiming Zhang, CSSC Marine Technology cO., Ltd, China; Wenbo Ding, Longshan Wu, Harbin Institute of Technology, China

MO-A4.1A.10 **11:20**

Maneuvering Target Detection Method Based on RD Spectrum of Skywave OTHR

Hui Zheng, Yang Li, Ning Zhang, Longshan Wu, Xinyang Wang, Wenbo Ding, Harbin Institute of Technology, China

Monday, July 8 | 08:00 - 11:20
MO-A3.1A | Room 305

Transient Simulations

Session Co-Chairs: Hakan Bagci, King Abdullah University of Science and Technology (KAUST); Tapan Sarkar, Syracuse University

MO-A3.1A.1 **08:00**

Transient Diffraction Mechanism of Electromagnetic Scattering from Conducting Bodies based on the Approximation of Physical Optics

Hsi-Tseng Chou, Chen-Yi Chang, National Taiwan University, Taiwan

MO-A3.1A.2 **08:20**

A Higher-order Explicit Marching-on-in-time for Analysis of Transient Acoustic Scattering from Rigid Objects

Rui Chen, Hakan Bagci, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

MO-A3.1A.3 **08:40**

A Stabilized Marching-on-in-Degree Solution of Time Domain Combined Field Integral Equation

Ming-Da Zhu, Xidian University, China; Tapan Sarkar, Syracuse University, United States; Yu Zhang, Xidian University, China

MO-A3.1A.4 **09:00**

Fast Multipole Time Domain Algorithm for the Scalar and Vector Wave Equation

Yifei Shi, Jiangsu University of Technology, China

MO-A3.1A.5 **09:20**

Predicting Instability in Transient Simulations, using Complex Numerical Impulse Response

Amirreza Jalali Khalilabadi, Ata Zadehgol, University of Idaho, United States

Break **09:40**

MO-A3.1A.6 **10:00**

A Two-Component Compact 2-D FDFD Method for Waveguide Structures with ARPACK

Xiaoliang Gu, Xiaolin Jin, Jinxin Li, Bin Li, University of Electronic Science and Technology of China, China

MO-A3.1A.7 **10:20**

Transient Analysis of Electromagnetic Scattering by Penetrable Objects Based on Time-Domain PMCHWT Equations

Qing Xu, Xi Yuan Du, Ze Yuan Lu, Mei Song Tong, Tongji University, China

MO-A3.1A.8 **10:40**

A Hybrid Sub-Gridded FDTD for Efficient Time Reversal Simulation

Bao-Jun Jiang, Xiao-Kun Wei, Fu-Long Jin, Zhipeng Wang, Wei Shao, University of Electronic Science and Technology of China, China

MO-A3.1A.9 **11:00**

Field Sampling Strategies for POD Model Order Reduction of Particle-in-Cell Simulations

Julio de Lima Nicolini, Dong-Yeop Na, Fernando Lisboa Teixeira, Ohio State University, United States

Monday, July 8 | 08:00 - 09:40
MO-UB.2A | Room 211

Frequency Selective Surfaces and Filters

Session Chair: Gregory Huff, Pennsylvania State University

MO-UB.2A.1 **08:00**

Plasmonic Metamaterial Based Dual-Band Filter

Nidhi Pandit, Rahul Kumar Jaiswal, Nagendra Prasad Pathak, Indian Institute of Technology, Roorkee, India

MO-UB.2A.2 **08:20**

Leveraging Data Science to Characterize Additively Manufactured Electromagnetic Components

Deanna Sessions, Pennsylvania State University, United States; Andrew Gillman, UES Inc., United States; Alexander Cook, NextFlex, United States; Kazuko Fuchi, University of Dayton Research Institute, United States; Gregory Huff, Pennsylvania State University, United States; Philip Buskohl, Air Force Research Laboratory, United States

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

Terahertz Plasmonic Metamaterial Based Multi-band Band-Pass Filter Using Micro-Ring Resonator

Rahul Kumar Jaiswal, Nidhi Pandit, Nagendra Prasad Pathak, Indian Institute of Technology, Roorkee, India

MO-UB.2A.4 **09:00**

Wideband BPF for 5G mm-wave Applications with Detailed Extraction of Poles and Zeros

Aqeela Saghir, Salman Arain, Abdul Quddious, Symeon Nikolaou, Photos Vryonides, Frederick Research Center, Frederick University, Cyprus

MO-UB.2A.5 **09:20**

Reflectionless perfect absorber based on hybridization of electric and magnetic resonant modes

Juan P. del Risco, Juan D. Baena, Universidad Nacional de Colombia, Colombia; Andrey Sayanskiy, Stanislav B. Glybovski, ITMO University, Russia

Monday, July 8 | 10:00 - 11:40
MO-A1.5A | Room 211

Spiral Antennas

Session Chair: Hisamatsu Nakano, Hosei University

MO-A1.5A.1 **10:00**

Analysis of Cross- and X-Shaped Spiral Antenna Arrays for Amplitude-Comparison DF Systems

Eduardo Sakomura, Daniel Ferreira, Ildefonso Bianchi, Daniel Chagas do Nascimento, Diego Moná, Technological Institute of Aeronautics, Brazil

MO-A1.5A.2 **10:20**

An Ultra-Wideband Edge-Fed Octagonal Four-Arm Archimedean Spiral Antenna

Sanghoon Lee, Michael E.D. Smith, Sensen Li, Hua Wang, Georgia Institute of Technology, United States

MO-A1.5A.3 **10:40**

Underwater Deployment and Performance of Curved Spiral Antennas in Mussel Backpacks

Ruben Llamas, Kumar Vijay Mishra, James Niemeier, Anton Kruger, University of Iowa, United States

MO-A1.5A.4 **11:00**

Bow-Spiral Antenna

Thi M. D. Tran, Marc Piette, Royal Military Academy, Belgium

MO-A1.5A.5 **11:20**

Performance Analysis of Azimuth-Only Amplitude-Comparison DF System in Operational Scenarios

Eduardo Sakomura, Daniel Ferreira, Ildefonso Bianchi, Daniel Chagas do Nascimento, Diego Moná, Technological Institute of Aeronautics, Brazil

Antenna Theory and Design I

Session Co-Chairs: Satish Sharma, San Diego State University; Kubilay Sertel, Ohio State University

MO-UB.3A.1 **08:00**

Wide Angle Beam Steering Cylindrical Parabolic Reflector with Phased Array as a Feed Source for Ku-Band Applications

Ghanshyam Mishra, Satish K Sharma, San Diego State University, United States; Jia-Chi Chieh, Randall Olsen, SPAWAR, United States

MO-UB.3A.2 **08:20**

Compressed Elliptical Geodesic Luneburg Lens for Ka-band Satellite Communications

Qingbi Liao, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden

MO-UB.3A.3 **08:40**

Flexibility In Space: Challenges and Evolution In Satellite Antennas Specification, Design and Test

Sara Mugnaini, Eva Gonzalez Esteban, Inmarsat plc, United Kingdom

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

Design of Dual-Polarized, Platform-Based HF Antennas for NVIS Applications Using the Characteristic Mode Theory

Kai Ren, Mohammad Ranjbar Nikkhah, Nader Behdad, University of Wisconsin-Madison, United States

MO-UB.3A.5 **09:20**

Voltage Doubler Rectenna Design with Surface Waves Suppression

Mohammad Fairouz, Public Authority for Applied Education and Training (PAAET), Kuwait

Break **09:40**

MO-UB.3A.6 **10:00**

Non-Contact Characterization of Antenna Parameters via Network Calibration

Seckin Sahin, Niru K. Nahar, Kubilay Sertel, Ohio State University, United States

MO-UB.3A.7 **10:20**

Design of a Fast Antenna Tuner for a Synchronously Tuned Mobile HF/VHF Transmitter

Jacob Rissmiller, Jacob Peiffer, Layth Hozi, Erica Daly, SPAWAR Systems Center Pacific, United States

MO-UB.3A.8 **10:40**

A Novel Planar Microstrip Line Comparator Network for Monopulse Tracking Radar System

Hanxiang Zhang, Han Ren, Bayaner Arigong, Washington State University, United States

MO-UB.3A.9 **11:00**

Full-wave synthesis procedure for the design of innovative metasurface devices

Modeste Bodehou, Christophe Craeye, Université catholique de Louvain, Belgium; Enrica Martini, Stefano Maci, University of Siena, Italy

MO-UB.3A.10 **11:20**

Accurate Reconstruction of Antenna Radiation Pattern from Measurements in a Small Non-ideal Chamber

Layth Abuhadma, University of Karbala, Iraq

Application of Machine/Deep Learning and Uncertainty Quantification Techniques in Computational Electromagnetics

Session Co-Chairs: Luis Gomez, Duke University School of Medicine; Cynthia Furse, University of Utah; Costas Sarris, University of Toronto

MO-SP.1P.1 **13:20**

Generalization Capabilities of Deep Learning Schemes in Solving Inverse Scattering Problems

Zhun Wei, Xudong Chen, National University of Singapore, Singapore

MO-SP.1P.2 **13:40**

Geometrically Stochastic Finite Difference Time Domain Method

Khadijeh Masumnia-Bisheh, Tarbiat Modares University, Iran; Cynthia Furse, University of Utah, United States

MO-SP.1P.3 **14:00**

Fast Surrogate Model-Assisted Uncertainty Quantification via Quantized Tensor Train Decompositions

Luis Gomez, Duke University School of Medicine, United States; Abdulkadir Yucel, Nanyang Technological University, Singapore; Weitian Sheng, Cadence Design Systems, United States; Eric Michielssen, University of Michigan, United States

MO-SP.1P.4 **14:20**

Deep Convolutional Neural Network Approach for Solving Nonlinear Inverse Scattering Problems

Lianlin Li, Longgang Wang, Peking University, China; Daniel Ospina Acero, Fernando Teixeira, Ohio State University, United States

MO-SP.1P.5 **14:40**

Error Estimation and Uncertainty Quantification Based on Adjoint Methods in Computational Electromagnetics

Branislav Notaros, Jake Harmon, Cam Key, Donald Estep, Colorado State University, United States; Troy Butler, University of Colorado Denver, United States

Break **15:00**

MO-SP.1P.6 **15:20**

A Multi-Level Reconstruction Algorithm for Electrical Capacitance Tomography Based on Modular Deep Neural Networks

Elizabeth Chen, Costas Sarris, University of Toronto, Canada

MO-SP.1P.7 **15:40**

Deep Neural Network Representations of Transient Electrodynamic Phenomena

Oameed Noakoasteen, Shu Wang, Zhen Peng, University of New Mexico, United States

MO-SP.1P.8 **16:00**

Fast and Accurate Near-Field to Far-Field Transformation Using an Adaptive Sampling Algorithm and Machine Learning

Rezvan Rafiee Alavi, Rashid Mirzavand, Pedram Mousavi, University of Alberta, Canada

MO-SP.1P.9 **16:20**

Experimental Microwave Target Identification Using Machine Learning

Clayton Kettlewell, Kyle Hetjmanek, George Scott, Waleed Al-Shaikhli, Blake Willig, Ala-Addin Nabulsi, Somen Baidya, Reza Derakhshani, Ahmed M. Hassan, University of Missouri-Kansas City, United States

MO-SP.1P.10 **16:40**

Uncertainty Quantification of Radio Propagation Models Using Artificial Neural Networks

Aristeidis Seretis, Xingqi Zhang, Costas Sarris, University of Toronto, Canada

Monday, July 8 | 13:20 - 17:00
MO-SP.2P | Special Session | Grand Ballroom D

Space-Time Modulated Metamaterials

Session Co-Chairs: Christophe Caloz, Polytechnique Montréal; Andrea Alù, CUNY Advanced Science Research Center

MO-SP.2P.1 **13:20**

The Dawn of Spacetime Metamaterials

Christophe Caloz, Zoé-Lise Deck-Léger, École Polytechnique de Montréal, Canada

MO-SP.2P.2 **13:40**

Propagation in a Temporally Modulated Transmission Line: Exotic Band Structures and Reconfigurable Applications

Peter Halevi, Alexander Gómez Rojas, Instituto Nacional de Astrofísica, Óptica y Electronica (INAOE), Mexico

MO-SP.2P.3 **14:00**

Nonreciprocal Transmission through Locally Time-Modulated Bianisotropic Metafilms

Ana Díaz-Rubio, Viktar Asadchy, Grigorii Ptitcyn, Mohammad Mirmoosa, Sergei Tretyakov, Aalto University, Finland

MO-SP.2P.4 **14:20**

Non-Reciprocity Based on Synthetic Momentum Bias

Ahmed Kord, University of Texas at Austin, United States; Dimitrios Sounas, Wayne State University, United States; Andrea Alù, CUNY Advanced Science Research Center, United States

MO-SP.2P.5 **14:40**

Nonreciprocal Metasurfaces through Biasing with Circularly Polarized Waves

Dimitrios Sounas, Wayne State University, United States

Break **15:00**

MO-SP.2P.6 **15:20**

UWB Impedance Matching by Temporal Switching

Yakir Hadad, Tel Aviv University, Israel; Amir Shlivinski, Ben Gurion University of the Negev, Israel

MO-SP.2P.7 **15:40**

Linear Pulse Compansion based on Space-Time Modulation

Nima Chamanara, David G. Cooke, McGill University, Canada; Christophe Caloz, Polytechnique Montréal, Canada

MO-SP.2P.8 **16:00**

Harmonic-Modulated Nonlinear Metasurface Based on Generalized Phase Conjugation Principle

Xibi Chen, Fan Yang, Tsinghua University, China

MO-SP.2P.9 **16:20**

Full-duplex Near-infrared Communication via Spatiotemporally-modulated Array Antennas

Mohammad Mahdi Salary, Hossein Mosallaei, Northeastern University, United States

MO-SP.2P.10 **16:40**

Coding Programmable Metasurfaces Based on Deep Learning Techniques

Tao Shan, Maokun Li, Tsinghua University, China

Monday, July 8 | 13:20 - 17:00
MO-A1.1P | Grand Ballroom A

Broadband Antennas

Session Co-Chairs: Prasad Shastry, Bradley University; MANISHA KAHAR, Indian Institute of Technology Kharagpur

MO-A1.1P.1 **13:20**

Enhanced Axial-Ratio Bandwidth Single-Point-Fed CP Antenna Using Slot Structure Modification

Ubaid Ullah, Slawomir Koziel, Reykjavik University, Iceland

MO-A1.1P.2 **13:40**

A Semi-Circular Slot Textile Antenna for Ultra-Wideband Applications

Swetha Amit, Viswanath Talasila, Ramaiah Institute of Technology, India; Prasad Shastry, Bradley University, United States

MO-A1.1P.3 **14:00**

L-Probe and U-Slot Microstrip Circular Antenna for Application in the Detection of Partial Discharges in Power Transformers

George Victor Rocha Xavier, Edson Guedes da Costa, Alexandre Jean René Serres, Camila Caroline Rodrigues de Albuquerque, Federal University of Campina Grande, Brazil

MO-A1.1P.4 **14:20**

High Gain Wideband Air Strip-Line Fed Antenna For High Power Applications

Sherif R. Zahran, Arab Academy for Science, Technology & Maritime Transport, Egypt; Ahmed Elshafey, Mahmoud A. Abdalla, Military Technical College, Egypt

MO-A1.1P.5 **14:40**

Design of Wideband Slot Antennas By Using Combined Characteristic Modes

Jiang-Feng Lin, Qing-Xin Chu, South China University of Technology, China

Break **15:00**

MO-A1.1P.6 **15:20**

Feed Based Bandwidth Enhancement of U-Slot Microstrip Patch using Theory of Characteristic Modes

Mahrukh Khan, University of Missouri-Kansas City, United States

MO-A1.1P.7 **15:40**

A Novel Class of Super-Elliptical Vivaldi Antennas with Enhanced Radiation Properties

Simay Kazıcı, Abraham Loutridis, Diego Caratelli, The Antenna Company, Netherlands

MO-A1.1P.8 **16:00**

Performance Evaluation on Various Resistively Loaded Wrapped Bowtie Antenna

Doojin Lee, George Shaker, William Melek, University of Waterloo, Canada

MO-A1.1P.9 **16:20**

A Wideband Top-Hat Loaded Monocone Antenna Using Shorting Strips

Kyoseung Keum, Sungpeel Kim, Hanyang University, Korea (South); Youngmi Park, Agency for Defense Development, Korea (South); Jaehoon Choi, Hanyang University, Korea (South)

MO-A1.1P.10 **16:40**

A Slotted Circular Patch Antenna with Wideband Filtering Characteristics

Manisha Kahar, Mrinal Kanti Mandal, Indian Institute of Technology, Kharagpur, India

Antennas for 5G II

Session Co-Chairs: Seckin Sahin, Ohio State University; Wonbin Hong, Pohang University of Science and Technology

MO-A5.1P.1 **13:20**

Wideband printed ridge gap waveguide differential feeding aperture antenna for millimeter wave applications

Islam Afifi, Magid Alzidani, Abdel Razik Sebak, Concordia University, Canada

MO-A5.1P.2 **13:40**

mmWave Double Cavity-Backed Slot Antenna featuring Electrically Small and Low-Profile

Jaehyun Choi, Junho Park, Woonbong Hwang, Wonbin Hong, Pohang University of Science and Technology (POSTECH), Korea (South)

MO-A5.1P.3 **14:00**

Conformal Antipodal Vivaldi Antenna With Parasitic Elements For 5G Millimeter Wave Applications

Yuxiao He, John Papapolymerou, Michigan State University, United States

MO-A5.1P.4 **14:20**

A Novel Wideband Millimeter Wave Integrated Substrate Gap Waveguide Patch Antenna

Bingshuai Huangfu, Dongya Shen, Yunnan University, China; Xiupu Zhang, Concordia University, Canada

MO-A5.1P.5 **14:40**

Silver Nanowire based Flexible, Transparent, Wideband Antenna for 5G Band Application

Weiwei Li, Azat Meredov, Atif Shamim, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

Break **15:00**

MO-A5.1P.6 **15:20**

An Aperture-Coupled Dual-Polarized Stacked Patch Antenna for Multi-Layer Organic Package Integration

Duixian Liu, Xiaoxiong Gu, Christian Baks, Alberto Valdes-Garcia, IBM T. J. Watson Research Center, United States

MO-A5.1P.7 **15:40**

Series Chained Patch Phased Array Antenna for mmWave 5G Mobile in Metal Bezel Design

Sung Soo Kim, Samsung Electronics, Korea (South); Sung Hoe Kim, Bae Jang Hwan, Young Joong Yoon, Yonsei University, Korea (South)

MO-A5.1P.8 **16:00**

Design of a Planar Wideband Yagi-Uda Antenna for Millimeter Wave SAR Imaging Application

Yuan Gao, Mohammad Ghasr, Reza Zoughi, Missouri University of Science and Technology, United States

MO-A5.1P.9 **16:20**

Millimeter-Wave Triple-Resonance Substrate Integrated Waveguide Cavity-Backed Slot Antenna With Cavity Resonator

Jang Hwan Bae, Jun Gi Jeong, Young Joong Yoon, Yonsei University, Korea (South); Hyungrak Kim, Daelim University College, Korea (South)

Reflectarray Design and Applications

Session Co-Chairs: Marco Salucci, ELEDIA Research Center, University of Trento; Zhirun Hu, University of Manchester

MO-A1.2P.1 **13:20**

Tx/Rx Reflectarray for Multiple Spot Beam Applications in Ka-band

Min Zhou, Stig Busk Sørensen, Niels Vesterdal Larsen, Michael Forum Palvig, Erik Jørgensen, TICRA, Denmark

MO-A1.2P.2 **13:40**

Phoenix cells reduced database construction for efficient reflectarray synthesis

Andrea Guarriello, Heriot-Watt University, United Kingdom; Renaud Loison, Institut d'Électronique et de Télécommunications de Rennes, France; George Goussetis, Heriot-Watt University, United Kingdom; Daniele Bresciani, Herve Legay, Thales Alenia Space, France

MO-A1.2P.3 **14:00**

Frontiers in Reflectarray Design

Giacomo Oliveri, Marco Salucci, Angelo Gelmini, Andrea Massa, ELEDIA Research Center (ELEDIA@ UniTN – University of Trento), Italy

MO-A1.2P.4 **14:20**

Design methodology of a passive reflectarray for main beam collimation

Jiawei Han, M. A. Constant Niamien, Zouheir Riah, Normandie University, UNIROUEN, ESIGELEC, IRSEEM, France

MO-A1.2P.5 **14:40**

A Feasibility Study of Sparse Reflectarray Antennas

Jianhua Yang, Feng Yang, Rui Wang, Zhiyu Xing, Xiao Ma, University of Electronic Science and Technology of China, China

Break **15:00**

MO-A1.2P.6 **15:20**

Design of High Gain Single Layer Reflectarray Antenna using Ring and Double Square Elements

Shafaq Kausar, Saeideh Shad, Ahmed Kausar, Hani Mehrpouyan, Boise State University, United States

MO-A1.2P.7 **15:40**

3D-Printable Perforated Dielectric Reflectarray in Ka-band

Andrea Massaccesi, Michele Beccaria, Paola Pirinoli, Politecnico di Torino, Italy

MO-A1.2P.8 **16:00**

Effects of Large Angle of Incidence in Offset-Fed Reflectarray Antennas

Yu-Cheng Lin, Chun-Tzu Lin, Yuan-Chun Lin, National Chung Cheng University, Taiwan; Shih-Cheng Lin, National Chiayi University, Taiwan; Wei-Yang Chen, Sheng-Fuh Chang, National Chung Cheng University, Taiwan

MO-A1.2P.9 **16:20**

Circular Polarization Conversion Reflectarray Suppressing Beam Shift

Hiroki Yamada, Kotaro Sakagawa, Hiroyuki Deguchi, Mikio Tsuji, Doshisha University, Japan

MO-A1.2P.10 **16:40**

Compact Folded Transmitarray Antenna with a Planar Feeder

Yuehe Ge, Chengxiu Lin, Yufang Wang, Guowei Li, Huaqiao University, China

Novel Reconfigurable Antennas and Arrays

Session Co-Chairs: Sajid Asif, Sheffield University; Kurt Schab, Santa Clara University

MO-A1.3P.1 **13:20**

Dense Microvasculature in Structural Composites for Reconfigurable Parallel Wire Screens

Kurt Schab, Santa Clara University, United States; Jason Patrick, Sarah Mann, North Carolina State University, United States

MO-A1.3P.2 **13:40**

Electronically Reconfigurable Dipole Antenna Using Integrated Passive Non-Volatile Solid-State Metal-Insulator-Metal Switches

Jayakrishnan Methapettyparambu Purushothama, Etienne Perret, Universite Grenoble Alpes, France; Arnaud Vena, Brice Sorli, Université de Montpellier 2, France

MO-A1.3P.3 **14:00**

On Changing the Impedance of a Reactive Surface Using Magneto-static Responsive Particles

Jerika Cleveland, Dipankar Mitra, Jaco Lewis, Benjamin D. Braaten, North Dakota State University, United States; Jeffery Allen, Monica Allen, Air Force Research Laboratory, United States

MO-A1.3P.4 **14:20**

Center-Fed Circularly Polarized Omnidirectional Open-Helical Element Optimization

Henadz Krukovich, Benjamin Bladow, Jeffrey Varness, Steven Schennum, Gonzaga University, United States

MO-A1.3P.5 **14:40**

Design of a Terahertz Reconfigurable Reflectarray with Individually Controlled 1-bit Phasing Elements

Hongjing Xu, Shenheng Xu, Fan Yang, Tsinghua University, China; Shaobo Dun, Shixiong Liang, HeBei Semiconductor Research Institute, China

Break **15:00**

MO-A1.3P.6 **15:20**

Novel Reconfigurable Circularly Polarized Square Slot Antenna for underground mine

Mohamed Lamine Seddiki, Mourad Nedil, Iyadh Gammoudi, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

MO-A1.3P.7 **15:40**

Study of interconnecting switch currents in reconfigurable parasitic layer antennas

Germán Augusto Ramírez Arroyave, Javier Leonardo Araque Quijano, Universidad Nacional de Colombia, Colombia; Christian Ballesteros, Sebastián Blanch Boris, Jordi Romeu, Universitat Politecnica de Catalunya (UPC), Spain; Bedri Cetiner, Utah State University, United States; Luis Jofre Roca, Universitat Politecnica de Catalunya (UPC), Spain

MO-A1.3P.8 **16:00**

Performance Analysis of Radially Polarized Conformal Array in DOA and Polarization Estimation

Yilong Lu, Ling Huang, Nanyang Technological University, Singapore

MO-A1.3P.9 **16:20**

Design of High Gain Low Cost Beam-Steering Reflectarray Antenna

Shafaq Kausar, Saeideh Shad, Ahmed Kausar, Hani Mehrpouyan, Boise State University, United States

MO-A1.3P.10 **16:40**

A MIMO Communication System with Fixed and Reconfigurable Band Notch Antennas

Rashid Saleem, Asim Quddus, University of Engineering and Technology (UET), Taxila, Pakistan; Farhan Shafique, COMSATS Institute of Information Technology (CIIT), Pakistan; Tayyab Shabbir, University of Engineering and Technology (UET), Taxila, Pakistan

Slot Antennas

Session Chair: Hiroyuki Arai, Yokohama National University

MO-A1.4P.1 **13:20**

MM-Wave Beam-Steering Slot Antenna using Gradient Relative-Permittivity FSS Superstrate

Zahra Mousavirazi, Mehri Borhani Kakhki, National Institute of Scientific Research (INRS), Canada; Vahid Rafii, Aydin University, Turkey; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

MO-A1.4P.2 **13:40**

A Multilayer Dielectric Filled Radial Substrate Integrated Waveguide Slot Antenna

Dhruva Kumar Chandrappa, Shraman Gupta, Abdel Razik Sebak, Concordia University, Canada

MO-A1.4P.3 **14:00**

Eigenmode Analysis of Printed-Ridge-Gap-Waveguide Cavity and Its Application to Antenna design

Zhenjiang Zhao, Huan Li, Mohamad Mantash, Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

MO-A1.4P.4 **14:20**

Dual Polarized Omni Cell Antenna with Cylindrical Loop Slot

Bakar Rohani, Hiroyuki Arai, Yokohama National University, Japan

MO-A1.4P.5 **14:40**

Dual-Band Anti-Interference Slot Antenna Using Metamaterial Structure

Zhi Zheng, Wei Wang, Hong-Tao Zhang, Yu-Yang Zheng, East China Research Institute of Electronic Engineering, China; Xian-Ling Liang, Shanghai Jiao Tong University, China

Break **15:00**

MO-A1.4P.6 **15:20**

VHF notch antenna integrated in an aircraft winglet

Marta Martínez-Vázquez, Jordi Balcells-Ventura, IMST GmbH, Germany; Zdeněk Řezníček, Evektor, Czech Republic; Kai Gonet, Stefan Steeger, Invent GmbH, Germany; Petr Vrchota, VZLU – Czech Aerospace Research Centre, Czech Republic

MO-A1.4P.7 **15:40**

Dual-Band Dual-Polarized SIW Filtering Antenna

Manisha Kahar, Mrinal Kanti Mandal, Indian Institute of Technology, Kharagpur, India

MO-A1.4P.8 **16:00**

Integrated Substrate Gap Waveguide Circularly Polarized Slot Antenna

DanDan You, Dongya Shen, Yunnan University, China; Xiupu Zhang, Concordia University, Canada

MO-A1.4P.9 **16:20**

W band Substrate-integrated Slot Antenna-in-package Using Higher Order Mode

En Zhang, Liang Zhou, Shanghai Jiao Tong University, China; Wen-Yan Yin, Zhejiang University, China

MO-A1.4P.10 **16:40**

Grounded ±45° Dual Slant Polarized Omnidirectional Antenna

Muhammad Shahzad Sadiq, Cunjun Ruan, Beihang University, China

Electromagnetic Measurements and Material Characterization II

Session Co-Chairs: Loic Markley, University of British Columbia; Agostino Monorchio, University of Pisa

MO-A2.1P.1 **13:20**

Q-band Free-Space Setup for Measuring Dielectric Properties

Mohamed Hassan, Cairo University, Egypt; Riddhi Goswami, Ahmed Kishk, Vincent Mooney-Chopin, Concordia University, Canada

MO-A2.1P.2 **13:40**

An application of the virtual transmission line model of an open-ended coaxial probe for dielectric properties characterization of biological tissues

Nunzia Fontana, Eliana Canicattì, Agostino Monorchio, University of Pisa, Italy

MO-A2.1P.3 **14:00**

Highly Sensitive Planar Microwaves Sensor

Ali Albishi, King Saud University, Saudi Arabia; Omar Ramahi, University of Waterloo, Canada

MO-A2.1P.4 **14:20**

Experiments on Magnetic Diffusion in Metal Sheets

Raju Manthena, Darmindra Arumugam, NASA Jet Propulsion Lab, California Institute of Technology, United States

MO-A2.1P.5 **14:40**

A modified test fixture using parallel strips for measuring attenuation of the dielectric rod

Chong Gao, En Li, Chengyong Yu, Yafeng Li, University of Electronic Science and Technology of China, China

Break **15:00**

MO-A2.1P.6 **15:20**

Analysis of Multiple Objective Cost Functions for Free Space Material Characterization with Genetic Algorithms

Raenita Fenner, Loyola University, United States; Ryan Banks, Virginia Polytechnic Institute and State University, United States; Mark Dorsey, Naval Research Laboratory, United States

MO-A2.1P.7 **15:40**

A Method for the Measurement of RF Absorber using Spectral Domain Transformations

Vince Rodriguez, Brett T. Walkenhorst, NSI-MI Technologies, United States; Jorgen Bruun, PPG Aerospace, United States

MO-A2.1P.8 **16:00**

A Novel Technique to Reduce Truncation Error in Near-Field Measurements

Marco Salucci, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy; Marco Donald Migliore, ELEDIA Research Center (ELEDIA@UniCAS - University of Cassino and Southern Lazio), Cassino, Italy, Italy

MO-A2.1P.9 **16:20**

Accuracy Investigation of Single-Cut Near-Field Far-Field Transformation Technique Based on 2D Plane-Wave Expansion

Shuntaro Omi, Toru Uno, Takuji Arima, Tokyo University of Agriculture and Technology, Japan

THz, Millimeter-Wave and Nanoscale EM

Session Chair: Andrea Alù, CUNY Advanced Science Research Center

MO-UB.1P.1 **13:20**

Low Loss Slotted Substrate Integrated Air Waveguide (SIAW) Antenna Array for Millimeter-Wave Applications

Linfeng Li, Jie-Bang Yan, University of Alabama, United States

MO-UB.1P.2 **13:40**

MEMS-Suspended Bowtie Antenna Array for Microbolometer mmW Imaging Device

Mark Lust, Shangyi Chen, Nima Ghalichechian, Ohio State University, United States

MO-UB.1P.3 **14:00**

Design of a Sectoral Beam Planar SIW RADAR for Surveillance Applications at Millimeter Waves

Santi Concetto Pavone, Matteo Albani, University of Siena, Italy

MO-UB.1P.4 **14:20**

Plasmonic-Enhanced Graphene/III-V Hybrid Optical Diode

Bowen Zheng, Ruizhe Yao, Hang Li, Sensong An, Hong Tang, Clayton Fowler, University of Massachusetts Lowell, United States; Jeehwan Kim, Massachusetts Institute of Technology, United States; Wei Guo, Hualiang Zhang, University of Massachusetts Lowell, United States

MO-UB.1P.5 **14:40**

Coherent Excitation of Embedded Eigenstates in non-Hermitian PT-Symmetrical Systems

Aleksandr Krasnok, Zarko Sakotic, CUNY Advanced Science Research Center, United States; Norbert Cselyuszka, Nikolina Jankovic, University of Novi Sad, Serbia; Andrea Alù, CUNY Advanced Science Research Center, United States

Terahertz Sensing Applications

Session Chair: Abdelhamid Nasr, University of Michigan

MO-A5.2P.1 **15:20**

Monitoring Health Status and Quality Assessment of Leaves Using Terahertz Frequency

Adnan Zahid, University of Glasgow, United Kingdom; Hasan Tahir Abbas, Texas A&M University at Qatar, Qatar; Fawad Sheikh, Thomas Kaiser, Universitat Duisburg-Essen, Germany; Ahmed Zoha, Muhammad Ali Imran, Qammer Hussain Abbasi, University of Glasgow, United Kingdom

MO-A5.2P.2 **15:40**

Monitoring Quality Control of Fruits Using Terahertz Sensing

Aifeng Ren, Xidian University, China; Adnan Zahid, Muhammad Ali Imran, Qammer H. Abbasi, University of Glasgow, United Kingdom; Akram Alomainy, Queen Mary University of London, United Kingdom

MO-A5.2P.3 **16:00**

Wideband In-Situ Measurement of Soil Electrical Parameters Using Planar Dipole Antennas

Christelle Nasrany, Elias Nassar, Notre Dame University-Louaize, Lebanon

MO-A5.2P.4 **16:20**

Dielectric Sheets Broadband Characterization Using Short-ended Coplanar Waveguide

Abdelhamid Nasr, Kamal Sarabandi, Adib Nashashibi, University of Michigan, United States; Matt Doyle, Abdel Mohamed, AGC Automotive Americas R & D, Inc., United States

Antenna Array I

Session Co-Chairs: Satish Sharma, San Diego State University; Felix Miranda, NASA GRC

MO-UB.2P.1 **13:20**

3D Printed Magneto-Electric Phased Array Antenna with Integrated Analog Beamforming for sub-6 GHz Frequency Band

Ghanshyam Mishra, Connor Laffey, Philip Nguyen, Satish K Sharma, San Diego State University, United States

MO-UB.2P.2 **13:40**

Dual Polarized UWB Millimeter-Wave Phased Arrays

Alexander D. Johnson, Elias Alwan, John L. Volakis, Florida International University, United States

MO-UB.2P.3 **14:00**

Dual-Band Transmit-Array Antennas Exploiting Polarization-Rotating Elements

Konstantinos Mavrakakis, Hung Luyen, John Booske, Nader Behdad, University of Wisconsin-Madison, United States

MO-UB.2P.4 **14:20**

A Planar Multi-Beam Antenna Array

Shuguang Chen, Mahmoud Khalil, Steven Goodall, US Army, United States

MO-UB.2P.5 **14:40**

Wideband Design of Feed Structure for 2×2-Element Waveguide Slot Arrays by Filter Design Theory

Takashi Tomura, Jiro Hirokawa, Tokyo Institute of Technology, Japan

Break **15:00**

MO-UB.2P.6 **15:20**

Investigations of All Metal Heat Sink Dual Linear Polarized Phased Array Antenna for Ku-Band Applications

Rudraishwarya Banerjee, Satish K Sharma, San Diego State University, United States; Jia-Chi Chieh, Randall Olsen, SPAWAR, United States

MO-UB.2P.7 **15:40**

Theory and Design of an Array of Skewed Stacked Dipoles

Cristina Yepes, Delft University of Technology, Netherlands; Erio Gandini, Stefania Monni, Frank E. van Vliet, TNO Defense, Safety and Security, Netherlands; Andrea Neto, Daniele Cavallo, Delft University of Technology, Netherlands

MO-UB.2P.8 **16:00**

3D Nolen Matrix Beamforming Phased Array

Han Ren, Bayaner Arigong, Washington State University, United States

MO-UB.2P.9 **16:20**

Unidirectional Bowtie Array Antenna with Titled Beams for Base Station Applications

Adam Mehrabani, Johns Hopkins University, United States; Maria Pour, University of Alabama in Huntsville, United States

MO-UB.2P.10 **16:40**

2D conformal wideband phased array antenna system

Minyoung Yoon, Seoul National University, Korea (South); Chanju Park, Yonsei University, Korea (South); Sanghoon Jung, Seoul National University, Korea (South); Young Joong Yoon, Yonsei University, Korea (South); Youngseek Chung, Sangwook Nam, Kwangwoon University, Korea (South)

Biomedical Applications of Electromagnetics I

Session Co-Chairs: Francesca Vipiana, Politecnico di Torino; Brian Garner, Baylor University

MO-A5.3P.1 **13:20**

Theory of Electromagnetic-Based Communication within Bacterial Communities

Navid Barani, Kamal Sarabandi, University of Michigan, United States

MO-A5.3P.2 **13:40**

Experimental Validation of a Microwave Brain Scanner for Cerebrovascular Diseases Monitoring

Jorge A. Tobon Vasquez, Politecnico di Torino, Italy; Rosa Scapaticci, Institute for Electromagnetic Sensing of the Environment, National Research Council of Italy, Italy; Giovanna Turvani, Politecnico di Torino, Italy; Gennaro Bellizzi, University of Naples Federico II, Italy; Nadine Joachimowicz, Université Paris-Diderot, France; Bernard Duchêne, CNRS, France; Mario R. Casu, Politecnico di Torino, Italy; Lorenzo Crocco, Institute for Electromagnetic Sensing of the Environment, National Research Council of Italy, Italy; Francesca Vipiana, Politecnico di Torino, Italy

MO-A5.3P.3 **14:00**

Passive Coil-Based Wearable Textile for Monitoring Cardiac Activity

Keren Zhu, Asimina Kiourti, Ohio State University, United States

MO-A5.3P.4 **14:20**

Measurement and Simulation of Various On-Body Antenna Utilizing a Modular Arm-Swinging Phantom Model for Wireless Body Area Network Applications

George Lee, Brian Garner, Yang Li, Baylor University, United States

MO-A5.3P.5 **14:40**

A Fast and Accurate Transfer Function Validation Strategy Using Rotational Invariant Lead Trajectories

Yu Wang, Jianfeng Zheng, Qingyan Wang, Ji Chen, University of Houston, United States

Break **15:00**

MO-A5.3P.6 **15:20**

Focused Microwave Therapy Study on Realistic Breast Phantoms

Srishti Saraswat, Jinpil Tak, Waleed Ahmad, Hongbo Zhao, Chandra Priya Karunakaran, Russell S. Witte, Hao Xin, University of Arizona, United States

MO-A5.3P.7 **15:40**

Electromagnetic Components Realized on Conductive Wires: A Copper vs. E-Thread Comparison

Vigyanshu Mishra, Asimina Kiourti, Ohio State University, United States

MO-A5.3P.8 **16:00**

Channel Capacity Comparison between Quorum Sensing and Electromagnetic-Based Communication within Bacterial Communities

Navid Barani, Kamal Sarabandi, University of Michigan, United States

MO-A5.3P.9 **16:20**

Analysis and Design of Near-Field Plates in the Presence of Dielectric Media

Andrew Strikwerda, Timothy Sleasman, Ra'id Awadallah, Johns Hopkins University Applied Physics Laboratory, United States; William Anderson, JHU School of Medicine, United States

MO-A5.3P.10 **16:40**

A Near-Field Microwave Biosensor for Glucose Concentration Level Detection

Abdulrahman Alghamdi, Saeed Mohammadi, Purdue University, United States; Rehab Alghamdi, Indiana State University, United States

Scattering, Diffraction and RCS

Session Co-Chairs: Christophe Caloz, Polytechnique Montréal; Guido Lombardi, Politecnico di Torino-ISMB

MO-A4.1P.1 **13:20**

Full Wave Solutions of Multiple Scattering Using 3D Vector Cylindrical Wave Expansions In Foldy-Lax Equations

Huanting Huang, Leung Tsang, University of Michigan, United States; Kung-Hau Ding, Air Force Research Laboratory, United States

MO-A4.1P.2 **13:40**

A Numerical Modelling Approach towards Radar Cross Section Characterization of Airborne Insects

Omar Alzaabi, Diego Peñaloza, Pennsylvania State University, United States; Mohammad Al-Khaldi, Ohio State University, United States; Julio Urbina, James Breakall, Michael Lanagan, Harland Patch, Christina Grozinger, Pennsylvania State University, United States

MO-A4.1P.3 **14:00**

Multiple Wedges Diffraction in Propagation Problems using the Generalized Wiener-Hopf Technique

Vito Daniele, Guido Lombardi, Rodolfo S. Zich, Politecnico di Torino-ISMB, Italy

MO-A4.1P.4 **14:20**

Scattering at Interluminal Interface

Zoé-Lise Deck-Léger, École Polytechnique de Montréal, Canada; Christophe Caloz, Polytechnique Montréal, Canada

MO-A4.1P.5 **14:40**

A non-iterative time-domain sidelobe suppression in doppler shifted LFM waveforms

Ehtesham Shareef, Muhammad Dawood, New Mexico State University, United States

Break **15:00**

MO-A4.1P.6 **15:20**

A Machine Learning Based 77 GHz Radar Target Classification for Autonomous Vehicles

Xiuzhang Cai, Kamal Sarabandi, University of Michigan, United States

MO-A4.1P.7 **15:40**

Improving Two Ends Precision of RCS Measurement Based on Spectral Extrapolation Technique

Chufeng Hu, Nanjing Li, Weijun Chen, Shuxia Guo, Northwestern Polytechnical University, China

MO-A4.1P.8 **16:00**

On Scattering of a Vector Cylindrical Wave by an Axisymmetric Semitransparent Reflector

Kirill Klionovski, Atif Shamim, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

MO-A4.1P.9 **16:20**

Diffuse Scattering Characteristics of Rough Materials at mm-Wave Frequencies

Haikuo Tian, Xi Liao, Chongqing University of Posts and Telecommunications, China; Rui Zhang, China Research Institute of Radiowave Propagation, China; Yu Shao, Yang Wang, Chongqing University of Posts and Telecommunications, China

Time-Domain Methods

Session Co-Chairs: Zhen Peng, University of New Mexico; Su Yan, Howard University

MO-UB.3P.1 **13:20**

Learning and Compensating Numerical Dispersion Errors in FDTD with Artificial Neural Networks

Xingqi Zhang, Aristeidis Seretis, Costas Sarris, University of Toronto, Canada

MO-UB.3P.2 **13:40**

Simulation of a switched electrically small antenna using FDTD-XSPICE

Ryan Westafer, Jonathan Andreasen, Georgia Tech Research Institute, United States

MO-UB.3P.3 **14:00**

A DGTD Algorithm with Dynamic h-Adaptation and Multirate Time Integration Techniques for EM–Plasma Interaction Simulations

Jiwei Qian, University of Illinois at Urbana-Champaign, United States; Su Yan, Howard University, United States; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

MO-UB.3P.4 **14:20**

Multiple-Region FDTD Method for Multi-Angle Bi-Static Ground Penetrating Rader

Takuji Arima, Tokyo University of Agriculture and Technology, Japan; Toshiyuki Nishibori, Akihisa Uematsu, JAXA, Japan; Toru Uno, Tokyo University of Agriculture and Technology, Japan

MO-UB.3P.5 **14:40**

A New FDTD Perfectly Matched Layer (PML) Model Constructed by the Machine Learning

Heming Yao, Lijun Jiang, University of Hong Kong, China

Break **15:00**

MO-UB.3P.6 **15:20**

A New Look at the Finite Element Particle-in-Cell Method

Zane Crawford, Scott O'Connor, John Lugisland, Balasubramaniam Shanker, Michigan State University, United States

MO-UB.3P.7 **15:40**

Space-time Parallel Methods for Multiscale Transient Electromagnetic Problems

Shu Wang, Zhen Peng, University of New Mexico, United States

MO-UB.3P.8 **16:00**

Comparison of Luebbers and Maloney implementations of complex objects composed with thin sheets in the FDTD grid

Afnan Alkandari, Fumie Costen, Jean-Pierre Berenger, University of Manchester, United Kingdom; Ryutaro Himeno, Hideo Yokota, RIKEN, Japan

MO-UB.3P.9 **16:20**

A Time-Domain Dual-Field Finite-Element Domain-Decomposition Boundary-Integral Method for Electromagnetic Scattering Analysis

Ming Dong, Ping Li, King Abdullah University of Science and Technology (KAUST), Saudi Arabia; Yifei Shi, Jiangsu University of Technology, China; Hakan Bagci, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

MO-UB.3P.10 **16:40**

An Explicit Time Marching Scheme for Solving the Nystrom-discretized Scalar Potential Integral Equation

Rui Chen, Hakan Bagci, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

B Monday, July 8 13:20 - 17:00
MO-UB.4P Room 211

Frequency Domain Methods

Session Co-Chairs: Jin-Fa Lee, Ohio State University; Roberto Graglia, Politecnico di Torino

MO-UB.4P.1 **13:20**

A Novel Dipole-Moment-Based Approach for Analyzing Scattering from Quasi-Periodic Structures

Kapil Sharma, MathWorks, Inc., United States; Raj Mittra, University of Central Florida, United States

MO-UB.4P.2 **13:40**

Complex Antenna Simulation By Using Embedded Domain Decomposition

Jiaqing Lu, Jin-Fa Lee, Ohio State University, United States

MO-UB.4P.3 **14:00**

On the GPU/CPU Implementation of Direct Domain Decomposition Methods (D3M)

Javad Moshfegh, Dimitrios Makris, Marinos Vouvakis, University of Massachusetts Amherst, United States

MO-UB.4P.4 **14:20**

Analysis of Electromagnetic Wave Interactions on Nanostructures with Non-local Dispersion Effects using a Volume Integral Equation Solver

Doolos Aibek Uulu, Sadeed Sayed, Ping Li, Hakan Bagci, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

MO-UB.4P.5 **14:40**

Integration of Singular Basis Functions for Plate Edges and Corners

Roberto Graglia, POLITECNICO DI TORINO, Italy; Andrew Peterson, Georgia Institute of Technology, United States; Paolo Petrini, POLITECNICO DI TORINO, Italy

Break **15:00**

MO-UB.4P.6 **15:20**

On the Use of a Full-Wave Solver in the Solution of the Electroencephalography Forward Problem

Clément Henry, Adrien Merlini, Lyes Rahmouni, Francesco P. Andriulli, Politecnico di Torino, Italy

MO-UB.4P.7 **15:40**

Surface-Volume-Surface Electric Field Integral Equation for Solution of Scattering Problems on 3D Composite Metal-Dielectric Objects

Reza Gholami, Vladimir Okhmatovski, University of Manitoba, Canada

MO-UB.4P.8 **16:00**

Modeling Focused CW Mm-Wave Scattering of a Penetrable Dielectric Slab Affixed to a Human Body

Ann Morgenthaler, Carey Rappaport, Northeastern University, United States

MO-UB.4P.9 **16:20**

Construction and Application of Geometrically Optimal Curvilinear Surface Elements for Double Higher-Order MoM-SIE Modeling

Jake Harmon, Cam Key, Sanja Manic, Branislav Notaros, Colorado State University, United States

MO-UB.4P.10 **16:40**

Topology Optimization for Maxwell Solvers

Zane Crawford, Alejandro Diaz, Balasubramaniam Shanker, Michigan State University, United States

B Monday, July 8 13:20 - 15:00
MO-UB.5P Room 212

Antenna Theory and Design II

Session Co-Chairs: Thomas Montoya, South Dakota School of Mines and Technology; Thomas Montoya, South Dakota School of Mines and Technology

MO-UB.5P.1 **13:20**

Monopole Antenna Radiation Pattern Control via 3D-Printed Dielectrics Optimized with Machine Learning Methods

Yashika Sharma, Jinpil Tak, Hao Helen Zhang, Hao Xin, University of Arizona, United States

MO-UB.5P.2 **13:40**

Improved Antenna with Distributed Resistive Loading for Wideband Performance

Thomas Montoya, South Dakota School of Mines and Technology, United States; Andrew Downs, Iowa State University, United States

MO-UB.5P.3 **14:00**

Design Considerations and Examples of Non-Foster Matched Electrically-Small Antennas for High Power Transmit Applications

Qianyi Li, Ting-Yen Shih, University of Idaho, United States

MO-UB.5P.4 **14:20**

Examination of the Bandwidth Potential of Electrically-Small Platform-Based Antennas at the HF Band

Alex Bouvy, Nader Behdad, University of Wisconsin-Madison, United States

MO-UB.5P.5 **14:40**

Huygens scatterer based on two uncoupled SRRs

Ana C. Escobar, Universidad Nacional de Colombia, Colombia; Andrey Sayanskiy, ITMO University, Russia; Javier Leonardo Araque Quijano, Universidad Nacional de Colombia, Colombia; Stanislav B. Glybovski, ITMO University, Russia; Juan D. Baena, Universidad Nacional de Colombia, Colombia

B Monday, July 8 15:20 - 16:40
MO-UB.6P Room 212

Antenna Theory and Arrays

Session Chair: Nader Behdad, University of Wisconsin-Madison

MO-UB.6P.1 **15:20**

A method for achieving 2-bit phase quantization for reconfigurable reflectarray antennas having single radiating layers

Hung Luyen, John Booske, Nader Behdad, University of Wisconsin-Madison, United States

MO-UB.6P.2 **15:40**

Design of Broadband VHF/UHF Antenna with Multiple Directional Beams

Ruyu Ma, Nader Behdad, University of Wisconsin-Madison, United States

MO-UB.6P.3 **16:00**

Design of a Fast, High Power RF Switch for a HF/VHF Direct Antenna Modulation System

Jacob Peiffer, Bruce Offord, Layth Hazi, Jacob Rissmiller, Erica Daly, SPAWAR Systems Center Pacific, United States

MO-UB.6P.4 **16:20**

Mixing Matrix Estimation of Frequency Hopping Signals Based on Single Source Points Detection

Yibing Li, Xiaoyu Geng, Xiaochen Guo, Qian Sun, Fang Ye, Tao Jiang, Harbin Engineering University, China

Memorial Session for Dr. R. C. Hansen

Session Co-Chairs: William Liles, Independent Consultant; Jennifer Bernhard, University of Illinois at Urbana-Champaign

TU-SP.1A.1 **08:00**

R. C. Hansen - His Life, His Awards and His Books

William Liles, Independent Consultant, United States

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

Robert C. Hansen - Managing Antenna Expectations

Dean Paschen, FIRST RF Corporation, United States

TU-SP.1A.3 **08:40**

Electrically Small Antennas: Hansen's Contribution and the State of the Art

Jacob Adams, North Carolina State University, United States

TU-SP.1A.4 **09:00**

Robert C. Hansen's Phased Antenna Array Contributions

Steven Holland, Milwaukee School of Engineering, United States

TU-SP.1A.5 **09:20**

REVISITING THE GENERALIZED 3-PARAMETER APERTURE DISTRIBUTION AND HANSEN'S 1-PARAMETER DISTRIBUTION

Yahya Rahmat-Samii, University of California, Los Angeles, United States

Break **09:40**

TU-SP.1A.6 **10:00**

Array Synthesis in the Autocorrelation Domain - Proof and Research Tracks

Mohammad Abdul Hannan, Lorenzo Poli, Giacomo Oliveri, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN – University of Trento), Italy

TU-SP.1A.7 **10:20**

Wideband Matching of Closely Spaced Arrays Using a Simplified Algorithm

Ronald J. Marhefka, Consultant, United States

TU-SP.1A.8 **10:40**

Phased Array Bandwidth Defined by Beam Squint and Pulse Dispersion

Randy Haupt, Colorado School of Mines, United States

TU-SP.1A.9 **11:00**

Optimization of Array Antenna Power Patterns Using Woodward Lawson and Schelkunoff's Polynomial Techniques

Sembiam Rengarajan, California State University, United States

TU-SP.1A.10 **11:20**

Tight Bounds on the Bandwidth of Small Multiresonant Electric Dipole Antennas

Howard Stuart, LGS Innovations, United States

International Collaborations on Next-Generation Radio Astronomical Instruments

Session Co-Chairs: David Davidson, Curtin University; Karl Warnick, Brigham Young University

TU-SP.2A.1 **08:00**

The Square Kilometre Array Observatory

Maria Grazia Labate, Mark Waterson, Gerhard Swart, Mark Bowen, Peter Dewdney, Square Kilometre Array (SKA) Organisation, United Kingdom

TU-SP.2A.2 **08:20**

Primary Beams of the MeerKAT Radio Telescope: Measurements and Simulations

Dirk De Villiers, Stellenbosch University, South Africa; Khan Asad, South African Radio Astronomy Observatory, South Africa; Oleg Smirnov, Rhodes University, South Africa; Robert Lehmensiek, EMSS Antennas (Pty) Ltd, South Africa; Matthieu De Villiers, Justin Jonas, South African Radio Astronomy Observatory, South Africa

TU-SP.2A.3 **08:40**

The SKA Aperture Array Verification System: Measured Digitally-Beam-Formed Radiation Patterns

Giuseppe Virone, Fabio Paonessa, Stefania Matteoli, Lorenzo Ciorba, Giuseppe Addamo, Oscar Antonio Peverini, CNR-IEIIT, Italy; Eloy de Lera Acedo, Edgar Colín-Beltrán, Nima Razavi Ghods, University of Cambridge, United Kingdom; Pietro Bolli, INAF-OAA, Italy; Giuseppe Pupillo, INAF-IRA, Italy; Andrea Maria Lingua, Marco Piras, Irene Aicardi, Politecnico di Torino, Italy; Kris Zarb Adami, Alessio Magro, University of Malta, Malta

TU-SP.2A.4 **09:00**

Sparse-Regular Array Design for SKA Mid Frequency Aperture Array

Brandt Klopper, Dirk De Villiers, Stellenbosch University, South Africa; Jan Geralt bij de Vaate, ASTRON and Stellenbosch University, Netherlands; David Davidson, ICRAR-Curtin and Stellenbosch University, Australia

TU-SP.2A.5 **09:20**

Geometry Optimization of a Phased Array Feed on the Arecibo Telescope for Maximum Survey Efficiency

Karl Warnick, Jakob Kunzler, Brigham Young University, United States; German Cortes-Medellin, Cornell University, United States

Break **09:40**

TU-SP.2A.6 **10:00**

Radiation Efficiency Calculation of the Murchison Widefield Array Using a Power Wave Based Framework

Daniel Ung, Adrian Sutinjo, David Davidson, Melanie Johnston-Hollitt, Steven Tingay, Curtin University, Australia

TU-SP.2A.7 **10:20**

New Receiver Technology for Radio Astronomy: A Technology Update from CSIRO and FAST

Alex Dunning, Mia Baquiran, Ron Beresford, Michael Bourne, Mark Bowen, Michael Brothers, John Bunton, Nick Carter, Santiago Castillo, Yuqing Chen, Wan Cheng, Yoon Chung, Paul Doherty, Daniel George, Grant Hampson, Douglas Hayman, Kanapathippillai Jeganathan, Henry Kanoniuk, Simon Mackay, Les Reilly, Paul Roberts, Peter Roush, Sean Severs, Robert Shaw, Ken Smart, Stephanie Smith, John Tuthill, Tasso Tzioumis, Veronica-Claire Venables, CSIRO, Australia; Rendong Nan, Chengjin Jin, Yan Zhu, Yang Cao, Xiangwei Shi, Jinyou Song, Jinglong Yu, Jin Fan, Youling Yue, Lei Qian, Dong Bin, Chinese Academy of Sciences, China

TU-SP.2A.8 **10:40**

Antenna Phase Center Analysis for the LOFAR Radio Telescope

Paola Di Ninni, Pietro Bolli, Renzo Nesti, Giuseppe Pupillo, INAF, Italy; Giuseppe Virone, National Research Council of Italy (CNR), Italy; Stefan Wijnholds, ASTRON, Netherlands

TU-SP.2A.9 **11:00**

Design of an Ultra Low Frequency CubeSat Antenna Payload for Radio Astronomy in Space: State of the Art

Cornelis Vertegaal, Mark Bentum, Eindhoven University of Technology, Netherlands

Cognitive Radio I

Session Co-Chairs: Jonathan Chisum, University of Notre Dame; Nader Behdad, University of Wisconsin-Madison

TU-UB.1A.1 **08:00**

Paraffin-Based RF Microsystems for Millimeter Wave Reconfigurable Antennas

Behnam Ghassemiparvin, Nima Ghalichechian, Ohio State University, United States

TU-UB.1A.2 **08:20**

High Radiation Efficiency Phase-change Material Antennas with Conductive Inclusions

David Connelly, Jonathan Chisum, University of Notre Dame, United States

TU-UB.1A.3 **08:40**

Beam-direction and Beam-width Switchable Monopole Antenna using Smart Shape Memory Hinges based Origami Reflectors

Syed Imran Hussain Shah, Sungjoon Lim, Chung Ang University, Korea (South)

TU-UB.1A.4 **09:00**

Electronically reconfigurable, 1-bit reflectarray antennas using polarization rotating unit cells

Hung Luyen, John Booske, Nader Behdad, University of Wisconsin-Madison, United States

TU-UB.1A.5 **09:20**

A Compact 1-Bit Reconfigurable Folded Reflectarray Antenna

Yuehe Ge, Zhenglong Wang, Guowei Li, Huaqiao University, China

Break **09:40**

TU-UB.1A.6 **10:00**

Effects of Spectral Interference on High-Accuracy Ranging in Coherent Distributed Arrays

Serge Mghabghab, Jeffrey Nanzer, Michigan State University, United States

TU-UB.1A.7 **10:20**

An Analog RF System with High Isolation for Simultaneous Transmit and Receive (STAR)

Nicholas Trudeau, Carlene Goodbody, Kuei Jih Lu, Tutku Karacolak, Washington State University Vancouver, United States

TU-UB.1A.8 **10:40**

Ultra-Wideband Frequency Reconfigurable RF Front-End with Bandwidth Tunability

Anthony Nunez, Stavros V. Georgakopoulos, Elias A. Alwan, Florida International University, United States

TU-UB.1A.9 **11:00**

Transmit-Receive Antenna Isolation Using a Passively Tuned Balun for Simultaneous Transmit and Receive (STAR) Applications

Alexander Hovsepian, Satheesh Bojja Venkatakrishnan, John L. Volakis, Florida International University, United States

TU-UB.1A.10 **11:20**

Improved Self-Interference Suppression in Wideband STAR

Satheesh Bojja Venkatakrishnan, Alexander Hovsepian, Florida International University, United States; Toshifumi Nakatani, Houman Ghajari, Jonmei Yan, MaXentric Technologies, United States; John L. Volakis, Florida International University, United States

5G MIMO Antenna Technology

Session Co-Chairs: Satish Sharma, San Diego State University; Buon Kiong Lau, Lund University

TU-A5.1A.1 **08:00**

A Broadside Three-Port Antenna for 5G Massive MIMO Antenna Systems

Li Ying Nie, Xian Qi Lin, University of Electronic Science and Technology of China, China; Buon Kiong Lau, Lund University, Sweden

TU-A5.1A.2 **08:20**

A Capacity Reconfigurable Multimode Origami MIMO Antenna

Nicholas Russo, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

TU-A5.1A.3 **08:40**

A LTE Band Integrated 5G Antenna Design using Characteristic Mode Analysis

Javid Ganie, Chitra Singh, Kumud Jha, Shri Mata Vaishno Devi University, India; Satish Sharma, San Diego State University, United States

TU-A5.1A.4 **09:00**

Effect of Antenna Array Element Separation on Capacity of MIMO Systems Including Mutual Coupling

Tomislav Marinovic, Katholieke Universiteit Leuven, Belgium; Amirashkan Farsaei, TU Eindhoven, Netherlands; Rob Maaskant, Chalmers University of Technology, Sweden; Adrian Lahuerta Lavieja, Katholieke Universiteit Leuven, Sweden; Martin Johansson, Ulf Gustavsson, Ericsson, Sweden; Guy A. E. Vandenbosch, Katholieke Universiteit Leuven, Belgium

TU-A5.1A.5 **09:20**

Effect of Antenna Coupling on the SNR Improvement of Mm-Wave Massive MIMO for 5G

Vahid Ezzati, Mohammad Fakharzadeh, Forouhar Farzaneh, Sharif University of Technology, Iran; Mohammadreza Ranjbar Naeini, University of Wisconsin-Madison, United States

Break **09:40**

TU-A5.1A.6 **10:00**

4x4 MIMO Antenna Elements Fed by Microstrip Ridge Gap Waveguide

Abdelmoniem Hassan, Ahmed Kishk, Concordia University, Canada

TU-A5.1A.7 **10:20**

Design of an Antipodal Bowtie Array MIMO Antenna for 5G Mobile Applications

Debarati Ganguly, Yahia Antar, Royal Military College of Canada, Canada; Anil Somagani, Chinmoy Saha, Indian Institute of Space Science and Technology, India

TU-A5.1A.8 **10:40**

A Dual-band and Dual-polarized Aperture Antenna for 5G Millmeter-wave Applications

He-Sheng Lin, Yi-Cheng Lin, National Taiwan University, Taiwan

TU-A5.1A.9 **11:00**

Path loss compensated pattern diversity antennas for mmWave 5G indoor base stations

Karthikeya GS, Mahesh P. Abegaonkar, Shiban K. Koul, Indian Institute of Technology, Delhi, India

TU-A5.1A.10 **11:20**

5G MIMO Antenna System for Mobile Terminals

Anping Zhao, Zhouyou Ren, Shenzhen Sunway Communication Co., Ltd, China

Metasurfaces for Beam Shaping

Session Co-Chairs: Shulabh Gupta, Carleton University; Brian Raeker, University of Michigan

TU-A2.1A.1 **08:00**

Broadband WAIM Metasurface Structure for Electronically Beam Scanning Holographic Antenna for Ku-Band Satellite Communications

Aidin Mehdipour, Mohsen Sazegar, Ryan Stevenson, Kymeta Corporation, United States

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

All-Dielectric Compound Metaoptics

Brian Raeker, Anthony Grbic, University of Michigan, United States; You Zhou, Jason Valentine, Vanderbilt University, United States

TU-A2.1A.3 **08:40**

Reflection-Cancelling Dielectric Huygens' Metasurface Pair for Wideband Millimeter-Wave Beam-Forming

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

TU-A2.1A.4 **09:00**

Impedance-matched circular polarization selective surfaces with spin-selective phase modulation

Minseok Kim, George V. Eleftheriades, University of Toronto, Canada

TU-A2.1A.5 **09:20**

Generation of Tilted High-Order Bessel Beam in Millimeter Range Using Metasurface

Dajun Zhang, Xiong Wang, ShanghaiTech University, China

Break **09:40**

TU-A2.1A.6 **10:00**

An Ultrathin Flexible Metasurface for Half Mirror and QWP Operation

Fahad Ahmed, Afzal Ahmed, Farooq Ahmad Tahir, Research Institute for Microwave & Millimeter-wave Studies (RIMMS) National University of Sciences and Technology (NUST), Islamabad, Pakistan; Hassan Tariq Chattha, Islamic University of Madinah, Saudi Arabia

TU-A2.1A.7 **10:20**

Design of 2-bit Programmable Reflective Metasurface in K-band

Yasir Saifullah, Fuheng Zhang, Guo-Min Yang, Feng Xu, Fudan University, China

TU-A2.1A.8 **10:40**

The Huygens' Box Antenna: Metasurface-Based Directive Antenna Beam-Steering with Dramatically Reduced Elements

Kayode A. Oyesina, Alex M. H. Wong, City University of Hong Kong, China

TU-A2.1A.9 **11:00**

Focusing Metasurface with arbitrary Focal Point Based on Pancharatnam-Berry Phase Principle

Meijun Qu, Shufang Li, Li Deng, Beijing University of Posts and Telecommunications, China; Xin Ma, China Academy of Information and Communications Technology (CAICT), China

TU-A2.1A.10 **11:20**

A Switchable Reflection-Type Linear/Circular Polarizers Based on Active Metasurface

You Li, You Li, You Li, Qunsheng Cao, Qunsheng Cao, Qunsheng Cao, Yi Wang, Yi Wang, Yi Wang, Nanjing University of Aeronautics and Astronautics, China

Material and Structural Antenna Reconfigurability

Session Co-Chairs: Giuseppe Vecchi, Politecnico di Torino; Hany Hammad, German University in Cairo

TU-A1.1A.1 **08:00**

Reconfigurable Antenna Based on Liquid Crystals for Continuous Beam Scanning with a Single Control

Enrica Martini, Santi Concetto Pavone, Matteo Albani, Stefano Maci, University of Siena, Italy; Valerio Martorelli, Ingegneria dei Sistemi, Italy; Giorgio Giodanengo, Istituto Superiore Mario Boella, Italy; Antonio Ferraro, Romeo Beccherelli, National Research Council of Italy (CNR), Italy; Giovanni Toso, ESA-ESTEC, Netherlands; Giuseppe Vecchi, Politecnico di Torino, Italy

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

Modular, Reconfigurable Block Cell Antenna Concept for Millimeter-wave 5G

Moogoong Choo, Junho Park, Wonbin Hong, Pohang University of Science and Technology (POSTECH), Korea (South)

TU-A1.1A.3 **08:40**

A Deployable and Reconfigurable Origami Antenna for Extended Mobile Range

Gian Carrara, Nicholas Russo, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

TU-A1.1A.4 **09:00**

Frequency-Reconfigurable mmWave Antenna Loaded with Capacitive Structure Integrated within a Microstrip Line

Jaehyun Choi, Junho Park, Youngno Youn, Woonbong Hwang, Wonbin Hong, Pohang University of Science and Technology (POSTECH), Korea (South)

TU-A1.1A.5 **09:20**

Reconfigurable RHCP-to-LP Helical Antenna Made of Pure Water

Zhen Ren, Shishan Qi, Wen Wu, The Ministerial Key Laboratory of JGMT, China; Zhongxiang Shen, Nanyang Technological University, China

Break **09:40**

TU-A1.1A.6 **10:00**

Effect of Electrolyte on a 2D Surface-Based Reconfigurable Liquid Metal Antenna

Feng Xie, Mei Song Tong, Tongji University, China; Jacob Adams, North Carolina State University, United States

TU-A1.1A.7 **10:20**

Optimization of an Adaptive Antenna Array Excitations Employing Genetic Algorithm

Abubakar Hamza, Hussein Attia, Sharif Sheikh, King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia; Muhammad Iqbal, FAST, Pakistan; Essam Hassan, Formerly with KFUPM, Saudi Arabia

TU-A1.1A.8 **10:40**

UWB Modified Elliptical Antipodal Vivaldi antenna array fed with four stage Wilkinson Power Divider

Hany Hammad, German University in Cairo, Egypt

TU-A1.1A.9 **11:00**

Experimental Investigation of Active Antenna

Igor Shirokov, Elena Shirokova, Sevastopol State University, Russia

Reflector Designs and Applications

Session Co-Chairs: Carey Rappaport, Northeastern University; John Papapolymerou, Michigan State University

TU-A1.2A.1 **08:00**

Reflector Antenna Optimisation with Multi-level Coordinate Search

Oscar Borries, Erik Jørgensen, Michael Forum Palvig, Tonny Rubæk, TICRA, Denmark

TU-A1.2A.2 **08:20**

Optimization of Feed Chains and Large Reflectors

Peter Meincke, Michael Forum Palvig, Niels Vesterdal Larsen, Erik Jørgensen, TICRA, Denmark

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

Design of Polarizing Cells for Broadband Reflectors

Samara Gharbieh, Institute of Electronic and Telecommunication in Rennes, IETR, INSA Rennes, France and CRSI, Lebanese University, Faculty of Engineering, EDST, Tripoli, Lebanon; Maria Garcia-Vigueras, Renaud Loison, Institute of Electronic and Telecommunication in Rennes, IETR, INSA Rennes, France; Ali Harmouch, CRSI, Lebanese University, Faculty of Engineering, EDST, France; Akil Jrad, LEPA, Lebanese University, Faculty of Sciences, EDST, Tripoli, Lebanon

TU-A1.2A.4 **09:00**

Gain-Maximization of FPA-fed Reflectors by Means of Linear Regression

S. Narayanan, National and Kapodistrian University of Athens, Greece; Ali Al-Rawi, A. Dubok, B.P. de Hon, A. Bart Smolders, Eindhoven University of Technology, Netherlands

TU-A1.2A.5 **09:20**

Design And Analysis Of FengYun3 Microwave Humidity Sounder(FY3MHS) Antenna

Hongjian Wang, NMRS, China

Break **09:40**

TU-A1.2A.6 **10:00**

Electromagnetic Gap Leakage Analysis for the SKA Mid-Frequency Dish

Mariet Venter, South African Radio Astronomy Observatory, South Africa; Pietro Bolli, Italy National Institute of Astrophysics, Italy

TU-A1.2A.7 **10:20**

The Bifocal Microwave Microscope

Carey Rappaport, Ann Morgenthaler, Northeastern University, United States

TU-A1.2A.8 **10:40**

Influence of rough surface on the electrical performance of reflector antenna based on fractal function

Shuo Zhang, Wei Wang, Hong Bao, Congsi Wang, Xidian University, China

TU-A1.2A.9 **11:00**

A K-band SIW High Gain Planar Antenna with Parabolic Metalized Via-holes Reflector

Wei Li, Ying Suo, Bowen Cai, Harbin Institute of Technology, China

Theoretical Electromagnetics I

Session Co-Chairs: Arthur Yaghjian, Electromagnetics Research; Andrea Alù, CUNY Advanced Science Research Center

TU-A2.2A.1 **08:00**

Time-Domain Force and Hidden Momentum for a Perfectly Conducting Sphere

Arthur Yaghjian, Electromagnetics Research, United States

TU-A2.2A.2 **08:20**

Diffraction by a Truncated Slab Filled by Dielectric Material

Vito Daniele, Guido Lombardi, Rodolfo S. Zich, Politecnico di Torino-ISMB, Italy

TU-A2.2A.3 **08:40**

Zero-Forward Scattering for Omnidirectional Incidence using non-Hermitian Particles

Yun Jing Zhang, Mei Song Tong, Tongji University, China; Andrea Alù, University of Texas at Austin, United States

TU-A2.2A.4 **09:00**

Gauge Transformations for Recasting Potential Representations

Ramakrishna Janaswamy, University of Massachusetts, United States

TU-A2.2A.5 **09:20**

Demonstration of Group Delay Modulation Based on EIT Using LC Circuits

Zhe Chen, Xianqi Lin, University of Electronic Science and Technology of China, China

Break **09:40**

TU-A2.2A.6 **10:00**

Analysis of a Chiral Helix Metamaterial Using Eigenmode Expansion Method and Characteristic Mode Theory

Nadia Kari, ESYCOM Lab, Univ. Paris-Est, France; Ozuem Chukwuka, Divitha Seetharamdoo, IFSTTAR, COSYS, LEOST, France; Jean Marc Laheurte, Francois Sarrazin, ESYCOM Lab, Univ. Paris-Est, France

TU-A2.2A.7 **10:20**

Relation between Complex Propagation Constant and Complex Eigenmodes in Lossy Traveling-Wave Structures

Daniel King, Shulabh Gupta, Carleton University, Canada

TU-A2.2A.8 **10:40**

Mathematical Modeling of a Smart Antenna Based on Hybrid Beam-forming Technique

Ahmed Kausar, Shafaq Kausar, Hani Mehrpouyan, Boise State University, United States

TU-A2.2A.9 **11:00**

High Frequency Diffraction by Thick Loaded Conducting Slits –H Polarization Case–

Khanh Nam Nguyen, Hiroshi Shirai, Chuo University, Japan

TU-A2.2A.10 **11:20**

Measurement of dispersion characteristic of slow-wave system by microwave network cascade method

Yong Gao, En Li, Gaofeng Guo, University of Electronic Science and Technology of China, China

Terahertz Antennas

Session Co-Chairs: Georgios Trichopoulos, Arizona State University; Niru K. Nahar, Ohio State University

TU-A5.2A.1 **08:00**

Two-Port, Common Aperture, High-Isolation, Dual-Polarized Sub-Millimeterwave Antenna System Based on Spatial Power Divider

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

TU-A5.2A.2 **08:20**

High Bandwidth Perovskite based Antenna for High- Resolution Biomedical Imaging at Terahertz

Abdoalbaset Abohmra, Glasgow University, United Kingdom; Syeda Fizzah Jilani, Hasan Abbas, Akram Alomainy, Queen Mary University of London, United Kingdom; Muhammad Ali Imran, Qammer H. Abbasi, University of Glasgow, United Kingdom

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

Generation of mW Average Power in the sub-mm Wavelength Band by Pulsed Photoconductive Connected Array

Alessandro Garufo, Paolo Sberna, Giorgio Carluccio, Delft University of Technology, Netherlands; Joshua Freeman, David Bacon, Lianhe Li, Univeristy of Leeds, United Kingdom; Juan Bueno, Jochem Baselmans, SRON, Netherlands; Edmund Linfield, Alexander Davies, Univeristy of Leeds, United Kingdom; Nuria Llombart, Andrea Neto, Delft University of Technology, Netherlands

TU-A5.2A.4 **09:00**

Fly's Eye Lens Phased Array for Submillimeter Wavelengths

Nuria Llombart, Sjoerd Bosma, Darwin Blanco, Delft University of Technology, Netherlands; Maria Alonso-delPino, Cecile Jung-Kubiak, NASA Jet Propulsion Lab, California Institute of Technology, United States

TU-A5.2A.5 **09:20**

A Wideband High-Gain Horn Antenna for 140GHz Short-Range Wireless Communication

Chaojun Ma, Hao Yu, Southern University of Science and Technology of China, China

Break **09:40**

TU-A5.2A.6 **10:00**

High Gain Constrained Lens Antenna on BCB Substrate for 300-GHz Applications

Adham Mahmoud, David Gonzalez-Ovejero, Mauro Ettorre, Ronan Sauleau, Institut d'Électronique et de Télécommunications de Rennes, France; Frédéric Aniel, Nicolas Zerounian, Anne-Sophie Grimault-Jacquin, Université Paris Sud, France

TU-A5.2A.7 **10:20**

A High Performance Terahertz Metalens

Hang Li, Sensong An, Bowen Zheng, Hong Tang, Clayton Fowler, Wei Guo, University of Massachusetts Lowell, United States; Rensheng Xie, Jun Ding, East China Normal University, China; Hualiang Zhang, University of Massachusetts Lowell, United States

TU-A5.2A.8 **10:40**

Toward Large-Scale Dynamically Reconfigurable Apertures Using Graphene

Panagiotis Theofanopoulos, Georgios Trichopoulos, Arizona State University, United States

TU-A5.2A.9 **11:00**

Equivalent Circuit Model for Reconfigurable Far-Infrared Filter Employing Vanadium Dioxide

Lucas Newton, Niru K. Nahar, Ohio State University, United States

TU-A5.2A.10 **11:20**

Full D-band Coplanar to Rectangular Waveguide Transition for UTC-PD Application

Caixia Wang, Yuan Yao, Junsheng Yu, Beijing University of Posts and Telecommunications, China; Xiaodong Chen, Queen Mary, University of London, United Kingdom

Antenna Array II

Session Co-Chairs: Maria Pour, University of Alabama in Huntsville; Mohammod Ali, University of South Carolina

TU-UB.2A.1 **08:00**

Textile Antenna Arrays and their Environmental Durability

Matthew Nichols, Alexander D. Johnson, Elias A. Alwan, John L. Volakis, Florida International University, United States

TU-UB.2A.2 **08:20**

A Broadband Dipole Array Based on Bandstop Frequency Selective Surfaces

Hong Tang, Bowen Zheng, Sensong An, Hang Li, Hualiang Zhang, University of Massachusetts Lowell, United States

TU-UB.2A.3 **08:40**

3D-Printed Double-Ridged Waveguide Array Antenna targeting High-Efficiency Ku-band SatCom on The Move Applications

Francesco Filice, ST Microelectronics, France; Nour Nachabe, Polytech'Lab, France; Frédéric Gianesello, ST Microelectronics, France; Cyril Luxey, Polytech'Lab, France

TU-UB.2A.4 **09:00**

Design of a Size-Reduced, 15-Element, Circularly-Polarized, Yagi-Uda Antenna

Kevin Leon, James Howell, Sungkyun Lim, Georgia Southern University, United States

TU-UB.2A.5 **09:20**

5D Array Synthesis for Future Radar Array Antenna Design

Xiao Xiao, Yilong Lu, Nanyang Technological University, Singapore

Break **09:40**

TU-UB.2A.6 **10:00**

High Gain Low Side Lobe Wideband Patch Array with High Forward to Backward Ratio

Dhruva Poduval, Mohammod Ali, University of South Carolina, United States

TU-UB.2A.7 **10:20**

An Innovative UWB Connected Array for Multifunctional Applications

Christian Canestri, Domenico Gaetano, Pietro Bia, Antonio Manna, Cosmo Mitrano, Elettronica S.p.A., Italy

TU-UB.2A.8 **10:40**

The Onset of Grating Lobes in Arrays of Electrically Large Apertures: A Study for Lenslet Arrays

Nicholas Estes, Nicolas Garcia, Jonathan Chisum, University of Notre Dame, United States

TU-UB.2A.9 **11:00**

Mitigation of Mutual-coupling Effects in Millimeter-wave Automotive Radars

Burak Ozbey, Ohio State University, United States; Alebel H. Arage, John Cabigao, Carlos Velasquez, Alps Electric NA, Inc., United States; Lucas Newton, Kubilay Sertel, Niru K. Nahar, Ohio State University, United States

TU-UB.2A.10 **11:20**

A Modified-Binomial Linear Array with Reduced Grating Lobes and One-Wavelength Element Spacing

Zabed Iqbal, Anderson Young, Maria Pour, University of Alabama in Huntsville, United States

Tuesday, July 9 | 08:00 - 11:40
TU-A5.3A | Room 303

Biomedical Applications of Electromagnetics II

Session Co-Chairs: Magda El-Shenawee, University of Arkansas; Susan Hagness, University of Wisconsin-Madison

TU-A5.3A.1 **08:00**

Wearable Electromagnetic Head Imaging Using Magnetic-based Antenna Arrays

Abdulrahman Algadami, Anthony E. Stancombe, Nghia Nguyen-Trong, Konstanty Bialkowski, Amin Abbosh, University of Queensland, Australia

TU-A5.3A.2 **08:20**

Recording Critical Epilepsy Indicators using a Fully-Passive Wireless System

Carolina Moncion, Satheesh Bojja Venkatakrishnan, Jorge Riera Diaz, John L. Volakis, Florida International University, United States

TU-A5.3A.3 **08:40**

Determining the Maximum Local Specific Absorption Rate of a Multiple-Antenna Transmitter Using K-Order Electric Field Models

Dinh Thanh Le, Kun Li, Soichi Watanabe, National Institute of Information and Communications Technology (NICT), Japan; Teruo Onishi, NTT DOCOMO, Inc., Japan

TU-A5.3A.4 **09:00**

Cancer Classification of Freshly Excised Murine Tumors with Ordered Orthogonal Projection

Tanny Chavez, Tyler Bowman, Jingxian Wu, Magda El-Shenawee, University of Arkansas, United States; Keith Bailey, Oklahoma State University, United States

TU-A5.3A.5 **09:20**

Fast prediction of MRI RF-induced heating for a generic stent with arbitrary orientation using ANN

Xiaohe Ji, Jianfeng Zheng, Ji Chen, University of Houston, United States

Break **09:40**

TU-A5.3A.6 **10:00**

Impacts of MRI frequency on RF-induced Heating for External Fixation with Insulating Material

Rui Yang, Jianfeng Zheng, Yu Wang, Ran Guo, Ji Chen, University of Houston, United States

TU-A5.3A.7 **10:20**

Extraction of Lung Water Content from Computerized Tomography Scans

Zhengqing Yun, Magdy Iskander, University of Hawaii, United States

TU-A5.3A.8 **10:40**

Evaluation of an Inversion Algorithm for Noninvasive Specific Absorption Rate Applications

Mario Phaneuf, Puyan Mojabi, University of Manitoba, Canada

TU-A5.3A.9 **11:00**

Influence of 3T MRI coil modeling on EM exposure estimation using a human model

Mikhail Kozlov, Nikolaus Weiskopf, Harald Möller, Max Planck Institute for Human Cognitive and Brain Sciences, Germany

TU-A5.3A.10 **11:20**

Optimization of microwave hyperthermia array applicators using field interpolation

Massimiliano Zanoli, Hana Dobsicek Trefna, Chalmers University of Technology, Sweden

Tuesday, July 9 | 08:00 - 09:40
TU-A3.1A | Room 304

Hybrid Methods I

Session Co-Chairs: Weng Cho Chew, Purdue University; Ozlem Ozgun, Hacettepe University

TU-A3.1A.1 **08:00**

Hybrid Solver Via Equivalence Principle Algorithm

Joseph Rutherford, Riverside Research, United States; Weng Cho Chew, Purdue University, United States

TU-A3.1A.2 **08:20**

A Novel Numerical Technique for Analyzing Metasurfaces

Ozlem Ozgun, Hacettepe University, Turkey; Raj Mittra, University of Central Florida, United States; Mustafa Kuzuoglu, Middle East Technical University, Turkey

TU-A3.1A.3 **08:40**

Approximation of Reflectarray Cross-Polarization Response Using A Hybrid FEM-PO Method

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

TU-A3.1A.4 **09:00**

Hybrid Method of FDTD/PO for EM Scattering Simulation of Electrically Large Targets

Shuo Liu, Bin Zou, Lamei Zhang, Harbin Institute of Technology, China

TU-A3.1A.5 **09:20**

Aggressive Space Mapping Technique for Reconfigurable Hexagonal Patch Antenna Design

Akinwale Fadamiro, Oluwole Famoriji, Rabiu Zakariyya, Fujiang Lin, University of Science and Technology of China, China; Fan Jiang, Qingsha Cheng, Southern University of Science and Technology of China, China; Oluwasegun Somefun, Erastus Ogunti, Federal University of Technology Akure, Nigeria

Tuesday, July 9 | 10:00 - 11:20
TU-UB.3A | Room 304

Hybrid Methods II

Session Co-Chairs: Eric Michielssen, University of Michigan; C J Reddy, Altair Engineering Inc

TU-UB.3A.1 **10:00**

Advanced Computational Tools for the Multidisciplinary Design Optimization of Airborne Radomes

Gopinath Gampala, Eamon Whalen, Katelyn Hunter, Sarthak Mishra, C J Reddy, Altair Engineering Inc., United States

TU-UB.3A.2 **10:20**

Hybrid Parabolic Equation – Integral Equation Solvers for Analyzing Long Range Propagation Over Complex Terrain

Eric Michielssen, Max Bright, University of Michigan, United States; Julius Kusuma, Facebook Research, United States

TU-UB.3A.3 **10:40**

Direct Domain Decomposition Method Finite Element Boundary Element Hybrid (D3M-FEBE)

Nash Lochner, Marinos Vouvakis, University of Massachusetts Amherst, United States

TU-UB.3A.4 **11:00**

BEM-FEBI Formulation Through ` PECfication'

Nash Lochner, University of Massachusettes, United States; Marinos Vouvakis, University of Massachusetts Amherst, United States

Tuesday, July 9 | 08:00 - 11:20
TU-A3.2A | Room 305

Computational Methods for Coupling and Scattering

Session Co-Chairs: Mei Song Tong, Tongji University; Atef Elsherbeni, Colorado School of Mines

TU-A3.2A.1 **08:00**

A Platform Green's Function Method for In-Situ Antenna Analysis and Design

Shu Wang, Zhen Peng, University of New Mexico, United States

TU-A3.2A.2 **08:20**

ADMM based Consensus and Sectioning Norm-1 Regularized Algorithm for Imaging with a CRA

Juan Heredia-Juesas, Luis Tirado, Ali Molaei, Jose Angel Martinez-Lorenzo, Northeastern University, United States

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

Electromagnetic Coupling Analysis of Printed Circuit Board Traces using Characteristic Mode Analysis

Kalyan Durbhakula, John Lancaster, Ahmed M. Hassan, Deb Chatterjee, Anthony Caruso, University of Missouri-Kansas City, United States; James Hunter, Yuanzhuo Liu, Daryl Beetner, Victor Khilkevich, Missouri University of Science and Technology, United States

TU-A3.2A.4 **09:00**

Electromagnetic Interference of Unmanned Aerial Vehicles: A Characteristic Mode Analysis Approach

Mohamed Hamdalla, Ahmed M. Hassan, Anthony Caruso, University of Missouri-Kansas City, United States; James Hunter, Yuanzhuo Liu, Victor Khilkevich, Daryl Beetner, Missouri University of Science and Technology, United States

TU-A3.2A.5 **09:20**

Identification of Suspicious Mass in Biological Tissues Using Resonance Parameters Extracted from Late Time Response

Marwa Bannis, Egyptian Russian University, Egypt; Fatma El Hefnawi, National Authority for Remote Sensing, Electronic Research Institute, Egypt; Atef Elsherbeni, Colorado School of Mines, United States

Break **09:40**

TU-A3.2A.6 **10:00**

RCS of Complex Targets via Compressive Sensing

Xiang Li, Mustapha Yagoub, University of Ottawa, Canada

TU-A3.2A.7 **10:20**

Austin RCS Benchmark Suite Developments

Jonathan Kelley, University of Texas at Austin, United States; Clifton Courtney, David A. Chamulak, Lockheed Martin Aeronautics Company, United States; Ali E. Yilmaz, University of Texas at Austin, United States

TU-A3.2A.8 **10:40**

RCS Enhancement Using Topology Optimization

Aseim Elfrgani, C J Reddy, Altair Engineering Inc., United States

TU-A3.2A.9 **11:00**

An Entire-Domain Analysis of Very Large 2-D Scatterers in TM mode Using Gegenbauer Polynomials

Jovana Perović, Dragan Olćan, University of Belgrade, Serbia

Tuesday, July 9 | 08:00 - 09:40
TU-A2.3A | Room 211

THz and Optical Metamaterials

Session Chair: Douglas H. Werner, Pennsylvania State University

TU-A2.3A.1 **08:00**

Three-dimensional Nanoantenna Inverse-design

Sawyer D. Campbell, Pennsylvania State University, United States; Danny Z. Zhu, United States Military Academy at West Point, United States; Eric B. Whiting, Pingjuan L. Werner, Douglas H. Werner, Pennsylvania State University, United States

TU-A2.3A.2 **08:20**

Tunable Hybrid Terahertz Metamaterials Based on VO2 Phase Transition

Lei Kang, Pennsylvania State University, United States; Shengxiang Wang, Wuhan Textile University, China; Sawyer D. Campbell, Douglas H. Werner, Pennsylvania State University, United States

TU-A2.3A.3 **08:40**

Polarization-independent and broadband THz coherent perfect absorber based on black phosphorus bifacial metasurfaces

Tianjing Guo, Christos Argyropoulos, University of Nebraska-Lincoln, United States

TU-A2.3A.4 **09:00**

Metasurface based far infrared solar absorber

Charmy Jani, Marwadi University, India; Shobhitkumar Patel, Marwadi Education Foundation, India

TU-A2.3A.5 **09:20**

Waveguide Surface on Textile for Body Area Network

Fabien Ferrero, Rania Khalifeh, Leonardo Lizzi, Universite Cote d'Azur, France

Tuesday, July 9 | 10:00 - 11:40
TU-A5.4A | Room 211

Additively Manufactured Antennas

Session Chair: Premjeet Chahal, Michigan State Uiversity

TU-A5.4A.1 **10:00**

A Novel 3D and Inkjet Printed Pressure-sensing Button-shaped Resonator

Yepu Cui, Wenjing Su, Manos Tentzeris, Georgia Institute of Technology, United States

TU-A5.4A.2 **10:20**

On the Surface Roughness and Smoothing in the 3D Printed THz Reflectors

Sinan Adibelli, Prateek Juyal, Alenka Zajić, Georgia Institute of Technology, United States

TU-A5.4A.3 **10:40**

Compact and High Gain half-sphere Dielectric Antenna Using 3D printing Technology

Enass Usama, Poznań University of Technology, Poland; Mohamed Basha, University of Waterloo, Canada; Rafal Krenz, Poznań University of Technology, Poland; Safieddin Safavi-Naeini, University of Waterloo, Canada

TU-A5.4A.4 **11:00**

A 3D Printed UHF Passive RFID tag for Plastic Components

Saranraj Karuppuswami, Mohd Ifwat Mohd Ghazali, Saikat Mondal, Deepak Kumar, Amanpreet Kaur, Premjeet Chahal, Michigan State University, United States

TU-A5.4A.5 **11:20**

3D Printed Inverted-F Antenna and Temperature Sensor Using Microfluidics Technologies

Shi Cong Wang, Mei Song Tong, Tongji University, China; Yang Yang Guan, Manos Tentzeris, Georgia Institute of Technology, United States

Imaging and Scatterer Characterization

Session Co-Chairs: Marco Salucci, ELEDIA Research Center, University of Trento; Magda El-Shenawee, University of Arkansas

TU-A4.1A.1 **08:00**

Image Reconstruction of Freshly Excised Human Breast Tumors using Terahertz Electrical Properties

Nagma Vohra, Tyler Bowman, Magda El-Shenawee, University of Arkansas, United States; Keith Bailey, Oklahoma State University, United States

TU-A4.1A.2 **08:20**

Experimental Demonstration of the Shadow Projection Algorithm for Near-Field Microwave Imaging of Buried Objects in Layered Media

Kai Ren, University of Wisconsin-Madison, United States; Robert Burkholder, Ohio State University, United States

TU-A4.1A.3 **08:40**

Automatic Permittivity Characterization of a Weak Dielectric Attached to Human Body Using Wideband Radar Image Processing

Mahshid Asri, Carey Rappaport, Northeastern University, United States

TU-A4.1A.4 **09:00**

Focused CW Mm-Wave Characterization of Lossy Penetrable Dielectric Slab Affixed to Human Body

Mohammad Tajdini, Carey Rappaport, Northeastern University, United States

TU-A4.1A.5 **09:20**

Electromagnetic Deep Learning Technology for Radar Target Identification

Abdelelah M. Alzahed, Royal Military College of Canada, Canada; Said M. Mikki, University of New Haven, United States; Yahia Antar, Royal Military College of Canada, Canada

Break **09:40**

TU-A4.1A.6 **10:00**

Locating Scattering Centers Using Compressive PSD Estimation

Ismail Jouny, Lafayette College, United States

TU-A4.1A.7 **10:20**

A Microwave Tomography System Using Time-Reversal Imaging

John Doroshewitz, Jason Merlo, Christopher Oakley, Lalita Udpa, Jeffrey Nanzer, David MacFarlane, Emily Huff, Michigan State University, United States; Saptarshi Mukherjee, Lawrence Livermore National Laboratory, United States

TU-A4.1A.8 **10:40**

Detection of Scatterers Inside Metal Containers via VLF Signals of Opportunity

Nathan Opalinski, Edward Slevin, Roderick Gray, Morris Cohen, Georgia Institute of Technology, United States; Vijay Harid, Mark Golkowski, University of Colorado Denver, United States; Sarah Patch, University of Wisconsin-Milwaukee, United States

TU-A4.1A.9 **11:00**

Opportunistic Equivalent Sources for Field Synthesis - Potentialities and Future Trends

Marco Salucci, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN – University of Trento), Italy

TU-A4.1A.10 **11:20**

Primitive Scatterer Reconstruction for Target Scattering in SAR images

Yongchen Li, Zichang Liang, Science and Technology on Electromagnetic Scattering Laboratory, China

Cybersecurity and Electromagnetic Systems: From DC to Daylight and from Wireless to Wired

Session Co-Chairs: Johnson Wang, Wang Electro-Opto Corporation; Andrew Peterson, Georgia Institute of Technology

TU-SP.1P.1 **13:20**

Cyber Resilience via Modeling & Simulation and Operations Analysis

Ambrose Kam, Lockheed Martin, United States

TU-SP.1P.2 **13:40**

Solving Cybersecurity Problem by Symmetric Dual-Space Formulation–Physical and Cybernetic

Johnson Wang, Wang Electro-Opto Corporation, United States

TU-SP.1P.3 **14:00**

Antenna-on-Display (AoD) for Millimeter-wave 5G Mobile Devices

Junho Park, Wonbin Hong, Pohang University of Science and Technology (POSTECH), Korea (South)

TU-SP.1P.4 **14:20**

Design of Ultra-Wideband Circularly Polarized CPW-Fed Antenna with a Metasurface Substrate

Ashwani Kumar, Prashant Chaudhary, Delhi University, India; Raj Mittra, University of Central Florida, United States

TU-SP.1P.5 **14:40**

A Novel Dual-band 28/38 GHz Slotted Microstip MIMO Antenna for 5G Mobile Applications

Mohamed I. Ahmed, Electronics Research Institute, Egypt; H. M. Marzouk, A. A. Shaalan, Zagazig University, Egypt

Break **15:00**

TU-SP.1P.6 **15:20**

Antenna Pattern Evaluation of 28GHz band Massive MIMO Antenna RF Frontend Module for 5G

Tasuku Kuriyama, Satoshi Yamaguchi, Hikaru Watanabe, Hideki Morishige, Hideyuki Nakamizo, Koji Tsutsumi, Manabu Sakai, Akihiro Okazaki, Toru Fukasawa, Naofumi Yoneda, Mitsubishi Electric Corporation, Japan

TU-SP.1P.7 **15:40**

Analysis and design of mm-wave phased array antennas for 5G access

Risto Valkonen, Efstratios Doumanis, Nokia Bell Labs, Finland

TU-SP.1P.8 **16:00**

A Compact Probe for EM Side-Channel Attacks on Cryptographic Systems

Frank Werner, Georgia Institute of Technology, United States; Antonije Djordjevic, University of Belgrade, Serbia; Alenka Zajić, Georgia Institute of Technology, United States

TU-SP.1P.9 **16:20**

Scan Properties of Slot-Fed Dielectric Resonator Antenna Arrays for 5G Wireless Communications

Ali Al-Rawi, A. Bart Smolders, Eindhoven University of Technology, Netherlands; Diego Caratelli, The Antenna Company, Netherlands

TU-SP.1P.10 **16:40**

Spread Spectrum Techniques for Interference Mitigation in Large Bandwidth

Md Rakibur Rahman, Satheesh Bojja Venkatakrishnan, Elias A. Alwan, John L. Volakis, Florida International University, United States

Metasurfaces in Antenna Applications

Session Co-Chairs: Stefano Maci, Università degli Studi di Siena; Anastasios Papathanasopoulos, UCLA

TU-SP.2P.1 **13:20**

Single Antenna Beam Scanning via Reconfigurable Vanadium Dioxide (VO2) Metasurface

Jack Eichenberger, Nima Ghalichechian, Ohio State University, United States

TU-SP.2P.2 **13:40**

A Wideband High-Gain Conical Short Horn based on a Metasurface-corrected Lens

Kaiting Liu, Yuehe Ge, Huaqiao University, China

TU-SP.2P.3 **14:00**

Bistatic RCS of a One-Dimensional Metasurface Leaky-Wave Antenna

Subramanian Ramalingam, Constantine Balanis, Craig Birtcher, Sivaseetharaman Pandi, Arizona State University, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia

TU-SP.2P.4 **14:20**

Radiation of Forward and Backward Leaky Waves in Sinusoidally-Modulated Metasurfaces

Subramanian Ramalingam, Constantine Balanis, Craig Birtcher, Arizona State University, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia

TU-SP.2P.5 **14:40**

A Novel Deployable Compact Lens Antenna Based on Gradient-Index Metamaterials

Anastasios Papathanasopoulos, Yahya Rahmat-Samii, University of California, Los Angeles, United States

Break **15:00**

TU-SP.2P.6 **15:20**

Robust Method for Synthesizing Low-RCS High-Gain Antennas Using Metasurfaces

Anuj Modi, Constantine Balanis, Craig Birtcher, Arizona State University, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia

TU-SP.2P.7 **15:40**

Dynamic Beam Steering by Metaguides and Multilattices

A N M Shahriyar Hossain, Igor Tsukerman, University of Akron, United States

TU-SP.2P.8 **16:00**

Bandwidth Enhancement of Square-Ring Antenna Using Surface Waves on Metasurface

Mohammed Alharbi, Constantine Balanis, Craig Birtcher, Arizona State University, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia; Saud Saeed, Prince Sattam bin Abdulaziz University, Saudi Arabia

TU-SP.2P.9 **16:20**

Directivity Enhancehment of Antipodal Vivaldi Antenna using Broadband Metasurface Lens

Omer Yesilyurt, Gonul Turhan Sayan, Middle East Technical University, Turkey

TU-SP.2P.10 **16:40**

A Meta-Surface Antenna Array Decoupling (MAAD) Method for Two Linear Polarized Compact Antenna Elements at 3.5GHz

Jiayin Guo, Feng Liu, Luyu Zhao, Xidian University, China

RFID Systems and Applications

Session Co-Chairs: Etienne Perret, Univ. Grenoble Alpes, Grenoble INP, LCIS; Premjeet Chahal, Michigan State University

TU-A5.1P.1 **13:20**

A PSK Modulation Scheme for Sensor Integrated RFIDs

Saikat Mondal, Deepak Kumar, Saranraj Karuppuswami, Mohd Ifwat Mohd Ghazali, Amanpreet Kaur, Premjeet Chahal, Michigan State University, United States

TU-A5.1P.2 **13:40**

Gesture Recognition Using A Portable and Flexible Meta-Atom Panel and Machine Learning

Mehdi Hajizadegan, Pai-Yen Chen, University of Illinois at Chicago, United States

TU-A5.1P.3 **14:00**

Characterization of Chipless RFID Tag in a 3-Dimensional Reading Zone

Raphael Tavares de Alencar, Nicolas Barbot, Marco Garbati, Etienne Perret, Univ. Grenoble Alpes, Grenoble INP, LCIS, France

TU-A5.1P.4 **14:20**

UHF Rectenna for Implanted and Free space Communications

Adamantia Chletsou, Ibrahim Kagan Aksoyak, John Papapolymerou, Ahmet Cagri Ulusoy, Michigan State University, United States

TU-A5.1P.5 **14:40**

Machine Embroidered Wearable e-textile Wideband UHF RFID Tag Antenna

Yutong Jiang, Ting Leng, Yixian Fang, Zhirun Hu, Lulu Xu, University of Manchester, United Kingdom

Break **15:00**

TU-A5.1P.6 **15:20**

Spatial characterization of the ambient backscatter communication performance in line-of-sight

Kammel Rachedi, Institut Langevin, France; Dinh Thuy Phan Huy, Orange Gardens, France; Abdelwaheb Ourir, Julien de Rosny, Institut Langevin, France

TU-A5.1P.7 **15:40**

The Future of Backscatter in Precision Agriculture

Spyridon Daskalakis, Heriot-Watt University, United Kingdom; Stylianos Assimonis, Queen's University Belfast, United Kingdom; George Goussetis, Heriot-Watt University, United Kingdom; Manos Tentzeris, Georgia Institute of Technology, United States; Apostolos Georgiadis, Heriot-Watt University, United Kingdom

TU-A5.1P.8 **16:00**

Broadband MST sensor probes based on a SP3T MEMs switch

Massimo Donelli, Mohammedhusen Manekiya, University of Trento, Italy; Jacopo Iannacci, Fondazione Bruno Kessler (FBK), Italy

TU-A5.1P.9 **16:20**

Orientation insensitive UHF RFID Tag Antenna with polarization diversity using Characteristic Mode Analysis

Abubakar Sharif, Jun Ouyang, University of Electronic Science and Technology of China, China; Muhammad Ali Imran, Qammer Hussain Abbasi, University of Glasgow, United Kingdom

TU-A5.1P.10 **16:40**

Analysis of Calibration-Free Detection Techniques for Frequency-Coded Chipless Radiofrequency Identification

Yi-Min Jhang, Jin-An Lin, Jyun-Yi Jhang, Bo-Lin Lin, Yen-Sheng Chen, National Taipei University of Technology, Taiwan

Millimeter-wave Antennas

Session Co-Chairs: Ahmed A. Kishk, Concordia University; Seckin Sahin, Ohio State University

TU-A5.2P.1 **13:20**

Wideband Millimeter-Wave Dielectric Resonator Antenna

Yazan Al-Alem, Ahmed Kishk, Concordia University, Canada

TU-A5.2P.2 **13:40**

High Gain Millimeter-Wave Slot Antenna with Symmetric Radiation Characteristics

Yazan Al-Alem, Ahmed Kishk, Concordia University, Canada

TU-A5.2P.3 **14:00**

A Series-fed Cavity-back Patch Array Antenna for a Miniaturized 77GHz Radar Module

Chen-Pang Chao, Shang-Hung Yang, Chiu-Ming Tung, Chang-Fa Yang, National Taiwan University of Science and Technology (Taiwan Tech), Taiwan; Wen-Hsiung Lin, Jorjin Technologies Inc., Taiwan; Chun-Yi Chai, XMMSE Co., Ltd, Taiwan; Ike Lin, WaveFidelity Inc., Taiwan

TU-A5.2P.4 **14:20**

Wideband, Wide Angle Radome Design for mm-Wave Automotive Radar Systems

Maruf Md Sajjad Hossain, Syed An Nazmus Saqueb, Ohio State University, United States; Alebel H. Arage, John Cabigao, Carlos Velasquez, Alps Electric NA, Inc., United States; Kubilay Sertel, Niru K. Nahar, Ohio State University, United States

TU-A5.2P.5 **14:40**

Low-Cost and High-Gain W-Band Circularly Polarized SIW Slot Antenna

Hao Liu, University of Electronic Science and Technology of China, China; Anyong Qing, Southwest Jiaotong University, China; Ziqiang Xu, Zhao Yang, University of Electronic Science and Technology of China, China

Break **15:00**

TU-A5.2P.6 **15:20**

K/Ka Dual-Band Dual-Polarized Gap Waveguide Array Antenna

Miguel Ferrando-Rocher, Alejandro Valero-Nogueira, Jose Ignacio Herranz-Heruzo, Universitat Politècnica de València, Spain

TU-A5.2P.7 **15:40**

Modeling the Effects of Gaseous Absorption and Attenuation due to Clouds for a 72 GHz Terrestrial Link

Ralph Lyndon Gesner, Christos Christodoulou, University of New Mexico, United States; Steven Lane, David Murrell, Air Force Research Laboratory, United States; Eugene Hong, Applied Technology Associates, United States; Nicholas Tarasenko, Air Force Research Laboratory, United States

TU-A5.2P.8 **16:00**

Ridge Gap Array Antenna with Inter-Element Spacing of a Wavelength

Mohammadmahdi Farahani, Institut national de la recherche scientifique (INRS), Canada; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TU-A5.2P.9 **16:20**

Array of stacked leaky wave antennas based on gap waveguide technology

Nafsika Memeletzoglou, Eva Rajo-Iglesias, Universidad Carlos III de Madrid, Spain

TU-A5.2P.10 **16:40**

A Stepped-Ring Fabry Perot Cavity Antenna for Millimeter Wave Applications

Qing-Yi Guo, Hang Wong, City University of Hong Kong, China

Wireless Communications

Session Co-Chairs: John Volakis, Florida International University; Giulia Buttazzoni, University of Trieste

TU-UB.1P.1 **13:20**

A Simple Method for Including the Antenna Pattern in Interfered Wireless Communications

Massimiliano Comisso, Fulvio Babich, Francesca Vatta, Giulia Buttazzoni, University of Trieste, Italy

TU-UB.1P.2 **13:40**

Analysis of full-duplex AF Relaying under Imperfect Channel State Information

Koffi Dogbe, Nadir Hakem, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TU-UB.1P.3 **14:00**

mm-Wave Varactor Reconfigurable Microstrip Patch Antennas using GaN on Sapphire Technology

Mohammod Ali, Norman Mattox, MVS Chandrashekhar, Grigory Simin, University of South Carolina, United States

TU-UB.1P.4 **14:20**

UWB Reconfigurable RF Self-Interference Cancellation Filter for Simultaneous Transmit and Receive System

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

TU-UB.1P.5 **14:40**

Intelligent Anti-Jamming Decision Method Based on the Mutation Search Artificial Bee Colony Algorithm for Wireless Systems

Fang Ye, Zitao Zhou, Hongbo Tian, Qian Sun, Yibing Li, Tao Jiang, Harbin Engineering University, China

Break **15:00**

TU-UB.1P.6 **15:20**

A Four-Element Digital Array Receiver at 2.4 GHz Using a Single Frequency-Multiplexed ADC

Arjuna Madanayake, Najath Akram, Elias A. Alwan, Satheesh Bojja Venkatakrishnan, John L. Volakis, Florida International University, United States; Soumyajit Mandal, Case Western Reserve University, United States; Leonid Belostotski, University of Calgary, Canada

TU-UB.1P.7 **15:40**

Bandwidth Extension of Planar Microstrip-to-Waveguide Transition by Via-Hole Locations at Both Sides of Microstrip Line

Nguyen Thanh Tuan, Kunio Sakakibara, Nobuyoshi Kikuma, Nagoya Institute of Technology, Japan

TU-UB.1P.8 **16:00**

Performance analysis of full-duplex relaying over Rayleigh-Rician fading channels

Koffi Dogbe, Nadir Hakem, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TU-UB.1P.9 **16:20**

Experimental Evaluation of Intersymbol Interference in Non-Far Region Transmission using 30-GHz Band Large Array Antennas

Tuchjuta Ruckkwaen, Kiyomichi Araki, Takashi Tomura, Jiro Hirokawa, Makoto Ando, Tokyo Institute of Technology, Japan

TU-UB.1P.10 **16:40**

4×4 Broadband Butler Matrix and Its Application in Antenna Arrays

Kai-Ran Xiang, Fu-Chang Chen, South China University of Technology, China

Tuesday, July 9 | 13:20 - 17:00
TU-A1.1P | Room 206/207

Pattern Reconfigurable Antennas

Session Co-Chairs: Wael Abdel-Wahab, University of Waterloo; Karu P. Esselle, Macquarie University

TU-A1.1P.1 **13:20**

NEW PATTERN RECONFIGURABLE ANTENNA WITH 4 U-SLOTS FOR MIMO APPLICATIONS

Saeed Haydhah, Rifaqat Hussein, Mohammad Sharawi, King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia

TU-A1.1P.2 **13:40**

A Yagi-Uda Pattern Reconfigurable Antenna for WiMAX Application

Sagiru Gaya, Hussein Attia, King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia; Abdelhady Mahmoud, Benha University, Egypt; Mohammad Sharawi, Polytechnique Montréal, Canada; Sharif Sheikh, King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia

TU-A1.1P.3 **14:00**

2-D Pattern Reconfigurable Array Antenna with Excitation Phase Difference Circuit

Hikaru Watanabe, Takashi Maruyama, Narihiro Nakamoto, Toru Fukasawa, Naofumi Yoneda, Mitsubishi Electric Corporation, Japan

TU-A1.1P.4 **14:20**

Implementation of a Pattern-Reconfigurable Antenna for modern wireless sensor network applications

Muamba Mukendi Leingthone, Hakem Nadir, Université de Québec en Abitibi-Témiscamingue, Canada

TU-A1.1P.5 **14:40**

A Dual-Band Beam-Switching Antenna Using Square Active Frequency Selective Surfaces

Hifa Houssein, Ghada Elzwawi, INRS, Canada; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

Break **15:00**

TU-A1.1P.6 **15:20**

PCB Bowing Effects on 60 GHz Switched-Beam Antenna Modules

Prabhat Baniya, Kathleen Melde, University of Arizona, United States

TU-A1.1P.7 **15:40**

Radiation Pattern Reconfigurable Horn Antenna

Mehmet Tanagardi, Utah State University, United States; Md Asaduzzaman Towfiq, i5 Technologies Inc., United States; Bedri Cetiner, Utah State University, United States

TU-A1.1P.8 **16:00**

A Passive Beam Reconfigurable Antenna System for Millimeter-wave Applications

Affan Aziz Baba, Raheel Hashmi, Karu Esselle, Macquarie University, Australia; Manik Attaygalle, Defence Science and Technology Group, Australia

TU-A1.1P.9 **16:20**

A Novel Bio-Inspired Quasi-Yagi Helical Antenna with Beam Direction and Beamwidth Switching Capability using Origami DNA

Syed Imran Hussain Shah, Sungjoon Lim, Chung Ang University, Korea (South)

TU-A1.1P.10 **16:40**

Fluidically Beam-Steering Metasurfaced Antenna

Aqeel Naqvi, Sungjoon Lim, Chung-Ang University, Korea (South)

Tuesday, July 9 | 13:20 - 16:40
TU-A5.3P | Room 209/210

Recent Advances in 4G and 5G Antennas for Mobile Devices

Session Co-Chairs: Jiang Zhu, Google, Inc.; Hongwei Liu, Futurewei Technologies, Inc

TU-A5.3P.1 **13:20**

A Compact Wideband Dual-polarized Millimeter Wave Antenna for 5G Smartphones

Menglou Rao, Kamal Sarabandi, University of Michigan, United States

TU-A5.3P.2 **13:40**

A Fundamental Study of Folded Monopole Antenna with Robustness to Metal

Yuta Nakagawa, Naobumi Michishita, Hisashi Morishita, National Defense Academy, Japan

TU-A5.3P.3 **14:00**

Co-design of Conformal 4G LTE and mmWave 5G Antennas for Smartphones

Idrees Magrey, Karthikeya GS, Shiban K. Koul, Indian Institute of Technology, Delhi, India

TU-A5.3P.4 **14:20**

A 5G Antenna Array Placed Close to a 4G Antenna

Takashi Yamagajo, Manabu Kai, Fujitsu Laboratories Limited, Japan

TU-A5.3P.5 **14:40**

Eight-element MIMO Antenna with Tightly-arranged Pairs for 5G Mobile Terminal

Changjiang Deng, Xin Lv, Beijing Institute of Technology, China

Break **15:00**

TU-A5.3P.6 **15:20**

On the Integration of Antennas With Touch Sensor Panels

Sameer Sharma, Andrea Luttgen, Costas Sarris, University of Toronto, Canada

TU-A5.3P.7 **15:40**

Dual Functional MIMO Antenna System for mm-Wave 5G and 2 GHz 4G Communications

Emad Al Abbas, Muhammad Ikram, Amin Abbosh, University of Queensland, Australia

TU-A5.3P.8 **16:00**

An Octa-Band Antenna for LTE Mobile Handsets without Ground Clearance

Daiwei Huang, Zhengwei Du, Tsinghua University, China

TU-A5.3P.9 **16:20**

A Side-Edge Frame Printed Eight-Element Antenna Array for Quad-Band MIMO Operations in the 5G Smartphone

Hongwei Wang, Yiming He, Guangli Yang, Shanghai University, China

Frequency Selective Surfaces: Applications

Session Co-Chairs: Shulabh Gupta, Carleton University; Rhonda Franklin, University of Minnesota, Twin Cities

TU-A2.1P.1 **13:20**

Development of High Aperture Efficiency Fabry-Perot Cavity Antenna System

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

TU-A2.1P.2 **13:40**

Development of High Gain Virtual-Element Arrays with Fabry-Perot Cavity Antenna Systems

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

TU-A2.1P.3 **14:00**

Improvement in FSS-Based Sensor Sensitivity by Miniaturization Technique

Mahboobeh Mahmoodi, Kristen M. Donnell, Missouri university of Science and Technology, United States

TU-A2.1P.4 **14:20**

A Low-cost Light-weight 3D-printed Choke Ring for Multipath Mitigation for GNSS Antennas

Mohamed K. Emara, Khaled Madhoun, Rawan Madhoun, Shulabh Gupta, Carleton University, Canada

TU-A2.1P.5 **14:40**

A Compact Metasurface Based Cross Polarization Converter for X Band Applications

Umer Farooq, Adnan Iftikhar, Muhammad Junaid Mughal, Muhammad Farhan Shafique, Muhammad Saeed Khan, Comsats University, Pakistan; Raed M. Shubair, Massachusetts Insitute of Technology, United States

Break **15:00**

TU-A2.1P.6 **15:20**

FSS and Meta-material Based Low Mutual Coupling MIMO Antenna Array

Shengyuan Luo, Yingsong Li, Tao Jiang, Beiming Li, Harbin Engineering University, China

TU-A2.1P.7 **15:40**

C-Band Multi-Beam Planar Lens Antenna Based on Frequency Selective Surface

Ying Suo, Hongyong Wang, Wei Li, Harbin Institute of Technology, China

Antenna Feeds and Matching Circuits I

Session Co-Chairs: Ashwin Iyer, University of Alberta; Chris Merola, University of Massachusetts

TU-A1.2P.1 **13:20**

An Improved Model for Static Field Micro-Particle Components on a Printed Transmission Line

Nasim Soufizadeh-Balaneji, David Rogers, Benjamin D. Braaten, North Dakota State University, United States

TU-A1.2P.2 **13:40**

On Modal Excitation Using Capacitive Coupling Elements and Matching Network

Hanieh Aliakbari, Buon Kiong Lau, Lund University, Sweden

TU-A1.2P.3 **14:00**

Design and Characterization of a Dual-Band Impedance Transformer Based on an Embedded MTM-EBG

Jacob Brown, Ashwin K. Iyer, University of Alberta, Canada

TU-A1.2P.4 **14:20**

Ultra-wideband Planar Marchand Balun Design for the Pyramidal Sinuous Antenna

Carlo Van Niekerk, Stellenbosch University, South Africa

TU-A1.2P.5 **14:40**

A 1x4 power divider capable of implementing any phase difference output based on a slow-wave substrate integrated waveguide

Chenchen Wang, Jinling Zhang, Beijing University of Posts and Telecommunications, China; Zhanqi Zheng, Institute of Microelectronics, Chinese Academy of Sciences, China; Xiongzhi Zhu, Beijing University of Posts and Telecommunications, China

Break **15:00**

TU-A1.2P.6 **15:20**

Coaxial Marchand Balun - Design and Fabrication

Michael Johnston, Carlo Van Niekerk, Dirk De Villiers, Stellenbosch University, South Africa

TU-A1.2P.7 **15:40**

Compact Comparator for Dual-Polarized Monopulse Array Based on Novel Eight-Port Coupler

Kejia Ding, Ahmed Kishk, Concordia University, Canada

TU-A1.2P.8 **16:00**

A Novel Hybrid Coupler Design based on the Concept of Balanced Loaded Transmission Lines

Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy

TU-A1.2P.9 **16:20**

Dual-Polarized Antenna With High Isolation Using Hybrid Balun Circuit

Zhongqian Niu, University of Electronic Science and Technology of China, China; Daotong Li, Chongqing University, China; Yaohui Zhang, Yonghong Zhang, Bo Zhang, Yong Fan, University of Electronic Science and Technology of China, China

TU-A1.2P.10 **16:40**

New dual-polarized slot-coupled antenna for wireless applications

Farid Shokouhi, Zaker Hossein Firouzeh, Reza Safian, Isfahan University of Technology, Iran

Antenna Array III

Session Co-Chairs: Hualiang Zhang, University of Massachusetts, Lowell; Saeed Khan, Kansas State University

TU-UB.2P.1 **13:20**

Light Weight and Large Beamwidth Antenna Array for 2.4/5.8 GHz WLAN Applications

Saber Soltani, Bowen Zheng, Hong Tang, University of Massachusetts Lowell, United States; Chang Chen, University of Science and Technology of China, China; Hualiang Zhang, University of Massachusetts Lowell, United States

TU-UB.2P.2 **13:40**

The High Efficiency and Low Cost Massive MIMO Array Antenna for Sub- 6GHz 5G Base Station

Jungmin Park, Seungtae Ko, Youngun Kim, Youngsub Kim, Youngjoo Lee, Samsung Electronics, Korea (South)

TU-UB.2P.3 **14:00**

Antenna with Parasitic Radiators for Front-to-Back Ratio Enhancement

Youngsub Kim, Seungtae Ko, Jungmin Park, Youngju Lee, Samsung Electronics, Korea (South)

TU-UB.2P.4 **14:20**

Perfect Absorption by an Array of Lossy Dipoles Located Close to a Ground Plane

Ofer Markish, Daniel Silverstein, Yehuda Leviatan, Technion - Israel Institute of Technology, Israel

TU-UB.2P.5 **14:40**

Design of an Active Scalable Phased Array Antenna System

Kai Yao, Shengchang Lan, Linting Ye, Guiyuan Zhang, Gang Lu, Lijia Chen, Harbin Institute of Technology, China

Break **15:00**

TU-UB.2P.6 **15:20**

An UTD Rapid Phased Array Antenna Coupling Package

Henry Zhang, Ryan From, Ruben Llamas, Quang Nguyen, Phong Tran, Boeing, United States

TU-UB.2P.7 **15:40**

Design and Analysis for Log Periodic Dipole Antenna Array for Low Altitude Source Search using Multirotor Unmanned Aerial Vehicles (UAV)

Saeed Khan, Kansas State University, United States

TU-UB.2P.8 **16:00**

Optimal Synthesis of Maximally Robust Antenna Arrays by Means of Circular Interval Arithmetics

Nicola Anselmi, Mohammad Abdul Hannan, Paolo Rocca, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

TU-UB.2P.9 **16:20**

Robust Fast Jamming Signal Nulling Using Particle Swarm Optimization Algorithm Implemented on FPGAs

Nghia Tran, Farshid Tamjid, Farhan Quaiyum, Aly E. Fathy, University of Tennessee at Knoxville, United States; Ozlem Kilic, Catholic University of America, United States

TU-UB.2P.10 **16:40**

Effects of a shorting post on the impedance characteristic of TCDA antenna

Seongjung Kim, Sangwook Nam, Seoul National University, Korea (South)

Biomedical applications of Electromagnetics III

Session Co-Chairs: Magdy Iskander, University of Hawaii; Zhengqing Yun, University of Hawaii; Susan Hagness, University of Wisconsin-Madison

TU-A5.4P.1 **13:20**

Mapping Lung Water Signal Distribution on Human Chest and Predition of Lung Water Content

Zhengqing Yun, Scott Clemens, Yuanzhang Xiao, Ruthsenne Perron, Magdy Iskander, University of Hawaii, United States

TU-A5.4P.2 **13:40**

Study of Bending Effects on a Dual-Band Implantable Antenna

Mohammad Haerinia, University of North Dakota, United States; Sima Noghanian, PADT Inc., United States

TU-A5.4P.3 **14:00**

Folding-Dependent vs. Folding-Independent Flexible Antennas on E-Textiles

Saad Alharbi, Asimina Kiourti, Ohio State University, United States

TU-A5.4P.4 **14:20**

An experimental Procedure and Initial Results of RF Propagation in Human Subjects

Sajid M. Asif, University of Sheffield, United Kingdom; Adnan Iftikhar, Umer Farooq, Comsats University, Pakistan; Jared Hansen, Ryan Striker, Benjamin D. Braaten, D. L. Ewert, North Dakota State University, United States; Keith Maile, Boston Scientific, United States

TU-A5.4P.5 **14:40**

On the Decoupling Robustness of Distributed Magnetic Traps in Biological Loaded Dual Tuned MR coils

Nunzia Fontana, Danilo Brizi, Filippo Costa, University of Pisa, Italy; Gianluigi Tiberi, London South Bank University, United Kingdom; Agostino Monorchio, University of Pisa, Italy

Break **15:00**

TU-A5.4P.6 **15:20**

Classification of Anomalies with Open-Ended Coaxial Probes

Tuba Yilmaz, Istanbul Technical University, Turkey; Erdem Topsakal, VCU, Turkey; Ibrahim Akduman, Istanbul Technical University, Turkey

TU-A5.4P.7 **15:40**

Liquid Metal Broadband Monopole for Stretchable Electronics

Nathan Seongheon Jeong, Amanda Koh, University of Alabama, United States

TU-A5.4P.8 **16:00**

Effect of Temperature Sensor Location and Measurement Time on Evaluation of the Calibration Factor of the Lead Electromagnetic Model

Mikhail Kozlov, Max Planck Institute for Human Cognitive and Brain Sciences, Germany; Wolfgang Kainz, Food and Drug Administration, United States

TU-A5.4P.9 **16:20**

Improved Reconstruction Method Based on k-Means by Finding Peak Density Automatically in Microwave Induced Thermoacoustic Tomography

Shuangli Liu, Zhiqin Zhao, University of Electronic Science and Technology of China, China; Xiong Wang, Dajun Zhang, ShanghaiTech University, China

TU-A5.4P.10 **16:40**

Research on Electromagnetic Positioning Calibration Technology Based on Kriging Interpolation

Hongjie Wang, Tao Jiang, Yingsong Li, Yibing Li, Fang Ye, Harbin Engineering University, China; Bin Cao, Marine Design & Research Institute of China, China

Tuesday, July 9 | 13:20 - 15:00
TU-A3.1P | Room 304

Finite Element Methods

Session Co-Chairs: Branislav Notaros, Colorado State University; Dan Jiao, Purdue University

TU-A3.1P.1 **13:20**

The Dual Weighted Residual and Error Estimation in Double Higher-Order FEM

Jake Harmon, Branislav Notaros, Colorado State University, United States

TU-A3.1P.2 **13:40**

Truncating Matrx-free Time-Domain Method with PML for Solving 3-D Open Region Problems

Zhangchao Wei, Dan Jiao, Purdue University, United States

TU-A3.1P.3 **14:00**

Distributed NUMA Implementation of a Direct Solver for DDM Preconditioning

Dimitrios Makris, Marinos Vouvakis, University of Massachusetts Amherst, United States

TU-A3.1P.4 **14:20**

Parallel Direct Domain Decomposition Methods (D3M) for Finite Elements

Javad Moshfegh, Dimitrios Makris, Marinos Vouvakis, University of Massachusetts Amherst, United States

TU-A3.1P.5 **14:40**

Linear-Complexity H2-Based Direct Sparse Solver for Electromagnetic and Multiphysics Analysis

Miaomiao Ma, Dan Jiao, Purdue University, United States

Tuesday, July 9 | 15:20 - 17:00
TU-A3.2P | Room 304

High Frequency and Asymptotic Techniques

Session Co-Chairs: Deb Chatterjee, University of Missouri-Kansas City; Cagatay Tokgoz, Lamar University; Cagatay Tokgoz, Lamar University

TU-A3.2P.1 **15:20**

Anisotropic Slab Scattering: A High Frequency Solution

Manushanker Balasubramanian, Douglas H. Werner, Pennsylvania State University, United States

TU-A3.2P.2 **15:40**

Radiation from a Non-conformal Antenna Array on an Electrically Large Conducting Convex Surface

Babajide Salau, Manthan Shah, Cagatay Tokgoz, Lamar University, United States

TU-A3.2P.3 **16:00**

On the Location of Transverse Electric Surface Wave Poles for Electrically Thick Substrates

Kalyan Durbhakula, Deb Chatterjee, Ahmed M. Hassan, University of Missouri-Kansas City, United States

TU-A3.2P.4 **16:20**

Special Functions for Radiation from Sources Close to an Electrically Large Conducting Convex Surface

Babajide Salau, Manthan Shah, Cagatay Tokgoz, Lamar University, United States

TU-A3.2P.5 **16:40**

Analysis of Rotated Corrugated Parallel Plate Waveguide Using Asymptotic Corrugation Boundary Conditions

Wei-Yu Lai, Malcolm Ng Mou Kehn, National Chiao Tung University, Taiwan

Tuesday, July 9 | 13:20 - 17:00
TU-A3.3P | Room 305

Computational Electromagnetics I

Session Co-Chairs: Ali Yilmaz, University of Texas at Austin; Yaniv Brick, Ben-Gurion University of the Negev

TU-A3.3P.1 **13:20**

2D Physical Optics Analysis of the Focal Region of Parallel-Plate Waveguide Lenses

Thomas Ströber, Mauro Ettorre, Centre National de la Recherche Scientifique (CNRS), France

TU-A3.3P.2 **13:40**

Multiphysics Modeling of Crosstalk Effect in Graphene-Encapsulated Cu Nano-Interconnects

Shuzhan Sun, Dan Jiao, Purdue University, United States

TU-A3.3P.3 **14:00**

The Use of Singular Basis Functions for Precise EM Analysis of Axially Symmetric Metallic Antennas

Aleksandra Krneta, Branko Kolundzija, University of Belgrade, Serbia

TU-A3.3P.4 **14:20**

Error Prediction in Electromagnetic Simulations Using Machine Learning

Bariscan Karaosmanoglu, Ozgur Ergul, Middle East Technical University, Turkey

TU-A3.3P.5 **14:40**

Implications of Recompression for Grid-Based Low-Rank Approximation Techniques

Jonathan Kelley, Tian Yao, University of Texas at Austin, United States; Yaniv Brick, Ben Gurion University of the Negev, Israel; Ali E. Yilmaz, University of Texas at Austin, United States

Break **15:00**

TU-A3.3P.6 **15:20**

All-Frequency Stable Potential-Based Formulation for Electromagnetic Modeling and Simulation

Su Yan, Howard University, United States

TU-A3.3P.7 **15:40**

Accurate Solution of Electromagnetic Scattering by Penetrable Objects with Changeable Shapes

Li Zhang, Yin Xuan Zhu, Han Yu Shi, Mei Song Tong, Tongji University, China

TU-A3.3P.8 **16:00**

Approximate Inverse of the Rao-Wilton-Glisson Basis Functions Gram Matrix via Monopolar Representation

Jonas Kornprobst, Josef Knapp, Thomas F. Eibert, Technical University of Munich, Germany

TU-A3.3P.9 **16:20**

Corrosion-Related Magnetostatic Field Analysis

John Young, Robert Pfeiffer, Robert Adams, University of Kentucky, United States; Stephen Gedney, University of Colorado Denver, United States

TU-A3.3P.10 **16:40**

Efficient Full-Wave Method For Analysing Transmit-Arrays Through an Equivalent Dielectric Description

Sergio Matos, Instituto de Telecomunicacoes, Instituto Universitario de Lisboa (ISCTE-IUL) Lisbon, Portugal; Jorge Costa, Instituto de Telecomunicacoes, Instituto Universitario de Lisboa, Portugal; Parinaz Nazeri, University of Toronto, Canada; Eduardo Lima, Carlos A. Fernandes, Instituto de Telecomunicações, Portugal; Nelson Fonseca, ESA Antenna and Sub-Millimeter Wave Section, Netherlands

Tuesday, July 9 | 13:20 - 15:00
TU-A5.5P | Room 211

Educational Advances

Session Chair: Marcus Walden, Plextek

TU-A5.5P.1 **13:20**

Modern Approaches and Self-Evaluation Tools for Teaching Electromagnetics

Alessandro Polo, Marco Salucci, Giacomo Oliveri, Paolo Rocca, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

TU-A5.5P.2 **13:40**

The Flipped Classroom Approach to Engineering Electromagnetics: A Case Study

Morris Cohen, Alenka Zajić, Georgia Institute of Technology, United States

TU-A5.5P.3 **14:00**

Anten'it: A Hardware for Antenna Design and Education

Umut Bulus, Antenom Antenna Technologies Inc., Turkey

TU-A5.5P.4 **14:20**

A WiFi Based Electromagnetic Visual Aid

Malcolm Simpson, Kiersten Kerby-Patel, University of Massachusetts Boston, United States

TU-A5.5P.5 **14:40**

Spinning Magnets in Electromagnetic Education

Marcus Walden, Plextek, United Kingdom

Tuesday, July 9 | 15:20 - 17:00
TU-UA.1P | Room 211

High-Frequency and Millimeter Wireless Metrology

Session Co-Chairs: Matthew Simmons, National Institute of Standards and Technology; Christopher Holloway, National Institute of Standards and Technology

TU-UA.1P.1 **15:20**

Novel 1256-Element Circularly-Polarized Metal-Only Reflectarray Using Spiral Slots

Kendrick Henderson, Nima Ghalichechian, Ohio State University, United States

TU-UA.1P.2 **15:40**

Overview of Dielectric Resonator Antennas for 5G Cellular Communication

Abas Sabouni, Wilkes University, United States

TU-UA.1P.3 **16:00**

A Rydberg Atom-Based Mixer for Phase and Weak Signal Detection

Matthew Simons, Abdulaziz Haddab, University of Colorado, United States; Joshua Gordon, Christopher Holloway, National Institute of Standards and Technology, United States

TU-UA.1P.4 **16:20**

User Proximity Analysis of Compact PIFA for MIMO Applications

Hari Shankar Singh, Thapar Institute of Engineering and Technology, India; Raed M. Shubair, Massachusetts Insitute of Technology, United States

TU-UA.1P.5 **16:40**

Fully-Metallic Leaky-Wave Antenna with Low Dispersion for 60 GHz Point-to-Point Communications

Qiao Chen, Oskar Dahlberg, Oscar Quevedo-Teruel, KTH Royal Institute of Technology, Sweden

Tuesday, July 9 | 13:20 - 16:40
TU-A4.1P | Room 212

Imaging Methods and Systems

Session Co-Chairs: Jeffrey Nanzer, Michigan State University; Francesca Vipiana, Politecnico di Torino

TU-A4.1P.1 **13:20**

Dual Frequency Processing of Subsampled Measurements in W-band

Yasmine Hesham Mohamed Ibrahim, Claire Migliaccio, Jérôme Lanteri, Jean-Yves Dauvignac, Laurent Brochier, Université Côte d'Azur, CNRS UMR 7248, LEAT, France

TU-A4.1P.2 **13:40**

Transmit Pattern Analysis for Active Incoherent Microwave Imaging

Stavros Vakalis, Jeffrey Nanzer, Michigan State University, United States

TU-A4.1P.3 **14:00**

A Method for Detection of Walls and Large Flat Surfaces in Through-the-wall SAR Imaging

Behzad Yektakhah, Kamal Sarabandi, University of Michigan, United States

TU-A4.1P.4 **14:20**

Microwave Imaging Technology for In-line Food Contamination Monitoring

Laura Farina, National University of Ireland Galway, Ireland; Rosa Scapaticci, Institute for Electromagnetic Sensing of the Environment, National Research Council of Italy, Italy; Jorge A. Tobon Vasquez, Javier Rivero, Politecnico di Torino, Italy; Amelie Litman, Institut Fresnel, France; Lorenzo Crocco, Institute for Electromagnetic Sensing of the Environment, National Research Council of Italy, Italy; Francesca Vipiana, Politecnico di Torino, Italy

TU-A4.1P.5 **14:40**

A Physical Optics Simulator for Dielectric Bodies Characterization Using a Multistatic Radar

Marcos Arias, Lorena Perez-Eijo, Yolanda Rodriguez-Vaqueiro, Borja Gonzalez-Valdes, José Vázquez-Cabo, Oscar Rubiños-Lopez, Antonio Pino, Universidade de Vigo, Spain; Yuri Álvarez, Universidad de Oviedo, Spain

Break **15:00**

TU-A4.1P.6 **15:20**

Array of Antennas for a GPR system on board a UAV

Yolanda Rodriguez-Vaqueiro, José Vázquez-Cabo, Borja Gonzalez-Valdes, Antonio Pino, Universidade de Vigo, Spain; Yuri Álvarez, Maria Garcia-Fernandez, Universidad de Oviedo, Spain; Fernando Las-Heras, University of Oviedo, Spain; Ana Arboleya, Universidad Rey Juan Carlos, Spain

TU-A4.1P.7 **15:40**

Global Maxwell Tomography using an 8-channel radiofrequency coil: simulation results for a tissue-mimicking phantom at 7T

Ilias Giannakopoulos, Skolkovo Institute of Science and Technology, Russia; José Serrallés, Massachusetts Institute of Technology, United States; Bei Zhang, New York University, United States; Luca Daniel, Jacob White, Massachusetts Institute of Technology, United States; Riccardo Lattanzi, New York University, United States

TU-A4.1P.8 **16:00**

High Resolution Subsurface 3D SAR Imaging Using Robotic Bi-Static Transceivers

Behzad Yektakhah, Kamal Sarabandi, University of Michigan, United States; Hussein Nasser Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia

TU-A4.1P.9 **16:20**

Elevation Imaging Based on Vortex Electromagnetic Wave

Ruiming Li, Haoquan Hu, Shiwen Lei, Zhipeng Lin, Bo Chen, University of Electronic Science and Technology of China, China

Optically Transparent Antennas

Session Co-Chairs: Christopher Valenta, Georgia Tech Research Institute; Hyok Jae Song, HRL Laboratories

WE-SP.1A.1 **08:00**

Characterization of Optically Transparent Copper Micro-Wire Transmission Lines

Christopher Liston, Carolyn Ellinger, Kevin O'Connor, Eastman Kodak Company, United States

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

Dual-Band WiFi Applique Antenna

Hyok J. Song, James H. Schaffner, HRL Laboratories, LLC, United States; Timothy Talty, Duane S. Carper, Eray Yasan, General Motors, LLC, United States

WE-SP.1A.3 **08:40**

2.5 GHz Meshed Inset-Fed Patch Antenna

Zachary Silva, Georgia Institute of Technology, United States; Charles Hunter, Christopher Valenta, Georgia Tech Research Institute, United States; Gregory Durgin, Georgia Institute of Technology, United States

WE-SP.1A.4 **09:00**

Transparent Microstrip Antennas for CubeSats

Xinyu Liu, David Jackson, Eric Ingram, Ji Chen, University of Houston, United States; Murilo Seko, University of Sao Paolo, Brazil

WE-SP.1A.5 **09:20**

Field Performance of A Novel Wideband Optically Transparent GNSS Antenna

Eray Yasan, Independent Researcher, United States; Hyok J. Song, HRL Laboratories, LLC, United States; Timothy Talty, General Motors, LLC, United States; James H. Schaffner, HRL Laboratories, LLC, United States; Duane S. Carper, General Motors, LLC, United States; Arthur Bekaryan, HRL Laboratories, LLC, United States

Broadband/Ultra Wideband Antennas and Systems I

Session Co-Chairs: Miguel Ferrando-Bataller, Universitat Politècnica de València; Félix Vega-Stavro, National University of Colombia

WE-A1.1A.1 **08:00**

Prediction of Impulse Response of a Flexible Wide-band Antenna for WBAN Applications

Sherif R. Zahran, Arab Academy for Science, Technology & Maritime Transport, Egypt; Mahmoud A. Abdalla, Military Technical College, Egypt; Luigi Boccia, University of Calabria, Italy

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

Dual Polarized THz Imaging FPA in 22nm CMOS

Sven van Berkel, Satoshi Malotaux, Bart van den Bogert, Marco Spirito, Daniele Cavallo, Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands

WE-A1.1A.3 **08:40**

Wideband Single-Pixel THz Imager in 28nm CMOS

Sven van Berkel, Satoshi Malotaux, Marco Spirito, Daniele Cavallo, Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands

WE-A1.1A.4 **09:00**

On the Bandwidth of Loop Antennas using Characteristic Mode Analysis

Daniel Antonio Santillán-Haro, Universitat Politècnica de València, Spain; Ferdaous Abderrazak, University of Tunis El Manar (UTM), Tunisia; Eva Antonino-Daviu, Miguel Ferrando-Bataller, Universitat Politècnica de València, Spain

WE-A1.1A.5 **09:20**

Extremely Wideband Imaging Antenna with Unifrom Radiation Patterns

Umair Naeem, Vincent Fusco, Queen's University Belfast, United Kingdom; Michael Keaveney, Mike O'Shea, James Breslin, Analog Devices Inc., Ireland

Break **09:40**

WE-A1.1A.6 **10:00**

Design Considerations in a Graded Index Flat Dielectric Lens for an Impulse Radiating Antenna

Fernando Albarracin-Vargas, Félix Vega-Stavro, National University of Colombia, Colombia; Christoph Baer, Kerstin Orend, Thomas Musch, Ruhr-University of Bochum, Germany

WE-A1.1A.7 **10:20**

A Broadband Mutimode Antenna Based on the Theory of Characteristic Mode

Wei Su, Shaker Alkaraki, Queen Mary University of London, United Kingdom; Qianyun Zhang, Beihang University, China; Yue Gao, Queen Mary University of London, United Kingdom

WE-A1.1A.8 **10:40**

GPR Bowtie Antennas with Reduced Induction Footprints for Dual-Modality Detectors

Wouter van Verre, Xianyang Gao, Frank Podd, David Daniels, Anthony Peyton, University of Manchester, United Kingdom

WE-A1.1A.9 **11:00**

A Modified Magnetoelectric Dipole Antenna

Lijia Chen, Shengmin Jiang, Dajing Wang, Shufeng Zhang, Shengchang Lan, Harbin Institute of Technology, China

IoT, 5G and mm-Wave Antennas and Components

Session Co-Chairs: Atif Shamim, King Abdullah University of Science and Technology (KAUST); Muhammad Ali, Georgia Institute of Technology

WE-A1.2A.1 **08:00**

Ultra-Wideband, Glass Package-Integrated Power Dividers for 5G and mm-Wave Applications

Muhammad Ali, Atom Watanabe, Tong-Hong Lin, Manos Tentzeris, Rao Tummala, Georgia Institute of Technology, United States; Pulugurtha Markondeya Raj, Florida International University, United States

WE-A1.2A.2 **08:20**

Analysis of Lossy SIW Patch Antenna for Near-Field Communications

Muhammad Khan, David Jackson, University of Houston, United States; Chatwin Lansdowne, NASA Johnson Space Center, United States

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

77 GHz Screen Printed, Flexible, Beam-Switching Antenna Array for Wearable Radar Applications

Azat Meredov, Kirill Klionovski, Atif Shamim, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

WE-A1.2A.4 **09:00**

High-Isolation, Low Cross-Polarization, Differential-Feed, Dual-Polarized Patch Antenna Array for a 2.45 GHz Retrodirective System Application

Jiangjie Zeng, Xianqi Lin, Yongmu Yang, University of Electronic Science and Technology of China, China

WE-A1.2A.5 **09:20**

Low-Cost and Highly Flexible Antenna for 2.4 GHz IoT applications

Denis Le Goff, Yuchan Song, Louis Barbier, Tan-Huat Chio, Koenraad Mouthaan, National University of Singapore, Singapore

Break **09:40**

WE-A1.2A.6 **10:00**

Effects of MWT Radiation on Sidelobe Levels in mm-Wave Microstrip Array Antenna

Eonsu Noh, Kangwook Kim, Gwangju Institute of Science and Technology, Korea (South)

WE-A1.2A.7 **10:20**

Triangular and Rectangular SIW Microstrip Antennas

Eduardo dos Santos Silveira, Daniel Chagas do Nascimento, Technological Institute of Aeronautics, Brazil

WE-A1.2A.8 **10:40**

28 GHz Side-Edge Loop Antenna with End-Fire Radiation Polarized Vertically to Substrate

Masayuki Nakajima, Masazumi Ishikawa, Gentei Sato, Antenna Giken Co., Ltd., Japan

WE-A1.2A.9 **11:00**

Rotman Lens-Based Fabry-Perot Resonator Antennas for Converged Multi-Mode OAM Beams

Xudong Bai, Fanwei Kong, Yunzhuo Song, Shengyang Xu, Weizhong Yan, Shanghai Scientific Instrument Factory, China; Anjie Cao, Shanghai Institute of Satellite Engineering, China; Chong He, Weiren Zhu, Xian-Ling Liang, Ronghong Jin, Shanghai Jiao Tong University, China

Multi-band Antennas I

Session Co-Chairs: Christos G. Christodoulou, University of New Mexico; Pedram Mousavi, University of Alberta

WE-A1.3A.1 **08:00**

Tuning Range Enhancement of a Frequency-Agile Tri-band Slot Antenna

Sajid M. Asif, Mohammad Anbiyaei, Adham Naji, Kenneth Ford, Timothy O'Farrell, Richard Langley, University of Sheffield, United Kingdom

WE-A1.3A.2 **08:20**

Compact, Multi-Band, Slot Antenna

Abdullah Haskou, Anthony Pesin, Jean-Yves Le Naour, Ali Louzir, Technicolor Research and Innovation, France

WE-A1.3A.3 **08:40**

A Dual-band Strain Sensor Based On Pop-up Half Wavelength Dipole Antenna

Shaghayegh Soltani, Paul S. Taylor, John C. Batchelor, University of Kent, United Kingdom

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

A Low-Profile Bull's-eye Antennas for Dual-Band Applications

Mohammad Mahdi Honari, University of Alberta, Canada; Kamal Sarabandi, University of Michigan, United States; Pedram Mousavi, University of Alberta, Canada

WE-A1.3A.5 **09:20**

Design of Modified Sierpinski Gasket Fractal Antenna for Tri-band Applications

Youcef Braham Chaouche, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Boualem Hammache, ET Laboratory, University of Mentouri Brothers Constantine 1, Algeria; Massinissa Belazzoug, ETA Laboratory, University of Bordj Bou Arreridj, Algeria

Break **09:40**

WE-A1.3A.6 **10:00**

A K/Ka Shared-Aperture DRA Array with High Isolation

Heba I. El-Sawaf, Wael M. Abdel-Wahab, Safieddin Safavi-Naeini, University of Waterloo, Canada

WE-A1.3A.7 **10:20**

A Dual Band Circular Polarized Antenna Array based on the Sequential Arrangement of Non-identical Disc Patches

Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy

WE-A1.3A.8 **10:40**

A Dual-Band Dual-Circularly Polarized Pyramidal Horn Antenna

Firas Ayoub, University of New Mexico, United States; Emil Ardelean, Air Force Research Laboratory, United States; Christos Christodoulou, University of New Mexico, United States; David Murrell, Steven Lane, Air Force Research Laboratory, United States

WE-A1.3A.9 **11:00**

Copper Ring as Superstrate Layer to Generate Dual Band Circularly Polarized Microstrip Patch Antenna for X-Band Applications

Halappa Gajera, University of Mysore, India

WE-A1.3A.10 **11:20**

Low-Profile Differentially-Fed Multi-Band Dual-Polarized Antennas

Xuanbo Wang, Yuehui Cui, RongLin Li, South China University of Technology, China

Frequency Reconfigurable and Tunable Antennas

Session Co-Chairs: Sima Noghanian, University of North Dakota; Mei Song Tong, Tongji University

WE-A1.4A.1 **08:00**

Origami-Enabled Frequency Reconfigurable Dipole Antenna

Md Rayhan Khan, Constantinos L. Zekios, Shubhendu Bhardwaj, Stavros V. Georgakopoulos, Florida International University, United States

WE-A1.4A.2 **08:20**

3D Printed Modular Origami Inspired Dielectrics for Frequency Tunable Antennas

Yingwei Wu, Andrea Vallecchi, Yunfang Yang, Zhong You, Christopher Stevens, Ekaterina Shamonina, Patrick Grant, University of Oxford, United Kingdom

WE-A1.4A.3 **08:40**

A Frequency-Tunable Dual-Band Single-Layer Shorted Multi-Ring Microstrip Antenna Fed by an L-probe with Varactor Diodes

Toru Ikeda, Sakuyoshi Saito, Yuichi Kimura, Saitama University, Japan

WE-A1.4A.4 **09:00**

Slot Based Frequency Reconfigurable and UWB Sensing MIMO Antennas for CR Applications

Rifaqat Hussain, King Fahd University of Petroleum and Minerals (KFUPM), Pakistan; Muhammad Umar, Amna Kamran, National University of Sciences and Technology (NUST), Pakistan; Mohammad Sharawi, Polytechnique Montréal, Canada

WE-A1.4A.5 **09:20**

Planar Frequency-Tunable Quad-Band Antenna with Independently Controllable Bands

Sajid M. Asif, Adham Naji, Mohammad Anbiyaei, Kenneth Ford, Timothy O'Farrell, Richard Langley, University of Sheffield, United Kingdom

Break **09:40**

WE-A1.4A.6 **10:00**

Patch Antenna Array With Continuous Frequency and Polarization Tuning For 5G Mid-Band Communications

Muhammad Ikram, Nghia Nguyen-Trong, Amin Abbosh, University of Queensland, Australia

WE-A1.4A.7 **10:20**

Design Guidelines for a Novel Tunable Aperture- Coupled Microstrip Patch Antenna

Prasad Shastry, Bradley University, United States; Krishna Katragadda, Google, United States

WE-A1.4A.8 **10:40**

Flexible Reconfigurable Antenna Robust to Folding in Wearable Applications

Luca Santamaria, Khai Nguyen, Fabien Ferrero, Robert Staraj, Leonardo Lizzi, Université Côte d'Azur, CNRS, LEAT, France

WE-A1.4A.9 **11:00**

A Bandwidth Reconfigurable Multiband Fractal Antenna For Wireless Applications

Youcef Braham Chaouche, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Idris Messaoudene, Higher school for computer science, Algeria

WE-A1.4A.10 **11:20**

A Frequency-Reconfigurable Magnetic Monopole Antenna Based on Quarter-Mode Substrate Integrated Waveguide

Huan Qian Xiong, Si Ce Wang, Yi Min Fan, Mei Song Tong, Tongji University, China

Vehicular Antennas and Electromagnetics

Session Co-Chairs: Nathan Jeong, The University of Alabma; Tayfun Ozdemir, Virtual EM Inc.

WE-A5.1A.1 **08:00**

A Glass-Integrated Ferrite FM Antenna for Vehicle Telematics

Md Fahim Chowdhury, Yang-Ki Hong, Hoyun Won, Woncheol Lee, Minyeong Choi, University of Alabama, United States

WE-A5.1A.2 **08:20**

Development of a Rear Glass Antenna System for a Hatchback Vehicle

Sang Heun Lee, Hyundai Motor Company, Korea (South); Frank Mierke, Continental Automotive, Germany

WE-A5.1A.3 **08:40**

Low-Profile, Vehicle Roof-Top Mounted Broadband Antenna for V2X

Martin (Wooseop) Lee, Nathan Seongheon Jeong, University of Alabama, United States

WE-A5.1A.4 **09:00**

Virtual Drive Testing based on Automotive Antenna Measurements for Evaluation of Vehicle-to-X Communication Performances

Francesco Saccardi, Alessandro Scannavini, Lucia Scialacqua, Lars Jacob Foged, Microwave Vision Italy SRL, Italy; Nicolas Gross, Arnaud Gandois, Stephane Dooghe, Per Olav Iversen, Microwave Vision Group Industries, France

WE-A5.1A.5 **09:20**

A V2X Communication System Test on Sea

Shravan Kumar Kalyankar, Hieu Nguyen Thanh, Yee Hui Lee, Yong Liang Guan, Nanyang Technological University, Singapore

Break **09:40**

WE-A5.1A.6 **10:00**

Covariance Matrix Evaluation of a Diversity Slot Antenna for Vehicular Communications

Abed Pour Sohrab, Petros Karadimas, Yingke Huang, University of Glasgow, United Kingdom

WE-A5.1A.7 **10:20**

Polarization-Diversity Conformal VHF Antenna with Near-Perfect Radiation Efficiency for Small UAVs

Tayfun Ozdemir, Chris Davis, Virtual EM Inc., United States

WE-A5.1A.8 **10:40**

A Compact Platform-Based Antenna for an Unmanned Ground Vehicle

Mohammad Ranjbar Nikkhah, Nader Behdad, University of Wisconsin-Madison, United States; Fikadu T. Dagefu, Army Research Laboratory, United States

WE-A5.1A.9 **11:00**

Automotive RADAR Front-End with Added Target Estimation in Elevation Plane

Umair Naeem, Dmitry Zelenchuk, Vincent Fusco, Queen's University Belfast, United Kingdom; Michael Keaveney, Mike O'Shea, James Breslin, Analog Devices Inc., Ireland

WE-A5.1A.10 **11:20**

Antenna Modeling on Complex Platforms Via Sparse Constrained Equivalent Distributions

Leo Tchorowski, Inder Gupta, Ohio State University, United States

Wide- and Dual-Band Frequency Selective Surfaces

Session Co-Chairs: Raj Mittra, University of Central Florida; Tayeb A. Denidni, National Institute of Scientific Research (INRS)

WE-A2.1A.1 **08:00**

Parametric Analysis of a Dual Band Polarized Frequency Selective Surface

Andrei – Marius Silaghi, Aldo De Sabata, University Politehnica Timisoara, Romania; Ladislau Matekovits, Politecnico di Torino, Italy

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

Design of Dual-Polarized Dual-Band Unit-Cell for Wideband FSS in Ku Band

Lamine N.A Bamogho, Jean-Jacques Laurin, École Polytechnique de Montréal, Canada

WE-A2.1A.3 **08:40**

Design of Frequency Selective Surfaces for Wide Frequency and Angular Responses

Nathawut Homsup, Raj Mittra, University of Central Florida, United States

WE-A2.1A.4 **09:00**

Cross Dipole FSS Bandwidth Enhancement

Yassine Zouaoui, Larbi Talbi, Khelifa Hettak, Université du Québec en Outaouais, Canada

WE-A2.1A.5 **09:20**

A High-Performance Double-Layer Frequency Selective Surface with Miniaturized Unit Cells

Zhiyu Xing, Feng Yang, Rui Wang, Jianhua Yang, Xiao Ma, University of Electronic Science and Technology of China, China

Break **09:40**

WE-A2.1A.6 **10:00**

A Dual-polarized FSS on a Single Substrate using Highly-coupled Interlayer Inductance

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

WE-A2.1A.7 **10:20**

Wideband Multilayer 45-Degree Polarizer (2 - 6GHz)

Wafa Abdouni-Abdallah, Muhammad Saeed Khan, Athanasios Konstantinidis, Emirates Technology and Innovation Center (ETIC), Khalifa University (KU), United Arab Emirates

WE-A2.1A.8 **10:40**

Design of a Dual-Band Band-stop Frequency Selective Surface

Wei Li, Ying Suo, Hongfei Ye, Harbin Institute of Technology, China

WE-A2.1A.9 **11:00**

An Ultra-thin Wideband 3-D Frequency Selective Rasorber based on Ferrite Absorber and Slow Wave Structure

Yihao Wang, Shishan Qi, Wen Wu, The Ministerial Key Laboratory of JGMT, China; Zhongxiang Shen, Nanjing University of Science and Technology, China

WE-A2.1A.10 **11:20**

Frequency-Selective Rasorber with Tri-resonant Absorption Band

Zhefei Wang, Jiahui Fu, Harbin Institute of Technology, China; Qingsheng Zeng, Nanjing University of Aeronautics and Astronautics, China; Huan Li, Université du Quebec, Canada; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

Antenna Feeds and Matching Circuits II

Session Co-Chairs: Carl Pfeiffer, Defense Engineering Corp.; Brett T. Walkenhorst, NSI-MI Technologies

WE-A1.5A.1 **08:00**

SIW-to-Mini-Coaxial Vertical Transition for Low Profile MM-Wave PCB-to-PCB Assembly

Wael M. Abdel-Wahab, University of Waterloo, Canada; Hussam Al-Saedi, University of Technology, Iraq; Ardeshir Palizban, Ahmad Ehsandar, Safieddin Safavi-Naeini, University of Waterloo, Canada

WE-A1.5A.2 **08:20**

H-Plane Metallic RWG-to-SIW Transition Using Aperture Coupling

Wael M. Abdel-Wahab, Safieddin Safavi-Naeini, University of Waterloo, Canada

WE-A1.5A.3 **08:40**

A Compact Broadband Phase-Inverter-Based Two-Section Forward Coupler for Sub-6-GHz Band

Robin Jeanty, Shih-Yuan Chen, National Taiwan University, Taiwan

WE-A1.5A.4 **09:00**

UWB Millimeter-Wave 180 degree Hybid Couplers

Carl Pfeiffer, Thomas Steffen, Defense Engineering Corp., United States; Boris Tomasic, Air Force Research Laboratory, United States

WE-A1.5A.5 **09:20**

2-Port Antenna with Matching Network for Dual-band IoT Terminal

Luca Santamaria, Tran Quang Khai Nguyen, Leonardo Lizzi, Fabien Ferrero, Robert Staraj, Université Côté d'Azur, CNRS, LEAT, France

Break **09:40**

WE-A1.5A.6 **10:00**

3:1 Bandwidth Dual Polarized Feeds for Compact Range and Near-Field Probes

German Cortes-Medellin, Brett T. Walkenhorst, NSI-MI Technologies, United States

WE-A1.5A.7 **10:20**

Finite Metal Wall Effects of W-Band Circular Polarized Horn Antenna with Inbuilt Polarizer

Ghanshyam Mishra, San diego state university, United States; Satish K Sharma, San Diego State University, United States; Jia-Chi Chieh, SPAWAR, United States

WE-A1.5A.8 **10:40**

Search-Based Design of Digital Non-Foster Antenna Match for High-Speed Low-Impedance Converters

Vinit Katariya, Thomas Weldon, University of North Carolina at Charlotte, United States

WE-A1.5A.9 **11:00**

X-Band Waveguide Coupler with Low Ripple and Losses

Alireza Pilevar, Shahid Beheshti University, Iran; Omid Manoochehri, University of Illinois at Chicago, United States; Mahdi Khorsandi, Tarbiat Modares University, Iran; Danilo Erricolo, University of Illinois at Chicago, United States

Array System Technologies

Session Co-Chairs: Jacob Houck, Georgia Tech Research Institute; Sunita Bhatia, Johns Hopkins Applied Physics Laboratory

WE-A1.6A.1 **08:00**

Bi-Static Simultaneous Transmit And Receive (STAR) Antenna Array System

Prathap Valale Prasannakumar, Aman Samaiyar, Mohamed Elmansouri, Ljubodrag Boskovic, Dejan Filipovic, University of Colorado at Boulder, United States; Sudhakar Rao, Northrop Grumman Aerospace Systems, United States

WE-A1.6A.2 **08:20**

Wideband Optically-steered phased array antenna using a Dual-Electrode Mach-Zehnder Modulator

Daniel Nuño, Maria Concepcion Santos, Jordi Romeu, Josep Prat, Luis Jofre Roca, Universitat Politecnica de Catalunya (UPC), Spain

WE-A1.6A.3 **08:40**

Near-Field Measurement Study for Over-the-Horizon Radar Transmit Beamformers

Simon Henault, Defence Research and Development Canada, Canada

WE-A1.6A.4 **09:00**

Using MIMO to Extend the Operating Band of Over-the-Horizon Radar Transmit Beamformers to Lower Frequencies

Simon Henault, Defence Research and Development Canada, Canada

WE-A1.6A.5 **09:20**

An Unified Equation for Active Reflection Coefficient in 4D Antenna Arrays including Mutual Coupling Effect

Feng Yang, Shiwen Yang, Kejin Chen, Fang Wang, Yikai Chen, University of Electronic Science and Technology of China (UESTC), China

Break **09:40**

WE-A1.6A.6 **10:00**

Broadband Array Antennas For Curved Geometries

Sharmistha Modak, Hung Tran, George R. Branner, University of California, Davis, United States; Preetham Kumar, California State University, Sacramento, United States

WE-A1.6A.7 **10:20**

Reducing the Number of Phase Shifters in Circular Arrays of Circular Subarrays for a Wide-Scanning Pattern

Elizvan Juarez, CICESE Research Center, Mexico; Marco A. Panduro, Center for Scientific Research and Higher Education of Ensenada, Mexico; Alberto Reyna, Universidad Autonoma de Tamaulipas, Mexico; David Covarrubias, Roberto Conte, CICESE Research Center, Mexico; Eduardo Murillo, Universidad Nacional Autónoma de México, Mexico

WE-A1.6A.8 **10:40**

Wideband Two-Beam Antenna array Fed by Modified Butler Matrix

Ji-Peng Chen, Fu-Chang Chen, South China University of Technology, China

WE-A1.6A.9 **11:00**

Generation of dual-beam orbital angular momentum vortex beam using transmit arrays

Rui Xi, Xidian University, China; S. Ang, Kaoru Porter, University of Arkansas, United States; Long Li, Xidian University, China

WE-A1.6A.10 **11:20**

Two-Way Phase Shifter with Equal Phase Shift

Zahra Rahimian Omam, Suren Gigoyan, University of Waterloo, Canada; Ali Pourziad, Saeid Nikmehr, University of Tabriz, Iran; Safieddin Safavi-Naeini, University of Waterloo, Canada

Biomedical Applications of Antennas

Session Co-Chairs: Dirk Manteuffel, Leibniz University Hannover; Arash Ebadi-Shahrivar, University of Notre Dame

WE-A5.2A.1 **08:00**

Investigation on Resolution of Thermoacoustic Imaging Based on Compressive Sensing: A Simulation Study

Baosheng Wang, Yifei Sun, Chenzhe Li, Xiong Wang, ShanghaiTech University, China

WE-A5.2A.2 **08:20**

Mutual Coupling Reduction in Wideband Electromagnetic Medical Imaging Antenna Array Using Compact Electromagnetic Band Gap

Abdulrahman S. M. Alqadami, Nghia Nguyen-Trong, Konstanty Bialkowski, Amin Abbosh, University of Queensland, Australia

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

Slot Antenna Design with Optimized On-Body Pattern for Eyewear Applications

Lukas Berkelmann, Dirk Manteuffel, Leibniz University Hannover, Germany

WE-A5.2A.4 **09:00**

A Modified Vivaldi Antenna with Low Self-reflectivity for Bone Health Detection

Gang Lu, Shengchang Lan, Kang Zhang, Kai Yao, Lijia Chen, Weichu Chen, Harbin Institute of Technology, China

WE-A5.2A.5 **09:20**

A Slot Antenna for Non-invasive Detection of Blood Constituents Concentrations

Jessica Hanna, Joseph Costantine, Rouwaida Kanj, Assaad Eid, Youssef Tawk, American University of Beirut, Lebanon; Ali Ramadan, Fahad Bin Sultan University, Saudi Arabia

Break **09:40**

WE-A5.2A.6 **10:00**

Evaluation of Bannisters Subsurface-to-Air Model for Implanted Antennas

Saba Meshksar, Lukas Berkelmann, Dirk Manteuffel, Leibniz University Hannover, Germany

WE-A5.2A.7 **10:20**

Codebook Requirements for Estimating Multi-Antenna SAR in Linear Time

Arash Ebadi-Shahrivar, Patrick Fay, Bertrand Hochwald, University of Notre Dame, United States; David Love, Purdue University, United States

WE-A5.2A.8 **10:40**

Near-field Electrically Small Sensors Array with PCA for Microwave Breast Tumor Detection

Maged Aldhaeebi, Saeed Bamatraf, Thamer Almoneef, Omar Ramahi, University of Waterloo, Canada

WE-A5.2A.9 **11:00**

A Fast Method to Estimate Peak Local SAR under MRI With RF Shimming

Shuo Song, Jianfeng Zheng, Ji Chen, University of Houston, United States

Methods of Inverse Scattering

Session Co-Chairs: Maokun Li, Tsinghua University; Xudong Chen, National University of Singapore

WE-A4.1A.1 **08:00**

Full Sparsity in Compressive Processing for Non-Linear Inverse Scattering

Nicola Anselmi, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

WE-A4.1A.2 **08:20**

A convenient rewriting to the 2D inverse scattering problem based on the reduced scattered field

Martina Teresa Bevacqua, Tommaso Isenia, Università Mediterranea di Reggio Calabria, Italy

WE-A4.1A.3 **08:40**

Microwave Imaging of Strong Scatterers through a Multi-Resolution Contraction Integral Equation Method

*Marco Salucci, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy; Kuiwen Xu, Key Lab of RF Circuits and Systems of Ministry of Education, Hangzhou Dianzi University, Hangzhou, China, China; Yu Zhong, Institute of High Performance Computing, A*STAR, Singapore, Singapore*

WE-A4.1A.4 **09:00**

Study on Different Representations of Contrast for Inverse Scattering Problems

Tiantian Yin, Zhun Wei, Xudong Chen, National University of Singapore, Singapore

WE-A4.1A.5 **09:20**

Multi-Scale Compressive Processing for Inverse Scattering within the Contrast Source Formulation

Marco Salucci, Lorenzo Poli, Nicola Anselmi, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

Break **09:40**

WE-A4.1A.6 **10:00**

Exploiting Sparsity in Adaptive Relevance Vector Machine for Reconfigurable Soft-Field Tomography

Daniel Ospina Acero, Fernando Teixeira, Ohio State University, United States; Qussai M. Marashdeh, Tech4Imaging LLC, United States

WE-A4.1A.7 **10:20**

Statistical Bayesian Inversion of Ultra-deep Electromagnetic LWD Data: Trans-dimensional Markov Chain Monte Carlo with Parallel Tempering

Qiuyang Shen, Jiefu Chen, University of Houston, United States; Hanming Wang, Chevron Corporation, United States; Yueqin Huang, Cyentech Consulting LLC, United States

WE-A4.1A.8 **10:40**

Three-dimensional Joint Inversion of Acoustic and Electromagnetic Data Based on Contrast Source Inversion

Xiaoqian Song, Maokun Li, Fan Yang, Shenheng Xu, Tsinghua University, China; Aria Abubakar, Schlumberger, United States

WE-A4.1A.9 **11:00**

A Multi-Resolution Evolutionary Programming Technique For GPR Applications

Maryam Hajebi, Hormozgan University, Iran; Ahmad Hoorfar, Villanova University, United States

WE-A4.1A.10 **11:20**

3D Electromagnetic Inverse Scattering by Magneto-Dielectric Objects with Arbitrary Anisotropy in Layered Uniaxial Media

Feng Han, Jiawen Li, Jianliang Zhuo, Xiamen University, China; Hai Liu, Guangzhou University, China

Optimization methods in EM designs

Session Co-Chairs: Douglas H. Werner, Pennsylvania State University; Daniel Weile, University of Delaware

WE-A3.1A.1 **08:00**

Accelerated Antenna Optimization Using Gradient Search with Selective Broyden Updates

Slawomir Koziel, Reykjavik University, Iceland; Anna Pietrenko-Dabrowska, Gdansk University of Technology, Poland

WE-A3.1A.2 **08:20**

Design Reusing for Expedited Design Optimization of Antenna Structures

Slawomir Koziel, Reykjavik University, Iceland; Adrian Bekasiewicz, Gdansk University of Technology, Poland

WE-A3.1A.3 **08:40**

Voronoi Tessellation Optimization

Ronald Jenkins, Douglas H. Werner, Pennsylvania State University, United States

WE-A3.1A.4 **09:00**

A Comparison Between Grey Wolf and Invasive Weed Optimizations Applied to Microstrip Filters

Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy

WE-A3.1A.5 **09:20**

Nature-Inspired Optimization of Aperiodic Metasurfaces for Antenna Beam-shaping

Ahmad Hoorfar, Christopher Israel, Villanova University, United States

Break **09:40**

WE-A3.1A.6 **10:00**

SNO and mBBO Optimization Methods for beam scanning Reflectarray Antennas

Michele Beccaria, Andrea Massaccesi, Paola Pirinoli, Politecnico di Torino, Italy; Alessandro Niccolai, Riccardo Zich, Politecnico di Milano, Italy

WE-A3.1A.7 **10:20**

Inversion-Free Evaluation of Small Geometry Perturbation in Method of Moments

Miloslav Capek, Lukas Jelinek, Czech Technical University in Prague, Czech Republic; Mats Gustafsson, Lund University, Sweden

WE-A3.1A.8 **10:40**

Gain Optimization of a Yagi-Uda Antenna using the Genetic Algorithm

Abdelbaki Zeghdoud, Mohammed Cherif Derbal, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A3.1A.9 **11:00**

Machine-Learning-Assisted Two-Step Antenna Modelling Method

Qi Wu, Jiexi Yin, Chen Yu, Haiming Wang, Wei Hong, Southeast University, China

WE-A3.1A.10 **11:20**

Complex Permittivity Estimation for Construction Materials based on PSO Method

Jiangui Luo, Yu Shao, Chongqing University of Posts and Telecommunications, China; Rui Zhang, China Research Institute of Radiowave Propagation, China; Xi Liao, Jie Zhang, Chongqing University of Posts and Telecommunications, China

B Wednesday, July 10 08:00 - 09:40
WE-UB.1A Room 211

MIMO Antennas and Systems

Session Co-Chairs: Mehrbod Mohajer, Qualcomm Inc.; Mats Gustafsson, Lund University

WE-UB.1A.1 **08:00**

Multi-beam Antennas Based on Modified Luneburg Lens

Muhammadeziz Tursunniyaz, Hung Luyen, John Booske, Nader Behdad, University of Wisconsin, United States

WE-UB.1A.2 **08:20**

Antenna Performance Evaluations in 8×8 MIMO Access Points

Mehrbod Mohajer, Adil Hussain, Eyal Hochdorf, Andy Friefeld, Steve Beaudin, Qualcomm Inc., United States

WE-UB.1A.3 **08:40**

Millimeter-wave Rotman lens-based radar system on the move for disaster rescue applications

Toan Vo Dai, Ozlem Kilic, Catholic University of America, United States

WE-UB.1A.4 **09:00**

Radiation modes and fundamental limitations on MIMO antennas

Mats Gustafsson, Casimir Ehrenborg, Lund University, Sweden

WE-UB.1A.5 **09:20**

Asymmetric Beamwidth Beamforming Antenna Using Rotman Lens

In-Ryeol Kim, Dong-Woo Kim, Jae-Beom Jin, Soon-Soo Oh, Chosun University, Korea (South)

B Wednesday, July 10 10:00 - 11:40
WE-UB.2A Room 211

EBG, UWB and RFID based Antennas

Session Chair: Abas Sabouni, Wilkes University

WE-UB.2A.1 **10:00**

Tunable True Time Delay Engine for UWB mm-Wave Beamforming

Raed Almhmadi, Kubilay Sertel, Ohio State University, United States

WE-UB.2A.2 **10:20**

RFID Tag Localization for Tires using Support Vector Machine Learning

Robert Burkholder, Ohio State University, United States

WE-UB.2A.3 **10:40**

Improving the Efficiency of Flexible Antenna for Biomedical Applications using EBG structure

Abas Sabouni, Wilkes University, United States

WE-UB.2A.4 **11:00**

Dislocation of Lattice Points for Impedance Matching of a Photonic Bandgap Cavity Resonator

Ning Zhou, Illinois Institute of Technology, United States; Terry Smith, Geoff Waldschmidt, Alireza Nassiri, Argonne National Laboratory, United States; Thomas Wong, Illinois Institute of Technology, United States

WE-UB.2A.5 **11:20**

CPW Fed Slotted Patch Antenna for UWB Applications

Girish Awadhwal, UIT, India; Sembiam Rengarajan, California State University, United States

B Wednesday, July 10 08:00 - 09:20
WE-UB.3A Room 212

Microstrip Antennas and Printed Devices

Session Co-Chairs: Sungkyun Lim, Georgia Southern University; Tutku Karacolak, Washington State University Vancouver

WE-UB.3A.1 **08:00**

Ultra Wideband Balanced Feeds for Scanning Arrays

Ireen S. Sefa, Alexander D. Johnson, Satheesh Bojja Venkatakrishnan, John L. Volakis, Florida International University, United States

WE-UB.3A.2 **08:20**

A Double Sided Bow-tie Antenna Array for Broadband Communications and Performance Study of Controlling Ground Plane

Md. Rabiul Hasan, Carlene Goodbody, Tuan Nguyen, Tutku Karacolak, Washington State University Vancouver, United States

WE-UB.3A.3 **08:40**

Design of a Directive UHF RFID Tag Antenna for a Pavement Embedded System

Lauryn Smith, Deon Lucien, Sungkyun Lim, Georgia Southern University, United States

WE-UB.3A.4 **09:00**

A Low-cost CPW-fed Conformal Antenna for Wearable Applications

Ali Arif, Muhammad Zubair, Muhammad Qasim Mehmood, Kashif Riaz, Information Technology University, Pakistan

Wednesday, July 10 10:00 - 11:40
WE-A2.2A Room 212

Theoretical Electromagnetics II

Session Chair: Christophe Caloz, Polytechnique Montréal

WE-A2.2A.1 **10:00**

Theoretical Modal Analysis of Square Waveguides filled with Effectively Skew Uniaxial Media

Walid Dyab, Prince Sultan University, Saudi Arabia; Ahmed Sakr, Stanford University, United States; Ke Wu, Polytechnique Montréal, Canada

WE-A2.2A.2 **10:20**

Compact Dual-Mode Ridge Waveguide Dual-Band Filter

Ya Xie, Fu-Chang Chen, South China University of Technology, China

WE-A2.2A.3 **10:40**

Analysis of a 200-GHz OAM Radio Link Using a Generalized Friis Transmission Equation

Woo Jin Byun, Electronics and Telecommunications Research Institute, Korea (South); Yong Heui Cho, Mokwon University, Korea (South)

WE-A2.2A.4 **11:00**

Acceleration of Laser-Driven Light Sails with Size Comparable to the Beam

Oscar Céspedes Vicente, Christophe Caloz, Polytechnique Montréal, Canada

WE-A2.2A.5 **11:20**

Geometric Improvements on Solar Cells for Reducing Reflections

Bariscan Karaosmanoglu, Behre Nur Bice, Ozgur Ergul, Middle East Technical University, Turkey

Time-Domain Computational Methods for Complex Electromagnetic and Multiphysics Problems

Session Co-Chairs: Ali Yilmaz, University of Texas at Austin; Yang Liu, Lawrence Berkeley Laboratory

WE-SP.1P.1 **13:20**

A DGTD-Based Multiscale Simulator for Electromagnetic Multiphysics Problems

Su Yan, Howard University, United States; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

WE-SP.1P.2 **13:40**

3D Multiscale Unconditionally Stable Time-Domain Modeling of Nonlinear RF Thin Film Magnetic Devices

Zhi Yao, Han Cui, Rüstü Umut Tok, Yuanxun Ethan Wang, University of California, Los Angeles, United States

WE-SP.1P.3 **14:00**

Implicit time integration schemes in electromagnetic-micromagnetic and quantum problems

Xueyang Wang, Marco Menarini, University of California, San Diego, United States; Amir Natan, Amir Boag, Tel Aviv University, Israel; Vitaliy Lomakin, University of California, San Diego, United States

WE-SP.1P.4 **14:20**

Fast evaluation of retarded electromagnetic potentials for quantum calculations

Dor Gabay, Amir Natan, Amir Boag, Tel Aviv University, Israel; Ali E. Yilmaz, University of Texas at Austin, United States

WE-SP.1P.5 **14:40**

Accelerated Cartesian Harmonics based framework for acceleration of retarded potentials

Daniel Dault, Naveen Nair, Balasubramaniam Shanker, Michigan State University, United States

Break **15:00**

WE-SP.1P.6 **15:20**

Role of Classical Time Domain CEM Methods for Quantum Electromagnetics

Thomas Roth, Sandia National Laboratories, United States; Weng Cho Chew, Purdue University, United States

WE-SP.1P.7 **15:40**

Numerical Cherenkov Instabilities in Kinetic Plasma Particle-in-Cell Simulations based on Structured and Unstructured Meshes

Dong-Yeop Na, Julio de Lima Nicolini, Fernando Lisboa Teixeira, Ohio State University, United States

WE-SP.1P.8 **16:00**

Zagorodnov Conformal Particle In Cell Simulations

Travis Garrett, Air Force Research Laboratory, United States

WE-SP.1P.9 **16:20**

Generalized Tensor FDTD Method for Sloped Plasmonic Interfaces

Qiming Zhao, Costas Sarris, University of Toronto, Canada

WE-SP.1P.10 **16:40**

A Unit-Cell Discontinuous Galerkin Scheme for Analyzing Plasmonic Photomixers

Liang Chen, Hakan Bagci, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

Design and Integration Aspects of Beyond 5G Communications for Mobile Devices

Session Co-Chairs: Wonbin Hong, Pohang University of Science and Technology; Rod Waterhouse, Pharad

WE-SP.2P.1 **13:20**

Overview of 5G mm-Wave Antenna Design Solutions in Cellular Phones: AiP, AiA, and AiAiP

Huan-Chu Huang, vivo Mobile Communication Co., Ltd, China

WE-SP.2P.2 **13:40**

Design and Analysis of Mobile Phone Antenna System with Integration of LTE 4G, Sub-6G and Millimeter Wave 5G Technologies

Guangli Yang, Shanghai University, China

WE-SP.2P.3 **14:00**

Millimeter-Wave Antenna Arrays with Beam Steering for 5G Mobile Terminals

Shuai Zhang, Gert Pedersen, Aalborg University, Denmark

WE-SP.2P.4 **14:20**

Integration and Evaluation of Antenna Systems for 5G mmWave Mobile Device

Kun Zhao, Olof Zander, Thomas Bolin, Zhinong Ying, Sony Mobile Communications, Sweden; Shuai Zhang, Gert Frølund Pedersen, Aalborg University, Denmark

WE-SP.2P.5 **14:40**

Correlation Coefficient Reduction in MIMO Antennas Using PRS at Sub-Wavelength Heights

Muhammad Umair Illahi, Muhammad Umar Khan, Tayyab Hassan, National University of Sciences and Technology (NUST), Pakistan; Rifaqat Hussain, King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia; Mohammad Sharawi, Polytechnique Montréal, Canada

Break **15:00**

WE-SP.2P.6 **15:20**

Advanced 12×12 MIMO Antennas for Next Generation 5G Smartphones

Chisang You, LG Electronics Inc., Korea (South); Kin-Lu Wong, National Sun Yat-Sen University, Taiwan

WE-SP.2P.7 **15:40**

Gain Enhancement of mm-wave On-chip Antenna through Functional Packaging

Haoran Zhang, Atif Shamim, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

WE-SP.2P.8 **16:00**

Antenna Design Considerations for 5G Millimeter-Wave Cellular Communications

Sumin Yun, Hosaeng Kim, Joonho Byun, Samsung Electronics, Korea (South)

WE-SP.2P.9 **16:20**

Performance Comparison of Silicon Substrates for IC-Waveguide Integration based on a Contactless Transition at mm-Wave frequencies

Alhassan Aljarosha, Piyush Kaul, A. Bart Smolders, Marion Matters-Kammerer, Rob Maaskant, Eindhoven University of Technology, Netherlands

WE-SP.2P.10 **16:40**

A Dual-Band Millimeter-Wave Antenna for 5G Mobile Applications

Chong-Zhi Han, Guan-Long Huang, Tao Yuan, Shenzhen University, China; Chow-Yen-Desmond Sim, Feng Chia University, Taiwan

Broadband/Ultra Wideband Antennas and Systems II

Session Co-Chairs: Kathryn Smith, University of North Carolina at Charlotte; Mei Song Tong, Tongji University

WE-A1.1P.1 **13:20**

Printed Cactus Monopole Antenna with Enhanced Impedance Bandwidth

Eric Eveleigh, Alexander Beaverstone, Natalia Nikolova, McMaster University, Canada

WE-A1.1P.2 **13:40**

High gain circularly polarized stacked circular patches loaded with a circular sector notches and vertical ground ring for UHF RFID universal reader

Hany Hammad, German University in Cairo, Egypt

WE-A1.1P.3 **14:00**

Graphene-based Textile Ultra Wideband Antennas for Integrated and Wearable Applications

Isidoro Ibanez Labiano, Syeda Fizzah Jilani, Queen Mary University of London, United Kingdom; Muhammed Said Ergoktas, Coskun Kocabas, University of Manchester, United Kingdom; Elif Ozden-Yenigun, Royal College of Art, United Kingdom; Akram Alomainy, Queen Mary University of London, United Kingdom

WE-A1.1P.4 **14:20**

Design of Compact UWB Coplanar Waveguide-Fed Modified Sierpinski Carpet Fractal Antenna

Abdennour Ben Terki, Mourad Nedil, Youcef Braham Chaouche, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A1.1P.5 **14:40**

A Wideband Endfire Antenna Using SWG-HIS Hybrid Structure

You-Feng Cheng, Cheng Liao, Institute of Electromagnetics, Southwest Jiaotong University, China; Fu-Long Jin, Yu-Ming Wu, Xiao Ding, Institute of Applied Physics, University of Electronic Science and Technology of China, China

Break **15:00**

WE-A1.1P.6 **15:20**

A Novel UWB Antenna For Wireless Communication Systems Using Genetic Algorithms

Mohammed Cherif Derbal, Abdelbaki Zeghdoud, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A1.1P.7 **15:40**

Design of Large-Band Highly Directive Antenna in the Millimeter Waves Range at 80 GHz

Habiba Hafdallah Ouslimani, Fanhong Meng, Paris Lumière University Paris Nanterre, France

WE-A1.1P.8 **16:00**

Design and Simulation of a Polygonal Discone Antenna for Simplified Fabrication and Reconfigurability

Mohamad Fazeli, Kathryn Smith, University of North Carolina at Charlotte, United States

WE-A1.1P.9 **16:20**

Elliptical Disk Cavity Backed Antenna for UWB Systems

Carlos Ramiro Peñafiel-Ojeda, Anibal Llanga-Vargas, Marta Cabedo-Fabrés, Miguel Ferrando-Bataller, Universitat Politècnica de València, Spain

WE-A1.1P.10 **16:40**

Wideband Omnidirectional Circularly Polarized Antenna for Millimeter-Wave Applications Using Printed Artificial Anisotropic Polarizer

Chen Ding, Kwai-Man Luk, State Key Laboratory of Terahertz and Millimeter Waves, China

Microstrip Antennas, Circuits and Design I

Session Co-Chairs: Sima Noghanian, University of North Dakota; Christos G. Christodoulou, University of New Mexico

WE-A1.2P.1 **13:20**

Data Acquisition Circuit for Identification of RF Signals' Direction of Arrival

Tarcisio Augusto de Bonfim Gripp, Bernardo Moscardini Fabiani, Eduardo dos Santos Silveira, Daniel Chagas do Nascimento, Technological Institute of Aeronautics, Brazil

WE-A1.2P.2 **13:40**

An Air Gap Loaded Low Profile Microstrip Antenna with Hanging Post Integrated Patch Surface: A New Approach to Reduce Cross Polarization Radiation

Subhradeep Chakraborty, Central Electronics Engineering Research Institute, India; Tanmoy Sarkar, Burdwan University, India; Atmakuru Nagaraju, Central Electronics Engineering Research Institute, India; Sudipta Chattopadhyay, Llk Singh, Mizoram University, India

WE-A1.2P.3 **14:00**

A Compact, Zero-Power and Low-Noise Harmonic-Transponder for Liquid and Moisture Sensing

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

WE-A1.2P.4 **14:20**

Two Element Series Fed Origami Antenna

David Rohde, Sima Noghanian, University of North Dakota, United States; Yi-hsiang Chang, Illinois State University, United States; Satish K Sharma, San Diego State University, United States

WE-A1.2P.5 **14:40**

Time-Varying Phase Control for Frequency Translation

Debjit Sarkar, Cody Scarborough, Zhanni Wu, Anthony Grbic, University of Michigan, United States

Break **15:00**

WE-A1.2P.6 **15:20**

Off-Body Dipole Antenna with Dogbone-Shaped AMC Bending on the Human Arm

Abdelbaki Zeghdoud, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A1.2P.7 **15:40**

Peel-off and Stick Antennas for Small Unmanned Aerial Vehicles

Jayakrishnan Vijayamohanan, Firas Ayoub, Marios Patriotis, Christos Christodoulou, University of New Mexico, United States; James Lyke, Air Force Research Laboratory, United States

WE-A1.2P.8 **16:00**

Closely-Spaced Resonant Cavity Antennas For Meeting ETSI Class-2 Specifications

Arslan Kiyani, Raheel Hashmi, Karu Esselle, Macquarie University, Australia

Multi-band Antennas II

Session Co-Chairs: Zhongxiang Shen, Nanyang Technological University; Gregory Mitchell, Army Research Laboratory

WE-A1.3P.1 **13:20**

Study of a Method for Increasing Isolation Between Closely Spaced Elements integrated in Multi-Standard Multi-Antenna Systems

Lamia Sadaoui, Luca Santamaria, Leonardo Lizzi, Robert Staraj, University Cote d'Azur, CNRS, France

WE-A1.3P.2 **13:40**

Compact, Dual-Band, Hybrid Monopole-ASA, Antenna

Abdullah Haskou, Anthony Pesin, Jean-Yves Le Naour, Ali Louzir, Technicolor Research and Innovation, France

WE-A1.3P.3 **14:00**

Millimeter-Wave SIW Cavity-Backed Dual-Band Self-Complementary Log-Periodic Antenna

Abdessalem Talbi, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A1.3P.4 **14:20**

Measured versus Simulated Results of a Dual Band, Hybrid Substrate, and Shared Aperture Antenna

Gregory Mitchell, Theodore Anthony, Army Research Laboratory, United States

WE-A1.3P.5 **14:40**

A Novel Design of Multiband Antenna Based on Non-dominated Sorting Genetic Algorithm

Si Ce Wang, Yun Jie Mao, Min Jun Li, Han Kai Yang, Mei Song Tong, Tongji University, China

Break **15:00**

WE-A1.3P.6 **15:20**

Multiport Enhance Gain Shared Aperture Antenna for S/X-Band Synthetic Aperture RadarApplications

Venkata Kishore Kothapudi, Vijay Kumar, Vellore Institute of Technology, India

WE-A1.3P.7 **15:40**

A Dual-Band Bifilar Helical Antenna With Parasitic Parallelogram Loops

Weihua Tan, Zhongxiang Shen, Nanyang Technological University, Singapore

WE-A1.3P.8 **16:00**

Band-Notched Filtering Crossed Dipole Antenna Without Extra Circuit

Yaohui Zhang, Yonghong Zhang, Yong Fan, University of Electronic Science and Technology of China, China; Daotong Li, Chongqing University, China

WE-A1.3P.9 **16:20**

A CSRR and SRR Based Ultrawideband MIMO Antenna with Band-Notched Characteristics

Hongmei Li, Zhe Jiang, Harbin Institute of Technology, China

Reconfigurable Arrays

Session Co-Chairs: Constantinos Zekios, Florida International University; Randy Haupt, Colorado School of Mines

WE-A1.4P.1 **13:20**

Two-Element Compact Antenna Arrays using Decoupling Networks and Phase Shifters for Four-Branch Switching Diversity

Kengo Nishimoto, Yasuhiro Nishioka, Naofumi Yoneda, Mitsubishi Electric Corporation, Japan

WE-A1.4P.2 **13:40**

A Thick Origami Four-Patch Array

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

WE-A1.4P.3 **14:00**

A Tightly Coupled Array Loaded On a Miura-Ori Pattern

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

WE-A1.4P.4 **14:20**

Study of Active VSWR in a Reduced BFN Antenna Array

Hala Alzein, Jorick Milbrandt, Abdul-Sattar Kaddour, Cyrille Menudier, Marc Thevenot, Thierry Monediere, Univ. Limoges, CNRS, XLim, France

WE-A1.4P.5 **14:40**

Wide Beam Coverage Dipole Antenna Array with Parasitic Elements for UAV Communication

Dong-Geun Seo, Chang-Hyun Jeong, Yu-Seong Choi, Jeong-Soo Park, Ye-Yeong Jeong, Wang-Sang Lee, GyeongSang National University, Korea (South)

Break **15:00**

WE-A1.4P.6 **15:20**

Waveguide-Fed Lens Based Beam-Steering Antenna For 5G Wireless Communications

Saeideh Shad, Shafaq Kausar, Hani Mehrpouyan, Boise State University, United States

WE-A1.4P.7 **15:40**

A Tri-Band Dual-Polarized Slot-Ring Antenna for Array Design

Junyi Huang, Xun Gong, University of Central Florida, United States

WE-A1.4P.8 **16:00**

A Reconfigurable Wideband Feeding Network for Polarization Diverse Antenna Arrays

Youssef Tawk, Joseph Costantine, American University of Beirut, Lebanon

WE-A1.4P.9 **16:20**

Reconfigurable Antenna For Automotive Radar System

Ji Dong, Lei Zhang, Institute of Microelectronics, Tsinghua University, China

Electromagnetic Energy Harvesting

Session Co-Chairs: Aline Eid, Georgia Institute of Technology; Rushi Vyas, University of Calgary

WE-A5.1P.1 **13:20**

A Dual-band Electromagnetic Energy Harvesting Surface

Faruk Erkmen, Omar Ramahi, University of Waterloo, Canada

WE-A5.1P.2 **13:40**

Analysis of Multi-Stage Voltage Doubler for RF Energy Harvesting

Alex Mouapi, Nadir Hakem, Nahi Kandil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A5.1P.3 **14:00**

High Efficiency RF Energy Harvester for IoT Embedded Sensor Nodes

Stylianos Assimonis, Queen's University Belfast, United Kingdom; Spyridon Daskalakis, Georgia Institute of Technology, United States; Vincent Fusco, Queen's University Belfast, United Kingdom; Manos Tentzeris, Georgia Institute of Technology, United States; Apostolos Georgiadis, Heriot-Watt University, United Kingdom

WE-A5.1P.4 **14:20**

Flexible W-Band Rectifiers for 5G-powered IoT Autonomous Modules

Aline Eid, Jimmy Hester, Bijan Tehrani, Manos Tentzeris, Georgia Institute of Technology, United States

WE-A5.1P.5 **14:40**

Wideband Metasurface for Microwave Energy Harvesting

Thamer Almoneef, Saud Saeed, Prince Sattam Bin Abdulaziz University, Saudi Arabia; Maged Aldhaeebi, University of Waterloo, Canada; Mohammed Bait-Suwailam, Sultan Qaboos University, Oman

Break **15:00**

WE-A5.1P.6 **15:20**

Dual Polarizations Single-feed Cross-Dipole Energy Harvesting Surface

Ahmed Ashoor, Omar Ramahi, University of Waterloo, Canada

WE-A5.1P.7 **15:40**

A Performance Analysis of Schottky Diode to support RF Energy Harvesting

Alex Mouapi, Nadir Hakem, Nahi Kandil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

WE-A5.1P.8 **16:00**

Optical Plasmonic Nano-Antennas Array for Energy Harvesting Applications

Patrizia Livreri, University of Palermo, Italy

WE-A5.1P.9 **16:20**

A Dual-band Rectenna with Improved RF-DC Sensitivity for Wireless Energy Harvesting

Sichong Li, Fadhel Ghannouchi, Rushi Vyas, University of Calgary, Canada

WE-A5.1P.10 **16:40**

4x4 Circularly Polarized Antenna Array for Ambient RF Energy Harvesting

Osama Dardeer, Ain Shams University, Egypt; Hala Elsadek, Esmat Abdallah, Electronics Research Institute, Egypt; Hadia Elhennawy, Ain Shams University, Egypt

Electromagnetic Band Gap Structures

Session Co-Chairs: Sharif Sheikh, King Fahd University of Petroleum and Minerals; Mohammod Ali, University of South Carolina; Dmitry Oshmarin, UCI

WE-A2.1P.1 **13:20**

A Simple Technique for EBG Design for Monopole Antenna Isolation Improvement

Ahmed Arman, Mohammod Ali, University of South Carolina, United States; Terry Vogler, Boeing, United States

WE-A2.1P.2 **13:40**

Modified EBG Design Circuit Model for Isolation Improvement Between Monopole Antennas

Ahmed Arman, Mohammod Ali, University of South Carolina, United States; Terry Vogler, Boeing, United States

WE-A2.1P.3 **14:00**

Pulse Generation using a Degenerate Band Edge Structure

Dmitry Oshmarin, Hamidreza Kazemi, Ahmed Abdelshafy, Filippo Capolino, University of California, Irvine, United States

WE-A2.1P.4 **14:20**

Tiling of Supershaped Electromagnetic Band Gap Structures

Shady Keyrouz, Bedilu Adela, Diego Caratelli, The Antenna Company, Netherlands

WE-A2.1P.5 **14:40**

Microstrip Antenna Array with Reduced Mutual Coupling Using Slotted-Ring EBG Structure for 5G Applications

Oludayo Sokunbi,, Hussein Attia, Sharif Sheikh, King Fahd University of Petroleum and Minerals (KFUPM), Saudi Arabia

Break **15:00**

WE-A2.1P.6 **15:20**

Dispersion Engineered Space-Time Modulated Transmission Line

Donald DiMarzio, Northrop Grumman, United States; Stéphane Larouche, NG Next, Northrop Grumman Corporation, United States; Philip Hon, Vesna Radisic, Northrop Grumman, United States

WE-A2.1P.7 **15:40**

External magnetic field induced conical singularities in the isofrequency surface of a ferrite-semiconductor metamaterial

Illia Fedorin, National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Ukraine

WE-A2.1P.8 **16:00**

A Compact EBG for High Isolation Between Two Very Closeby Wire-Antennas for RFID Tags

Jinyoung Kwon, Heejun Park, Changhyeong Lee, Gwanggyun Namgung, Yejune Seo, Sungtek Kahng, Incheon National University, Korea (South); Jaewook Kim, National IoT Industry Promotion Agency, Korea (South)

WE-A2.1P.9 **16:20**

Three-Dimensional Bandstop Frequency-Selective Structures Based on Gielis-Shaped Loop Resonator

Vignesh Shanmugam Bhaskar, Eng Leong Tan, King Ho Holden Li, Nanyang Technological University, Singapore

WE-A2.1P.10 **16:40**

Composite Lattice Structure Frequency-selected Radome Design

Jiahe Mei, Tao Jiang, Yingsong Li, Yibing Li, Fang Ye, Harbin Engineering University, China; Bin Cao, Marine Design & Research Institute of China, China

Metasurfaces and Transmit/Reflect Arrays

Session Co-Chairs: Anthony Grbic, University of Michigan; Hoyeong Kwon, University of Texas at Austin; Andrea Alù, University of Texas at Austin

WE-A2.2P.1 **13:20**

Transmitarray based Metasurface Lens Antenna

Asif Ahmed, Md. Rokunuzzaman Robel, Wayne S. T. Rowe, RMIT University, Australia

WE-A2.2P.2 **13:40**

X-Band Reflective Electromagnetic Beam Controlling Metasurfaces

Hongmei Li, Hongmei Li, Xuming Man, Xuming Man, Harbin Institute of Technology, China

WE-A2.2P.3 **14:00**

Omega-bianisotropic Wire-Loop Huygens' Metasurface for Wide-Angle Refraction

Michael Chen, George V. Eleftheriades, University of Toronto, Canada

WE-A2.2P.4 **14:20**

A Circuit-based Approach to the Synthesis of 2-D Omega Materials

Luke Szymanski, Anthony Grbic, University of Michigan, United States

WE-A2.2P.5 **14:40**

Polarization Independent, Broad Angle Retro-Reflection with an Optical Meta-Grating

Hoyeong Kwon, Andrea Alù, University of Texas at Austin, United States

Break **15:00**

WE-A2.2P.6 **15:20**

Metasurface from Hyperuniform Disordered Distribution

Haoyang Zhang, Yang Hao, Queen Mary University of London, United Kingdom

WE-A2.2P.7 **15:40**

Effect of Applying Meta-surface Reflector with Two Types Reflection Characteristics on 2×2 LOS MIMO

Ryuji Kuse, Takeshi Fukusako, Akira Matsushima, Kumamoto University, Japan

WE-A2.2P.8 **16:00**

Towards Decreasing Side Lobes Produced by Near-Field Phase Gradient Metasurfaces

Khushboo Singh, Muhammad Usman Afzal, Karu Esselle, Maria Kovaleva, Macquarie University, Australia

WE-A2.2P.9 **16:20**

Transmissive Suppressed-Order Diffraction Grating (SODG)

Ashutosh Patri, Guillaume Lavigne, Christophe Caloz, Polytechnique Montréal, Canada

WE-A2.2P.10 **16:40**

An Efficient and Broadband Metalens for X Band

Yumna Siddique, Muhammad Zubair, Information Technology University, Pakistan; Muhammad Mahmood Ali, GIK Institute of Engineering Science & Technology, Pakistan; Muhammad Qasim Mehmood, Information Technology University, Pakistan

Broadband Arrays

Session Co-Chairs: John Volakis, Florida International University; Carl Pfeiffer, Defense Engineering Corp.

WE-A1.5P.1 **13:20**

One Dual-Polarization 10-40 GHz Planar Array Antenna For Sattellite Communication

Yujie Liu, Yang Hao, Queen Mary University of London, United Kingdom

WE-A1.5P.2 **13:40**

Low Angle Scanning Phased Arrays With Greater Than 50:1 Bandwidth

Alexander D. Johnson, Elias A. Alwan, John L. Volakis, Florida International University, United States

WE-A1.5P.3 **14:00**

Optimization of A Wideband Planar Sparse Array Based on Danzer Aperiodic Tiling

Shaoqing Hu, Chao Shu, Xiaodong Chen, Queen Mary University of London, United Kingdom; Kai Wang, East China Research Institute of Electronic Engineering, China

WE-A1.5P.4 **14:20**

An Efficient Design Approach for Wideband Tightly Coupled Antenna Arrays

Wenyang Zhou, Yikai Chen, Shiwen Yang, University of Electronic Science and Technology of China, China

WE-A1.5P.5 **14:40**

A Novel Wide Band Fractal-based Leaky Wave Antenna with Array Patches

Lifang Zhang, Hongjian Wang, Yang Liu, Key Laboratory of Microwave Remote Sensing, National Space Science Center (NSSC),University of Chinese Academy of Sciences (UCAS), China

Break **15:00**

WE-A1.5P.6 **15:20**

A Broadband Array with Unbalanced Feeds: Elements and Power Combiners Based on the Fragmented Aperture Principle

David Landgren, Georgia Tech Research Institute, United States; Theresa Brunasso, D & S Microwave Inc., United States; Kenneth Allen, Daniel Dykes, Joshua Kovitz, Jonathan Perez, James Dee, Jeramy Marsh, Charles Hunter, Glenn Smith, Georgia Tech Research Institute, United States

WE-A1.5P.7 **15:40**

Lossy Antenna Arrays with Frequency-Independent Beamwidth

Carl Pfeiffer, Thomas Steffen, Defense Engineering Corp., United States; George Kakas, Air Force Research Laboratory, United States

WE-A1.5P.8 **16:00**

Modeling of circularly-polarized CTS arrays

Michele Del Mastro, University of Rennes 1, France; Francesco Foglia Manzillo, Maciej Smierzchalski, CEA - Leti, Minatec Campus, France; David Gonzalez-Ovejero, University of Rennes 1, France; Philippe Pouliguen, Patrick Potier, Direction Générale de l'Armement (DGA), France; Ronan Sauleau, Mauro Ettorre, University of Rennes 1, France

WE-A1.5P.9 **16:20**

Wideband Aperiodic Linear Array Synthesis with MOEA/D

Chuang Yan, Peng Yang, Lirong Jian, Feng Yang, University of Electronic Science and Technology of China, China

WE-A1.5P.10 **16:40**

Millimeter-Wave Wideband Circularly Polarized Antenna Array Using SIW-Fed S-Dipole Elements

Long Zhang, Yejun He, Sai-Wai Wong, Shenzhen University, China; Steven Gao, University of Kent, United Kingdom

Implantable and Ingestible Devices

Session Chair: Luis Gomez, Duke University School of Medicine

WE-UK.1P.1 **13:20**

Array of Non-Resonant Coils for Receiver Size Reduction in Wireless Power Transfer Applications

Danilo Brizi, University of Pisa, Italy; John Stang, University of Southern California, United States; Agostino Monorchio, University of Pisa, Italy; Gianluca Lazzi, University of Southern California, United States

WE-UK.1P.2 **13:40**

Computationally Designed Focal Deep Transcranial Magnetic Stimulation (fdTMS) Coils

Luis Gomez, Lari Koponen, Rena Hamdan, Stefan Goetz, Angel Peterchev, Duke University School of Medicine, United States

WE-UK.1P.3 **14:00**

Maximization of the Efficiency in a Multi-Coil Wireless Power Transfer Systems for Biomedical Applications

Manjunath Machnoor, University of Southern California, United States; Danilo Brizi, University of Pisa, Italy; John Stang, Gianluca Lazzi, University of Southern California, United States

WE-UK.1P.4 **14:20**

A Computational Network Model of Healthy Mammalian Retina Connectome

Ege Iseri, Javad Paknahad, Guanbo Chen, University of Southern California, United States; Pragya Kosta, Kyle Loizos, University of Utah, United States; Gianluca Lazzi, University of Southern California, United States

WE-UK.1P.5 **14:40**

Numerical Analysis of AIMD Lead Tolerances Using the Lead Electromagnetic Model

Mikhail Kozlov, Max Planck Institute for Human Cognitive and Brain Sciences, Germany; Wolfgang Kainz, Food and Drug Administration, United States

Biomedical Applications

Session Chair: Kubilay Sertel, Ohio State University

WE-UK.2P.1 **15:20**

Full Wave Numerical Model for Thermoacoustic Imaging of the Human Breast with a Concave 1.5D Ultrasound Array

Hongbo Zhao, Srishti Saraswat, Jinpil Tak, Waleed Ahmad, Min Liang, Chandra Priya Karunakaran, Russell S. Witte, Hao Xin, University of Arizona, United States

WE-UK.2P.2 **15:40**

Morphological Feature Extraction in Biomedical Samples using Polarimetric Terahertz Imaging

Maruf Md Sajjad Hossain, Niru K. Nahar, Kubilay Sertel, Ohio State University, United States

WE-UK.2P.3 **16:00**

Optimization of a Fully-Passive Neurosensor for Recording Neural Activity of a Free-Moving Animal: Characterization of Rat Skin Dielectric Properties

Carolina Moncion, Satheesh Bojja Venkatakrishnan, Jorge Riera Diaz, John L. Volakis, Florida International University, United States

WE-UK.2P.4 **16:20**

Microwave Characteristics of an Open Coplanar Waveguide Line-Based Glucose Droplet

Hee-Jo Lee, Daegu University, Korea (South)

WE-UK.2P.5 **16:40**

UWB Rotation Scanning System for Breast Imaging

Huihai Wang, Lin Sun, Zhenhua Hu, Shenzhen Terahertz Science and Technology Co. Ltd., China; Dan Pan, Rui Wu, Xiaofeng Zhang, Fan Yang, Shenzhen ET Medical Technology Co. Ltd., China

Fast Methods

Session Chair: Yaniv Brick, Ben-Gurion University of the Negev

WE-UB.1P.1 **13:20**

Low-Rank- and Butterfly-Compressibility of Moment Matrix Blocks

Yaniv Brick, Ben Gurion University of the Negev, Israel

WE-UB.1P.2 **13:40**

Multilevel Nonuniform Grid Time Domain Algorithm for Elongated Geometries

Amir Natan, Dor Gabay, Amir Boag, Tel Aviv University, Israel

WE-UB.1P.3 **14:00**

GPU-Acceleration of Characteristic Basis Function Method (CBFM) for Efficient Analysis of Complex Platforms involving Layered Media

Yang Su, University of Waterloo, Canada; Raj Mittra, University of Central Florida, King Abdulaziz University, United States

WE-UB.1P.4 **14:20**

Towards Black-Box Direct Domain Decomposition Methods

Dimitrios Makris, Marinos Vouvakis, University of Massachusetts Amherst, United States

WE-UB.1P.5 **14:40**

Fast Solution of Scattering Problems with Tensor Train Accelerated Method of Moments on Structured and Unstructured Meshes

Zhuotong Chen, Shucheng Zheng, University of Manitoba, Canada; Abdulkadir Yucel, Nanyang Technological University, Singapore; Vladimir Okhmatovski, University of Manitoba, Canada

High Performance Computing

Session Co-Chairs: Raj Mittra, University of Central Florida; Branko Kolundzija, University of Belgrade

WE-A3.1P.1 **15:20**

Auxiliary Space-based Preconditioner for Higher Order Finite Element Method

Elia Amedeo Attardo, Ulrich Jakobus, Altair Engineering GmbH, Germany; Marianne Bingle, Johann van Tonder, Altair Development S.A. (Pty) Ltd, South Africa

WE-A3.1P.2 **15:40**

Phased Antenna Array Beamforming using Convolutional Neural Networks

Ricardo Lovato, Xun Gong, University of Central Florida, United States

WE-A3.1P.3 **16:00**

Modeling Large and Complex Objects with Fine Geometrical Details by using the Massively Parallel Computer Codes JEMS-FDTD

Xuesong Meng, Xianfeng Bao, Qiang Liu, Institute of Applied Physics and Computational Mathematics, China; Zhihong Ye, Chongqing University of Posts and Telecomunications, China; Raj Mittra, University of Central Florida, United States; Haijing Zhou, Institute of Applied Physics and Computational Mathematics, China

WE-A3.1P.4 **16:20**

Massively Parallel Simulation of Antenna Array Using Domain Decomposition Method and a High-Performance Computing Scheme

Hao-Xuan Zhang, Li Huang, Liang Zhou, Shanghai Jiao Tong University, China; Z.G Zhao, Yu-Teng Zheng, Institute of Applied Physics and Computational Mathematics, China; G.D Zhu, Wen-Yan Yin, Zhejiang University, China

WE-A3.1P.5 **16:40**

Parallelization Efficiency of Multi-GPU In Core LU Decomposition of Dense Matrices

Nimrod Teneh, Elta Systems Ltd. Group & Subsidiary of IAI Ltd., Israel; Branko Mrdakovic, Milan Kostic, WIPL-D d.o.o., Serbia; Dragan Olćan, Branko Kolundzija, University of Belgrade, Serbia

Integral Equation Methods I

Session Co-Chairs: Vijay Harid, University of Colorado Denver; Shanker Balasubramaniam, Michigan State University

WE-UB.2P.1 **13:20**

Residual Error Based Mesh Refinement for Surface Integral Equations

Jorge A. Tobon Vasquez, Politecnico di Torino, Italy; Zhen Peng, University of New Mexico, United States; Jin-Fa Lee, Ohio State University, United States; Giuseppe Vecchi, Francesca Vipiana, Politecnico di Torino, Italy

WE-UB.2P.2 **13:40**

A Refinement-Free Calderon preconditioner for the Symmetric Formulation of the EEG Forward Problem

John Ortiz, Lyes Rahmouni, Politecnico di Torino, Italy; Simon B. Adrian, Technical University of Munich, Germany; Francesco P. Andriulli, Politecnico di Torino, Italy

WE-UB.2P.3 **14:00**

Novel Closed-Form Layered Medium Greens Function Approximation Via Discretization of the Scattered Field Formulation of the Spectral Differential Equation

Xinbo Li, Vladimir Okhmatovski, University of Manitoba, Canada

WE-UB.2P.4 **14:20**

Singular Integration by Interpolation (SIBI) for Integral Equations: A Tensor Decomposition Approach

Ioannis G. Kyriakou, Marinos Vouvakis, University of Massachusetts Amherst, United States

WE-UB.2P.5 **14:40**

On the Use of Machine Learning Strategies in Preconditioning Electromagnetic Integral Equations

Davide Consoli, Adrien Merlini, Francesco P. Andriulli, Politecnico di Torino, Italy

Break **15:00**

WE-UB.2P.6 **15:20**

On a Refinement-Free Strategy for Preconditioning Electromagnetic Integral Equations in the High Frequency Regime

Alexandre Dély, Adrien Merlini, Politecnico di Torino, Italy; Simon B. Adrian, Technical University of Munich, Germany; Francesco P. Andriulli, Politecnico di Torino, Italy

WE-UB.2P.7 **15:40**

Modeling Low Frequency Magnetic Field Shielding using the Locally Corrected Nyström Method

Vijay Harid, Mark Golkowski, Stephen Gedney, Ronald Rorrer, University of Colorado Denver, United States; Morris Cohen, Nathan Opalinski, Georgia Institute of Technology, United States; Sarah Patch, University of Wisconsin-Milwaukee, United States

WE-UB.2P.8 **16:00**

Modeling of High-Q Cavity with Surface Integral Equation Discontinuous Galerkin (IEDG) Method

Chung Hyun Lee, Xuezhe Tian, Jingyue Zhang, Jin-Fa Lee, Ohio State University, United States; William L. Langston, Brian Zinser, Lorena I. Basilio, Salvatore Campione, Sandia National Laboratories, United States

WE-UB.2P.9 **16:20**

Analytical Models for L-Probe fed Microstrip Antennas

Bidisha Barman, Deb Chatterjee, Anthony Caruso, University of Missouri at Kansas City, United States

WE-UB.2P.10 **16:40**

Efficient Modeling of Thin Sheet in Multilayered Uniaxial Media

Shubin Zeng, Donald Wilton, Jiefu Chen, University of Houston, United States

Point-to-Point Propagation Effects

Session Co-Chairs: Tracy Haack, Naval Research Laboratory; David Michelson, University of British Columbia

WE-UF.1P.1 **13:20**

A Classification Scheme for Wireless Channel Models Across the Development Life Cycle

David Michelson, University of British Columbia, Canada; Nada Golmie, Camillo Gentile, Jeanne Quimby, Kate Remley, National Institute of Standards and Technology, United States; Yvo de Jong, Ken Gracie, Communications Research Centre Canada, Canada

WE-UF.1P.2 **13:40**

UHF Mountain Propagation: Measurements and Modelling

Roger Lang, George Washington University, United States; Daniel Breton, ERDC Cold regions Research & Engineering Labs, United States; Can Suer, George Washington University, United States; Caitlin Haedrich, ERDC Cold regions Research & Engineering Labs, United States

WE-UF.1P.3 **14:00**

Measurements of Radiowave Propagation in a Partially Constructed Building

Andrew Austin, Michael Neve, Kevin Sowerby, University of Auckland, New Zealand

WE-UF.1P.4 **14:20**

Challenges in Modeling Shipboard Wireless Propagation Environments

David Michelson, Yiqing Huang, Zahra Vali, Aresh Rizvi, University of British Columbia, Canada

WE-UF.1P.5 **14:40**

Terrestrial Trunked Radio Propagation Simulation in Subways

Levent Yılmaztürk, Yuksel Proje, Turkey

Break **15:00**

WE-UF.1P.6 **15:20**

RF Propagation Characterization in the Arctic

Zachary Burchfield, Thomas Hanley, Ethan Miller, Hyosub Kil, David Drzewiecki, Kirk Shawhan, Andrew Riel, Johns Hopkins University Applied Physics Laboratory, United States

WE-UF.1P.7 **15:40**

Comparison of Measured and Predicted Propagation during CASPER East Field Campaign using Different Methods of Environmental Estimation

Douglas Pastore, Mathew Stanek, Daniel Greenway, Coastal Carolina University, United States; Qi Wang, Robert Burkholder, Ohio State University, United States; Tracy Haack, Naval Research Laboratory, United States; Qing Wang, Naval Postgraduate School, United States; Erin Hackett, Coastal Carolina University, United States

WE-UF.1P.8 **16:00**

Impact of Assimilating in-situ Data Sources on Model Predictions of Refractivity, Ducting and EM Propagation

Tracy Haack, David Flagg, Daniel Tyndall, Teddy Holt, Naval Research Laboratory, United States

WE-UF.1P.9 **16:20**

Blending Surface Layer, NWP Model and Climatological Refractivity Profiles: Methods and Issues

Paul Frederickson, Naval Postgraduate School, United States

WE-UF.1P.10 **16:40**

A Blending Algorithm for Atmospheric Refractivity Using 1-Dimensional Boundary Layer Modeling

Qing Wang, Kuan-min Kang, Hway-Jen Chen, Naval Postgraduate School, United States; Denny P. Alapputtu, Moss Landing Marine Laboratory, United States; Ryan Yamaguchi, Paul Frederickson, Naval Postgraduate School, United States

Wednesday, July 10 | 13:20 - 15:00
WE-A1.6P | Room 212

Antenna Feeds and Matching Circuits III

Session Co-Chairs: Ting-Yen Shih, University of Idaho; Ray Lewis, Viasat

WE-A1.6P.1 **13:20**

Design of a Characteristic-Mode-Based Fully-Planar Antenna for Indoor In-Band Full-Duplex Radios

Qianyi Li, Ting-Yen Shih, University of Idaho, United States

WE-A1.6P.2 **13:40**

A Substrate Integrated Waveguide Filtering Slot Antenna Array

Ricardo Lovato, Xun Gong, University of Central Florida, United States

WE-A1.6P.3 **14:00**

Compact Comparator for 2-D Monopulse Array Based on Novel Eight-Port Coupler

Kejia Ding, Ahmed Kishk, Concordia University, Canada

WE-A1.6P.4 **14:20**

Broadband Optimization of a High Power UHF Band Cylindrical Sleeve Dipole Antenna

Ray Lewis, Viasat Inc., United States

WE-A1.6P.5 **14:40**

Ultra-Wideband Antenna Array based on Orbital Angular Momentum

Massimo Donelli, Mohammedhusen Manekiya, University of Trento, Italy; Viviana Mulloni, Giada Marchi, Fondazione Bruno Kessler (FBK), Italy

Wednesday, July 10 | 15:20 - 16:40
WE-UE.1P | Room 212

Interference and Environmental Effects

Session Co-Chairs: Lawrence Cohen, Naval Research Laboratory; Danilo Erricolo, University of Illinois at Chicago

WE-UE.1P.1 **15:20**

Suitability of Consumer Software-defined Radios for Precompliance Radiated Emissions Testing

William Stevers, Edward Rothwell, Michigan State University, United States

WE-UE.1P.2 **15:40**

Measurement of Radiation Power from an Aircraft FMCW Radar Altimeter for Investigating Spectrum-Sharing Conditions with Wireless Avionics Intra-Communication Systems

Shunichi Futatsumori, Norihiko Miyazaki, Electronic Navigation Research Institute, National Institute of Maritime, Port and Aviation Technology, Japan; Tetsuya Sekiguchi, Takashi Hikage, Hokkaido University, Japan

WE-UE.1P.3 **16:00**

Detection of Interference in Dedicated Short-Range Communications Networks

Quinn Ramsay, Hamed Noori, David Michelson, University of British Columbia, Canada

WE-UE.1P.4 **16:20**

Green's Function Method for Classical and Statistical Electromagntics

Zhen Peng, University of New Mexico, United States

Thursday, July 11 | 08:00 - 11:40
TH-SP.1A | Special Session | Grand Ballroom C

Advanced DGTD and FVTD Methods

Session Co-Chairs: Jamesina Simpson, University of Utah; Jianming Jin, University of Illinois at Urbana Champaign

TH-SP.1A.1 **08:00**

Advanced Discontinuous Galerkin Time-Domain Methods for Challenging Engineering Problems

Su Yan, Howard University, United States; Jian-Ming Jin, University of Illinois at Urbana-Champaign, United States

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

Arbitrary High Order Discontinuous Galerkin Transient Analysis of Periodic Structures

Huaguang Bao, Sawyer D. Campbell, Pingjuan L. Werner, Douglas H. Werner, Pennsylvania State University, United States

TH-SP.1A.3 **08:40**

Higher order, Globally Constraint-preserving FVTD schemes for CED

Dinshaw Balsara, University of Notre Dame, United States; Allen Taflove, Northwestern University, United States; Jamesina Simpson, University of Utah, United States

TH-SP.1A.4 **09:00**

Higher order, Globally Constraint-preserving DGTD schemes for CED

Jamesina Simpson, University of Utah, United States; Allen Taflove, Northwestern University, United States; Dinshaw Balsara, University of Notre Dame, United States

TH-SP.1A.5 **09:20**

DGTD Using Parametric Variational Principle for Nonlinear Electromagnetic Simulations

Qiang Ren, Beihang University, China; Bao Zhu, Dalian University of Technology, China; Jiefu Chen, University of Houston, United States

Break **09:40**

TH-SP.1A.6 **10:00**

A Krylov-Subspace-Exponential Time Integration Scheme for 3-D Discontinuous Galerkin Time-Domain Methods

Jiawei Wang, Duke University, United States; Feng Chen, Xikui Ma, Jinghui Shao, Xi'an Jiaotong University, China; Qing Huo Liu, Duke University, United States

TH-SP.1A.7 **10:20**

Development of Higher-Order DG-FETD Tool for Efficient Modeling of Complex Electromagnetic Structures

Chao-Fu Wang, National University of Singapore, Singapore

TH-SP.1A.8 **10:40**

Parallel Subdomain Level DGTD Method with Load Balancing

Jiamei Mi, Qiang Ren, Beihang University, China

TH-SP.1A.9 **11:00**

Waveport Modeling for DGTD Method and Its Applications

Lei Zhao, Geng Chen, Wenhua Yu, Jiangsu Normal University, China

TH-SP.1A.10 **11:20**

Dual-Field Interior Pentalty Discontinuous Galerkin Time Domain Method

Yan Shi, Xidian University, China

Driving Forward: Advances in Propagation Modeling for Wireless Systems

Session Co-Chairs: Alenka Zajić, Georgia Institute of Technology; Zhen Peng, University of New Mexico

TH-SP.2A.1 **08:00**

Configuration of Network Level Algorithms for Wireless Train Control Systems using Physics-Based Propagation Models

Neeraj Sood, Sami Baroudi, Xingqi Zhang, Jorg Liebeherr, Costas Sarris, University of Toronto, Canada

TH-SP.2A.2 **08:20**

Parameter Estimation for Stochastic Channel Models using Temporal Moments

Ayush Bharti, Ramoni Adeogun, Troels Pedersen, Aalborg University, Denmark

TH-SP.2A.3 **08:40**

Physics-Oriented Statistical Analysis of Information Transmission in Wave-Chaotic Environments

Shen Lin, Zhen Peng, University of New Mexico, United States

TH-SP.2A.4 **09:00**

K-factor and Correlation Analysis of a 2×2 MIMO Off-body Channel Inside a Mine

Moulay El Hassan El Azhari, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Larbi Talbi, Université du Québec en Outaouais, Canada; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TH-SP.2A.5 **09:20**

Performance Analysis of Time-modulated Array in Digital Communication System

Qianwei Zeng, Peng Yang, Feng Yang, Yin Lu, Yuyi Gan, University of Electronic Science and Technology of China, China

Break **09:40**

TH-SP.2A.6 **10:00**

Propagation Modeling for Air-Ground Channel over Rough Sea Surface in Low Altitudes

Zhuangzhuang Cui, Ke Guan, Danping He, Bo Ai, Zhangdui Zhong, Beijing Jiaotong University, China

TH-SP.2A.7 **10:20**

How Many Antennas Do We Need for Massive MIMO Channel Sounding? – Validating Through Measurement

Thomas Choi, Francois Rottenberg, Peng Luo, University of Southern California, United States; Jianzhong Zhang, Samsung Resarch America Inc., United States; Andreas F. Molisch, University of Southern California, United States

TH-SP.2A.8 **10:40**

Path Loss Model as a Function of Antenna Height for 300 GHz Chip-to-Chip Communications

Jinbang Fu, Prateek Juyal, Alenka Zajić, Georgia Institute of Technology, United States

TH-SP.2A.9 **11:00**

A Path Loss Model for Through the Soil Wireless Communications in Digital Agriculture

Abdul Salam, Purdue University, United States

Multi-band antennas for Mobile Communications

Session Co-Chairs: Xinhua Ren, Google; Ata Zadehgol, University of Idaho

TH-A1.1A.1 **08:00**

Dual-Band Eight-Antenna MIMO Array for 5G Smartphone

Peng Yang, Kuixi Yan, Yuyi Gan, Feng Yang, University of Electronic Science and Technology of China, China

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

A Tri-band Shared-Aperture Antenna for Wi-Fi MIMO and Beam-Scanning Wi-Gig Applications

Yanran Ding, Yujian Cheng, University of Electronic Science and Technology of China (UESTC), China

TH-A1.1A.3 **08:40**

An Ultra-thin Triple-band Smartwatch Antenna with Support of Several Wireless Application Bands

Amirreza Jalali Khalilabadi, Ata Zadehgol, University of Idaho, United States

TH-A1.1A.4 **09:00**

A Compact Tri-Band Antenna for Vehicle Communication and Navigation Applications

Shan Jiang, Chang Chen, Qingyuan Zhang, Weidong Chen, University of Science and Technology of China, China; Hualiang Zhang, University of Massachusetts Lowell, United States

TH-A1.1A.5 **09:20**

A MIMO Antenna Array for 5G Mobile Terminals

Lijia Chen, Dajing Wang, Shufeng Zhang, Li Xia, Shengmin Jiang, Shengchang Lan, Harbin Institute of Technology, China

Break **09:40**

TH-A1.1A.6 **10:00**

Dual Band Graphene Nanoflakes Printed Compact Monopole Antenna for Low Cost WIFI Applications

Ting Leng, Kewen Pan, Yutong Jiang, Zhirun Hu, University of Manchester, United Kingdom; Habiba Ouslimani, Université Paris Ouest Nanterre La Défense, France; Mahmoud A. Abdalla, Military Technical College, Egypt

TH-A1.1A.7 **10:20**

A Low-Profile Dual-Band Dual-Polarized Base Station Antenna Array for Sub-6 GHz Applications

Yufeng Zhu, Yikai Chen, Shiwen Yang, University of Electronic Science and Technology of China, China

TH-A1.1A.8 **10:40**

Low Profile Tri-Bands Antenna for Wireless Applications

Ali Al-Azza, Basrah uvevrsity, Iraq; Nuhad Malalla, Iraq University, Iraq; Mohamed Morsy, Texas A&M University-Texarkana, United States; Frances Harackiewicz, Southern Illinois University Carbondale, United States

TH-A1.1A.9 **11:00**

A Novel Triple Band Antenna for WLAN Application

Xiao Jia Huang, Hong Qin Zheng, Han Yu Shi, Yin Xuan Zhu, Mei Song Tong, Tongji University, China

TH-A1.1A.10 **11:20**

A Capacitive Loaded CRLH in Reversal Triple band MIMO Antenna

Mahmoud A. Abdalla, Military Technical College, Egypt; Ahmed Elmowafy, Toka Ghaly, October University for Modern Sciences and Arts (MSA), Egypt

Nanoelectromagnetics

Session Co-Chairs: Amir Zaghloul, United States Army Research Laboratory; Rhonda Franklin, University of Minnesota, Twin Cities

TH-A2.1A.1 **08:00**

Novel Electromagnetic Scattering Model for Carbon Nanotube Composites using the Multilayer Green's Function Approach

Sumitra Dey, Deb Chatterjee, University of Missouri-Kansas City, United States; Edward J. Garboczi, National Institute of Standards and Technology, United States; Ahmed M. Hassan, University of Missouri-Kansas City, United States

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

Susceptibility of Nanoparticles Studied by Landau-Lifshitz-Gilbert and Snoek's Equations

Quang Nguyen, Amir Zaghloul, Army Research Laboratory, United States

TH-A2.1A.3 **08:40**

Optimization of Coplanar Waveguide Structure for Ultra Wideband Integrated Electro-optic Mach Zehnder Modulator

Farzaneh Arab Juneghani, Reza Safian, Imec Florida, United States

TH-A2.1A.4 **09:00**

Slow light at the nanoscale based on active epsilonnear- zero plasmonic waveguides

Ying Li, Christos Argyropoulos, University of Nebraska-Lincoln, United States

TH-A2.1A.5 **09:20**

Signal Enhancement for Ferromagnetic Resonance Measurement of Magnetic Nanowire array

Yali Zhang, Joseph Um, Bethanie Stadler, Rhonda Franklin, University of Minnesota, Twin Cities, United States

Break **09:40**

TH-A2.1A.6 **10:00**

A Ferromagnetic Resonance Measurement System for Small Volume Magnetic Nanowires

Yali Zhang, Joseph Um, Bethanie Stadler, University of Minnesota, United States; Rhonda Franklin, University of Minnesota, Twin Cities, United States

TH-A2.1A.7 **10:20**

On Propagation Losses due to In-Vivo Electromagnetic Nanoscale Communication

Sarah Hussein, Youmni Ziade, Beirut Arab University, Lebanon; Raed M. Shubair, Massachusetts Institute of Technology, United Arab Emirates

TH-A2.1A.8 **10:40**

Performance Parameter Optimization of Graphene Enhanced Surface Plasmon Resonance Biosensors

Mariam M. Moussilli, Abdul Rahman El Falou, Beirut Arab University, Lebanon; Raed M. Shubair, Massachusetts Institute of Technology, United States

TH-A2.1A.9 **11:00**

Design of Transmitting Nano-Dipole Antenna Using a Subwavelength Laser Excitation Method

Amer Abu Arisheh, Jordan University of Science and Technology, Jordan; Said Mikki, University of New Haven, United States; Nihad Dib, Jordan University of Science and Technology, Jordan

TH-A2.1A.10 **11:20**

Ultra-Deep Sub-Wavelength Mode Confinement in Graphene Waveguides

Ramin Emadi, Zaker Hossein Firouzeh, Reza Safian, Abolghasem Zeidaabadi Nezhad, Isfahan University of Technology, Iran

Cloaking/RCS Reduction and Absorption

Session Co-Chairs: Francesco Monticone, Cornell University; Amit Mehta, Swansea University

TH-A2.2A.1 **08:00**

On Broadband Active Cloaking

Aobo Chen, Francesco Monticone, Cornell University, United States

TH-A2.2A.2 **08:20**

Design of Waveform-Selective Mantle Cloaks for Antenna Applications

Stefano Vellucci, "Roma Tre" University, Italy; Alessio Monti, Mirko Barbuto, "Niccolò Cusano" University, Italy; Alessandro Toscano, Filiberto Bilotti, "Roma Tre" University, Italy

TH-A2.2A.3 **08:40**

Numerical Investigation on Graphene Based Mantle Cloaking of a PEC Cylinder

Carola Rizza, Ladislau Matekovits, Politecnico di Torino, Italy

TH-A2.2A.4 **09:00**

Perfect Penetrable Cloaking Using Gain-Less and Loss-less Bianisotropic Metasurfaces

Mojtaba Dehmollaian, University of Tehran, Iran; Christophe Caloz, Polytechnique Montréal, Canada

TH-A2.2A.5 **09:20**

Frequency Independent Method for RCS Reduction of Dihedral Corners Using Metasurfaces

Anuj Modi, Constantine Balanis, Craig Birtcher, Arizona State University, United States

Break **09:40**

TH-A2.2A.6 **10:00**

On the design of metamaterial radar absorber applying AMC by controlling surface resistance

Yixian Fang, Yutong Jiang, Kewen Pan, Zhirun Hu, University of Manchester, United Kingdom

TH-A2.2A.7 **10:20**

Ring Resonator Metamaterials for Radar Cross Section Reduction

Nikolay Litov, Arpan Pal, Amit Mehta, Swansea University, United Kingdom

TH-A2.2A.8 **10:40**

Ultra-wideband RCS Reduction Based on Reflection Phase Cancellation and Tunable Absorption

Xianliang Zeng, Linxi Zhang, Guobin Wan, Northwestern Polytechnical University, China

TH-A2.2A.9 **11:00**

Design of A Metamaterial Absorber With Ultra-Wide Angle Incidence

Yuming Wu, Xiao Ding, Zhipeng Wang, Bing-Zhong Wang, University of Electronic Science and Technology of China, China

TH-A2.2A.10 **11:20**

Simulation Design of Dual Band Metamaterial Absorber Based on the Fractal Structure

Mohamed Edries, Higher Institute of Engineering El Shorouk City, Egypt; Hesham A. Mohamed, Electronics Research institute, Egypt; Sherif S. Hekal, Banha University, Egypt; Mohamed A. El-morsy, Higher Institute of Engineering El Shorouk City, Egypt; Hala A. Mansour, Banha University, Egypt

Microstrip Antenna Arrays I

Session Co-Chairs: Dimitra Psychogiou, University of Colorado at Boulder; Adam Mehrabani, Johns Hopkins University

TH-A1.2A.1 **08:00**

A Compact Series Array for Vehicular Communication in the C-Band

Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy

TH-A1.2A.2 **08:20**

Broadband Linear Antenna Arrays with Frequency-Invariant Half-Power Beamwidth

Dakotah Simpson, Dimitra Psychogiou, University of Colorado at Boulder, United States

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

A Circularly Polarized Patch Antenna Array for Ku-Band Data-Link

Muhammad Saeed Khan, Wafa Abdouni-Abdallah, Hend Al Hosani, Styliauos Triantafyllidis, Majd Al Marri, Aamna Alteneiji, Emirates Technology and Innovation Center (ETIC), Khalifa University (KU), United Arab Emirates

TH-A1.2A.4 **09:00**

A SIW Uniform Circular Antenna Array for 5G Applications Fed By a Radially-symmetric Eight-way SIW Power Divider

Alireza Pourghorban Saghati, Alireza Pourghorban Saghati, Kamran Entesari, Texas A&M University, United States

TH-A1.2A.5 **09:20**

Design of a 1×4 CPW Microstrip Antenna Array on PET substrate for Biomedical Applications

Umer Farooq, Adnan Iftikhar, Adnan Fida, Muhammad Saeed Khan, Muhammad Farhan Shafique, Comsats University, Pakistan; Sajid M. Asif, University of Sheffield, United Kingdom; Raed M. Shubair, Massachusetts Institute of Technology, United States

Break **09:40**

TH-A1.2A.6 **10:00**

A Massive MIMO Array Antenna Incorporating Filtering Sub-Arrays

Hamidreza Memarzadeh, Gary Xu, Samsung Resarch America Inc., United States

TH-A1.2A.7 **10:20**

A Low-Profile Wideband Connected Dipole Array with Compact Balun and Power Divider

Linfeng Li, Jie-Bang Yan, University of Alabama, United States

TH-A1.2A.8 **10:40**

A Directive Circularly Polarized Planar Yagi Array Antenna

Yang Cheng, Yuandan Dong, University of Electronic Science and Technology of China, China

TH-A1.2A.9 **11:00**

Broadband Dual Linear Polarized (DLP) Antenna Array for Energy Harvesting System

Dalia Elsheakh, Electronics Research Institute, Egypt

TH-A1.2A.10 **11:20**

A Novel Broadband Microstrip Array Antenna with Beam Tilt

Min Guo, Min Wang, Yuan-Bo Shang, Ming-Ming Fan, Science and Technology on Electromagnetic Scattering Laboratory, China

Adaptive, Active and smart antennas

Session Co-Chairs: Jacob J. Adams, North Carolina State University; John Sanford, University of California, San Diego

TH-A1.3A.1 **08:00**

Design of a Miniature Reactive Beam Forming Network

John Sanford, University of California, San Diego, United States

TH-A1.3A.2 **08:20**

Design of Miniaturized ESPAR Antenna for Next Generation Communication Systems

Shafaq Kausar, Ahmed Kausar, Hani Mehrpouyan, Boise State University, United States; Hamood Rehman, National University of Sciences & Technology, Pakistan

TH-A1.3A.3 **08:40**

Gain Optimization of a Seven Element ESPAR Antenna

Ahmed Kausar, Shafaq Kausar, Hani Mehrpouyan, Boise State University, United States

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

IoT Equipment Structure with Reduced Risk of Damage on Attachable to Manhole Cover

Yasumitsu Ban, Manabu Kai, Fujitsu Laboratories Limited, Japan

TH-A1.3A.5 **09:20**

Beamforming Optimization based on Kalman Filter for Vehicle in Constrained Route

Shaowei Dai, Qammer H. Abbasi, MingHui Li, Muhammad Ali Imran, University of Glasgow, Singapore

Break **09:40**

TH-A1.3A.6 **10:00**

A Dodecahedron Sequential Rotation Antenna Array for Space Division Multiple Access

Lisa Berretti, Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy

TH-A1.3A.7 **10:20**

Direction of Arrival Estimation using Root-Transformation Matrix Technique

Murdifi Muhammad, Minghui Li, Qammer H. Abbasi, Cindy Goh, Muhammad Ali Imran, University of Glasgow, Singapore

TH-A1.3A.8 **10:40**

A Circular Polarized Four-Beam Antenna for Direction of Arrival Applications at 2.45GHz

Stefano Maddio, Giuseppe Pelosi, Monica Righini, Stefano Selleri, University of Florence, Italy

TH-A1.3A.9 **11:00**

Ringing Effects Due to Non-ideal Components in Direct Antenna Modulation Transmitters

Danyang Huang, Jacob Adams, North Carolina State University, United States; Kurt Schab, Santa Clara University, United States

TH-A1.3A.10 **11:20**

Matching of Small Transmitting Antenna using Non-Foster-inspired Two-transmitter System

Silvio Hrabar, University of Zagreb, Croatia (Hrvatska)

Antennas from Tesla to Today

Session Co-Chairs: Magdalena Salazar Palma, University Carlos III; Olutola Jonah, Ford Motor Company

TH-A1.4A.1 **08:00**

The Tesla Antenna and its Unique Design

Tapan Sarkar, Syracuse University, United States; Magdalena Salazar Palma, Universidad Carlos III de Madrid, Spain

TH-A1.4A.2 **08:20**

Role of the Parkes Radiotelescope in the First Moon Landing

Trevor Bird, Antengenuity, Australia

TH-A1.4A.3 **08:40**

How the Lualualei VLF Antenna was Designed

Ted Simpson, University of South Carolina, United States

TH-A1.4A.4 **09:00**

Dualband Multi-Constellation GNSS Antenna

Olutola Jonah, Leo Lanctot, Ford Motor Company, United States

TH-A1.4A.5 **09:20**

Mechanically-Rotating Electret ULF/VLF Antenna Transmitter

Chen Wang, Yong Cui, Beihang University, China; Minsong Wei, University of California, Berkeley, United States

Break **09:40**

TH-A1.4A.6 **10:00**

A novel structure for VHF band dipole antenna miniaturization

Jiawei Long, En Li, Hu Zheng, Yihang Tu, University of Electronic Science and Technology of China, China

TH-A1.4A.7 **10:20**

Challenges for Antenna Design at mm-Waves

Shafaq Kausar, Ahmed Kausar, Hani Mehrpouyan, Boise State University, United States

TH-A1.4A.8 **10:40**

Design of RFID antenna using metamaterials for microwaves applications

Amina Bendaoudi, Mohamed Debab, Zoubir Mahdjoub, Djillali Liabes University of Sidi Bel Abbés, Algeria

TH-A1.4A.9 **11:00**

Simulation and Experiment of a Loaded Ultra-small Symmetric Dipole Antenna

Shu Lin, Jian-Lin Jiao, Yu-Wei Zhang, Zhuang Chen, Cai-Tian Yang, Hong-Jun Zhang, Harbin Institute of Technology, China

TH-A1.4A.10 **11:20**

Compact UWB Slotted Pentagonal Patch Antenna for Radar and Communication

Farah Mohd Isa, Nur Hidayah Kamaludin, Norun Abdul Malek, Sarah Mohamad, International Islamic University Malaysia, Malaysia

Topics in Metamaterials and Metasurfaces

Session Co-Chairs: Davide Ramaccia, Roma Tre University; Justin Kasemodel, Raytheon Space and Airborne Systems

TH-A2.3A.1 **08:00**

An Easily Fabricated 3D Design for Increased Permittivity Range in Artificial Dielectric Layers

Mohamad Fazeli, University of North Carolina at Charlotte, United States; Justin Kasemodel, Raytheon Space and Airborne Systems, United States; Kathryn Smith, University of North Carolina at Charlotte, United States

TH-A2.3A.2 **08:20**

Complex Transformation Optics and Generalized Double Negative Layers

Hayrettin Odabasi, Eskisehir Osmangazi University, Turkey; Fernando Teixeira, Ohio State University, United States

TH-A2.3A.3 **08:40**

Broadband dispersion engineering of CRLH Transmission Lines for low signal distortion in backward regime

Alessandro Brizzi, Davide Ramaccia, Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy

TH-A2.3A.4 **09:00**

Ultra-compact wave-based solvers for fractional-calculus equations

Aobo Chen, Francesco Monticone, Cornell University, United States

TH-A2.3A.5 **09:20**

Measurement of Hybrid Genetic Programming Synthesized Artificial Magnetic Conductors

Scott Clemens, Hawaii Advanced Wireless Technologies Institute, United States; Gui Chao Huang, University of Hawaii, United States; Magdy Iskander, Zhengqing Yun, Hawaii Advanced Wireless Technologies Institute, United States

Break **09:40**

TH-A2.3A.6 **10:00**

Electromagnetically Induced Transparency in Metamaterials Using Theory of Characteristic Modes

Ozuem Anthony Chukwuka, Divitha Seetharamdoo, Hassanein Rabah, Univ. Lille Nord de France - IFSTTAR, France

TH-A2.3A.7 **10:20**

Development of X-Band Metamaterial-Inspired Sensors for Dielectric Constant Detection

Mark Ruiz, Nantakan Wongkasem, University of Texas Rio Grande Valley, United States

TH-A2.3A.8 **10:40**

2D Periodic Leaky-Wave Antennas in the Microwave and Optical Regimes

Sohini Sengupta, Energous Corporation, United States; David Jackson, University of Houston, United States; Ahmad Almutawa, Hamidreza Kazemi, University of California, Irvine, United States; Stuart Long, University of Houston, United States; Filippo Capolino, University of California, Irvine, United States

TH-A2.3A.9 **11:00**

Spread-Spectrum Camouflaging based on Time-Modulated Metasurface

Xiaoyi Wang, Christophe Caloz, Polytechnique Montréal, Canada

TH-A2.3A.10 **11:20**

Directional Monopole Antenna with Low Back-Radiation using Metamaterial Absorber

Heijun Jeong, Sungjoon Lim, Chung-Ang University, Korea (South)

Thursday, July 11 08:00 - 11:40
TH-A1.5A Room 302

Slot Arrays I

Session Co-Chairs: Xun Gong, University of Central Florida; Saranraj Karuppuswami, Michigan State University

TH-A1.5A.1 **08:00**

A Compact and High Gain Dielectric-Loaded 60GHz Multi-Stepped Waveguide Antenna Array

Saeideh Shad, Hani Mehrpouyan, Boise State University, United States

TH-A1.5A.2 **08:20**

Compact Slot Antenna Array for 5G Communications

Tiago Varum, João Matos, Instituto de Telecomunicações, Portugal

TH-A1.5A.3 **08:40**

Empty Substrate Integrated Waveguide Planar Slot Antenna Array for 5G Wireless Systems

Zia Ullah Khan, Akram Alomainy, Queen Mary University of London, United Kingdom; Tian Hong Loh, National Physical Laboratory, United Kingdom

TH-A1.5A.4 **09:00**

2 ×2 and 4 ×4 MIMO Antennas for 5G mm-Wave Wireless Communication

Shaker Alkaraki, Yue Gao, Queen Mary University of London, United Kingdom

TH-A1.5A.5 **09:20**

1D Slotted Waveguide Antenna with Controlled Beamwidth and Sidelobe Level Ratio

Hilal M. El Misilmani, Beirut Arab University, Lebanon; Mohammed Al-Husseini, Lebanese Center for Studies and Research, Lebanon

Break **09:40**

TH-A1.5A.6 **10:00**

High Gain Dual Polarized Omni Antenna for four channel MIMO Applications

John Sanford, University of California, San Diego, United States

TH-A1.5A.7 **10:20**

A Four-Corner-Fed Slotted Waveguide Sparse Array for Near-Field Focusing

Miao Zhang, Bolin Jiang, Xiamen University, China; Jiro Hirokawa, Tokyo Institute of Technology, Japan; Qing Huo Liu, Duke University, United States

TH-A1.5A.8 **10:40**

An Electronically-Steerable Parasitic Array Radiator (ESPAR) Using Microstrip-Line-Fed Cavity-Backed Slot Antennas in the E Plane

Wei Ouyang, Xun Gong, University of Central Florida, United States

TH-A1.5A.9 **11:00**

Analyzing the Coupling from Radiating Slots in a Double-Layered Radial Line Slot Array Antenna

Mst Nishat Yasmin Koli, Muhammad Usman Afzal, Karu Esselle, Macquarie University, Australia; Md Zahidul Islam, Teleaus:Information and Communications Engineering Company, Australia

TH-A1.5A.10 **11:20**

A Dual Band and Dual Circular Polarization Radial Line Slot Antenna

Jinwei Shao, Feng Yang, Rui Wang, Zhiyu Xing, Jianhua Yang, University of Electronic Science and Technology of China, China

Thursday, July 11 08:00 - 09:40
TH-UA.1A Room 303

Bioeffects and medical applications

Session Chair: Matthew Simmons, National Institute of Standards and Technology

TH-UA.1A.1 **08:00**

Real-Time Thermoacoustic Thermometry for Focused Microwave Therapy

Chandra Priya Karunakaran, Srishti Saraswat, Jinpil Tak, Hongbo Zhao, Hannah Schmitz, Waleed Ahmad, Hao Xin, Russell S. Witte, University of Arizona, United States

TH-UA.1A.2 **08:20**

Antenna Configuration and Transmission Medium to Optimize Malignant Cell Destruction

Sean Bovier, Abas Sabouni, Wilkes University, United States

TH-UA.1A.3 **08:40**

Characterization of Temperature Effect on the Dielectric of Aqueous Solutions

Yong Zhou, Wei Lin, University of Texas Rio Grande Valley, United States

TH-UA.1A.4 **09:00**

Study on the Fluorescence spectra characteristics and Growth curve of Escherichia coli

Wenjing Xie, Panpan Zhu, Ying Liu, Hao Lu, Qi Tang, Caiqin Han, Jiangsu Normal University, China

TH-UA.1A.5 **09:20**

Automatic and Accurate Non-contact Obstructive Sleep Apnea Detection using Wavelet Information Entropy Spectrum

Fugui Qi, Jianqi Wang, Fourth Military Medical University, China; Aly E. Fathy, University of Tennessee at Knoxville, United States

Thursday, July 11 10:00 - 11:40
TH-UK.1A Room 303

Human-body Interactions with Antennas and other Electromagnetic Devices

Session Chair: Khem Poudel, Middle Tennesse State University

TH-UK.1A.1 **10:00**

Wireless Power Transfer for Medical Implants

Khem Poudel, Middle Tennesse State University, United States; Madhav Pant, University of Technology Sydney, Australia

TH-UK.1A.2 **10:20**

Influence of External Cables on EM Exposure Investigated with a Human Model in a 3T MRI Coil

Mikhail Kozlov, Nikolaus Weiskopf, Harald Möller, Max Planck Institute for Human Cognitive and Brain Sciences, Germany

TH-UK.1A.3 **10:40**

Performance evaluations of microwave snare

Kazuyuki Saito, Masashi Sugiyama, Chiba University, Japan

TH-UK.1A.4 **11:00**

Color Selectivity using Electrical Stimulation of Retinal Ganglion Cells: Computational Study

Javad Paknahad, University of Southern California, United States; Kyle Loizos, Pragya Kosta, University of Utah, United States; Ege Iseri, Guanbo Chen, John Stang, Gianluca Lazzi, University of Southern California, United States

TH-UK.1A.5 **11:20**

A Real-time Hand Gesture Recognition System using 24 GHz Radar Array

Guiyuan Zhang, Kang Zhang, Shengchang Lan, Yuanxun Liu, Lijia Chen, Harbin Institute of Technology, China

Thursday, July 11 08:00 - 09:20
TH-A4.1A Room 304

Novel Radar Techniques

Session Chair: Jeffrey Nanzer, Michigan State University

TH-A4.1A.1 **08:00**

Millimeter-Wave Localization of Multiple Targets Using TDOA and Wideband Frequency Modulation

Liang Gong, Stavros Vakalis, Jeffrey Nanzer, Michigan State University, United States

TH-A4.1A.2 **08:20**

Gaussian Process Regression for Array Interpolation

Arjun Gupta, Christos Christodoulou, Manel Martinez Ramon, University of New Mexico, United States; Jose Luis Rojo Alvarez, Universidad Rey Juan Carlos, Spain

TH-A4.1A.3 **08:40**

Adaptive Equalization Super-Resolution Time Delay Estimation with High Accuracy and Low Complexity

Foad Fereidoony, Ali Jishi, Maziar Hedayati, Yuanxun Ethan Wang, University of California, Los Angeles, United States

TH-A4.1A.4 **09:00**

A New Millimeter Wave FMCW Radar Target Simulator Based on Frequency Synchronization

Mohammad Chavoshi, Shahed Shahir, Mohammad-Reza Nezhad-Ahmadi, Safieddin Safavi-Naeini, University of Waterloo, Canada

Thursday, July 11 10:00 - 11:40
TH-A4.2A Room 304

Inverse Scattering and Imaging

Session Chair: Giacomo Oliveri, ELEDIA Research Center, University of Trento

TH-A4.2A.1 **10:00**

A Total-Variation Compressive Processing Approach to Two-Dimensional Field Reconstruction

Baozhu Li, Nanjing Normal University, China; Giacomo Oliveri, Nicola Anselmi, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN – University of Trento), Italy; Wei Ke, Wanchun Tang, Nanjing Normal University, Italy

TH-A4.2A.2 **10:20**

Joint Stripmap/Spotlight Synthetic Aperture Radar enabled by Element-Level Digital Arrays

Joseph Garry, James Conroy, Richard Tillman, Johns Hopkins University Applied Physics Laboratory, United States

TH-A4.2A.3 **10:40**

Turntable ISAR Imaging of a Circular Array

Kris Buchanan, Sara Wheeland, Drew Overturf, Oren Sternberg, Naval Information Warfare Center Pacific, United States

TH-A4.2A.4 **11:00**

Comparison of Propagation Losses in THz and Optical Non-Line-of-Sight Imaging

Yiran Cui, Georgios Trichopoulos, Arizona State University, United States

TH-A4.2A.5 **11:20**

Simplified Synthetic Electrode Strategy for Electrical Capacitance Volume Tomography

Shah Chowdhury, Fernando Teixeira, Ohio State University, United States; Qussai M. Marashdeh, Tech4Imaging LLC, United States

Thursday, July 11 08:00 - 11:40
TH-A3.1A Room 305

Integral Equation Methods II

Session Co-Chairs: Matthys Botha, Stellenbosch University; Dan Jiao, Purdue University

TH-A3.1A.1 **08:00**

MoM Analysis of Conducting Surface-to-Wire Structures in Multilayered Uniaxial Media

Shubin Zeng, Donald Wilton, Jiefu Chen, University of Houston, United States

TH-A3.1A.2 **08:20**

6-D Integrals for Numerical Evaluation by Double Application of the Divergence Theorem

Javier Rivero, Francesca Vipiana, Politecnico di Torino, Italy; Donald Wilton, University of Houston, United States; W. A. Johnson, Consultant, United States

TH-A3.1A.3 **08:40**

Fast Algorithms for Converting an FMM-Based Representation of Electrically Large Integral Operators to a Minimal-Rank H2-Matrix

Chang Yang, Miaomiao Ma, Dan Jiao, Purdue University, United States

TH-A3.1A.4 **09:00**

Potential-Based TDIEs for Dielectric Regions Using Magnetic Currents

Thomas Roth, Sandia National Laboratories, United States; Weng Cho Chew, Purdue University, United States

TH-A3.1A.5 **09:20**

A Fast Macromodeling Approach to Simulate Complex Electromagnetic Surfaces

Utkarsh Patel, Piero Triverio, Sean Hum, University of Toronto, Canada

Break **09:40**

TH-A3.1A.6 **10:00**

An Efficient Basis-Free Loop-Star Preconditioner Using Sparse Direct Solvers

Yi-Ru Jeong, Ali E. Yilmaz, University of Texas at Austin, United States

TH-A3.1A.7 **10:20**

Highly Accurate 3D EM Modeling Based on Ultra High Order Basis Functions

Branko Kolundzija, Aleksandra Krneta, Dragan Olćan, University of Belgrade, Serbia; Milan Kostic, WIPL-D d.o.o., Serbia

TH-A3.1A.8 **10:40**

Efficient and accurate electromagnetic scattering analysis of perfectly conducting thick plates

Eduard Ubeda, Ivan Sekulic, Juan M. Rius, Universitat Politecnica de Catalunya (UPC), Spain

TH-A3.1A.9 **11:00**

Novel SIE Formulations for Accurate and Stable Analysis of Near-Zero-Index Materials

Bariscan Karaosmanoglu, Utku Ozmu, Ozgur Ergul, Middle East Technical University, Turkey

TH-A3.1A.10 **11:20**

Novel Integral Equation Formulation for the Analysis of Capacitive Step Discontinuities

Fernando Daniel Quesada Pereira, Celia Gómez Molina, Alejandro Álvarez Melcón, Universidad Politécnica de Cartagena, Spain; Vicente Enrique Boria Esbert, Marco Guglielmi, Universidad Politécnica de Valencia, Spain

B Thursday, July 11 08:00 - 09:40
TH-UB.1A Room 211

Theoretical Electromagnetics III

Session Chair: Piergiorgio L. E. Uslenghi, University of Illinois at Chicago

TH-UB.1A.1 **08:00**

Completeness of the Characteristic Mode Expansion

Mats Gustafsson, Lund University, Sweden; Miloslav Capek, Czech Technical University in Prague, Czech Republic; Kurt Schab, Santa Clara University, United States

TH-UB.1A.2 **08:20**

Exact Geometrical Optics Scattering by a Class of Metallic Wedges Under Multiple Plane Waves Illumination

Piergiorgio L. E. Uslenghi, University of Illinois at Chicago, United States

TH-UB.1A.3 **08:40**

Difference Between a Zenneck Wave and a Surface Wave

Tapan Sarkar, Syracuse University, United States; Magdalena Salazar Palma, Universidad Carlos III de Madrid, Spain

TH-UB.1A.4 **09:00**

An Analytical Spectral Formulation to Determine the Antenna Phase Center

Santi Concetto Pavone, Matteo Albani, University of Siena, Italy

TH-UB.1A.5 **09:20**

Novel Finite-Energy Spatiotemporally Confined Waves in Free Space and in the Presence of Temporal Dispersion

Ioannis Besieris, Virginia Polytechnic Institute and State University, United States; Amr Shaarawi, American University in Cairo, Egypt

B Thursday, July 11 10:00 - 11:40
TH-UB.2A Room 211

Guided Wave and Waveguiding Structures

Session Co-Chairs: Abdel Razik Sebak, Concordia University; Jiro Hirokawa, Tokyo Institute of Technology

TH-UB.2A.1 **10:00**

Design of Printed RGW Crossover for Millimeter Wave Beam Switching Network

Mohamed Ali, Islam Afifi, Abdel Razik Sebak, Concordia University, Canada

TH-UB.2A.2 **10:20**

Analysis and design of a 30 GHz printed ridge gap Ring-crossover

Islam Afifi, Mohamed Ali, Abdel Razik Sebak, Concordia University, Canada

TH-UB.2A.3 **10:40**

Design of 48x32-slot Corporate-feed Plate-laminating Waveguide Antenna with Circular Polarization

Jiro Hirokawa, Shuki Wai, Takashi Tomura, Tokyo institute of Technology, Japan

TH-UB.2A.4 **11:00**

Design of a Highly Efficient Transition from Guided Mode of the Microstrip to the TM Mode of the Spoof Surface Plasmon Polariton

Rahul Kumar Jaiswal, Nidhi Pandit, Nagendra Prasad Pathak, Indian Institute of Technology, Roorkee, India

TH-UB.2A.5 **11:20**

Equivalent Transverse Electromagnetic Modes and Effective medium inside Waveguide

Yue Li, Tsinghua University, China

Thursday, July 11 08:00 - 09:40
TH-A5.1A Room 212

Novel Energy Harvesting Techniques

Session Co-Chairs: Sima Noghanian, University of North Dakota; Pai-Yen Chen, University of Illinois

TH-A5.1A.1 **08:00**

Optimal Number of Coils for Wireless Power Transfer through Cascaded Resonator Systems

Connor Badowich, Loïc Markley, University of British Columbia, Canada

TH-A5.1A.2 **08:20**

Efficient and Misalignment-Robust PT-Symmetric Wireless Power Transfer

Maryam Sakhdari, Pai-Yen Chen, University of Illinois, United States

TH-A5.1A.3 **08:40**

Ultra-Low Power Pulse Width Detector for RF Wake-Up Receivers

Ahmed Abed Benbuk, Nour Kouzayha, Fatima Asadallah, Joseph Costantine, Zaher Dawy, American University of Beirut, Lebanon

TH-A5.1A.4 **09:00**

Performance Comparison between Single and Multiple Implanted Receivers in a Hybrid Power/Data Transfer System

Reem Shadid, Applied Science Private University, Jordan; Sima Noghanian, University of North Dakota, United States

TH-A5.1A.5 **09:20**

A Retro-reflective Scheme for Wireless Power transmission in Fully Enclosed Environments

Xin Wang, Xueqi Wang, Nanjing University of Aeronautics and Astronautics, China; Mingyu Lu, West Virginia University Institute of Technology, United States

C Thursday, July 11 10:00 - 11:20
TH-UC.1A Room 212

Communication Systems

Session Co-Chairs: Gregory Huff, Pennsylvania State University; Jean-Francois Chamberland-Tremblay, Texas A&M University

TH-UC.1A.1 **10:00**

Low Cost Millimeter Wave Antenna for 5G Base Station

Juneseok Lee, Dohyuk Ha, JunSig Kum, Kwanghyun Baek, Jinsu Heo, Jungyub Lee, YoungJu Lee, Samsung Electronics, Korea (South)

TH-UC.1A.2 **10:20**

6G-Next Decade Wireless Technology

Kapal Dev, Politecnico di Milano, Italy; Saleem Shahid, Air University, Pakistan

TH-UC.1A.3 **10:40**

Reconfigurable RF Front-Ends for Collocated DSRC and Millimeter-Wave Vehicle to Vehicle Communication

Sandhiya Reddy Govindarajulu, Elias A. Alwan, Florida International University, United States

TH-UC.1A.4 **11:00**

A NOVEL METHOD FOR ESTIMATION OF MORE DOA WITH LESS ANTENNAS

Dah Guy Luc Hermann Segba, Nadir Hakem, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

Innovative Reconfigurable and Multifunction Antenna Arrays

Session Co-Chairs: Paolo Rocca, ELEDIA Research Center, University of Trento; Nicola Anselmi, ELEDIA Research Center, University of Trento; Randy Haupt, Colorado School of Mines

TH-SP.1P.1 **13:20**

Massive MIMO Beamforming on a Chip

Christopher Merola, University of Massachusetts, United States; Marinos Vouvakis, University of Massachusetts Amherst, United States

TH-SP.1P.2 **13:40**

A Reconfigurable K/Ka Band Filtenna Using a Double Arm Ring Resonator

Marios Patriotis, Firas Ayoub, Christos Christodoulou, University of New Mexico, United States; Michael Chryssomallis, Democritus University of Thrace, Greece

TH-SP.1P.3 **14:00**

Beam Reconfiguration Using Imaging Reflector Antennas

Sudhakar Rao, Northrop Grumman Aerospace Systems, United States; Philip Venezia, Custom Microwave Incorporated, United States

TH-SP.1P.4 **14:20**

Experimental Studies on Reconfigurable Multi-beam Antenna Arrays using a Software Defined Radio Digital Beamformer

Payam Nayeri, Randy Haupt, Colorado School of Mines, United States

TH-SP.1P.5 **14:40**

Capacity-Driven Design of Clustered Array Architectures for New Generation 5G MU-MiMo Systems

Giorgio Gottardi, Giacomo Oliveri, Andrea Massa, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy

Break **15:00**

TH-SP.1P.6 **15:20**

Wideband Vector Antenna using Radiation Pattern Reconfigurability for 3-D Direction Finding

Johan Duplouy, Christophe Morlaas, ENAC, France; Hervé Aubert, LAAS-CNRS, France; Patrick Potier, Philippe Pouliguen, Direction Générale de l'Armement (DGA), France

TH-SP.1P.7 **15:40**

Design of a Reconfigurable Metal-Plasma L-Band Transmit-Array Antenna

Giulia Mansutti, University of Padova, Italy; Paolo Rocca, ELEDIA Research Center, Italy; Mohammad Abdul Hannan, ELEDIA Research Center (ELEDIA@UniTN - University of Trento), Italy; Federico Boulos, ELEDIA Research Center, Italy; Antonio-D. Capobianco, Paola De Carlo, University of Padova, Italy; Alberto Tuozzi, ASI - Italian Space Agency, Italy

TH-SP.1P.8 **16:00**

Transmit Beamforming Based on 4D Antenna Arrays with Pseudo-Random Orthogonal Time Sequences

Kejin Chen, Shiwen Yang, Yikai Chen, Shi-Wei Qu, University of Electronic Science and Technology of China, China; Paolo Rocca, Andrea Massa, University of Trento, Italy

TH-SP.1P.9 **16:20**

Development of Sub-Millimeter Wave Graphene Switched Antennas

Panagiotis Theofanopoulos, Georgios Trichopoulos, Arizona State University, United States

TH-SP.1P.10 **16:40**

An Electrically-Large and Multiply-Fed Holographic Antenna Based on Waveguide-Fed Metasurfaces

Timothy Sleasman, David Shrekenhamer, Ra'id Awadallah, Johns Hopkins University Applied Physics Laboratory, United States

Antennas and RF Systems for Inteference Mitigation and Spectrum Management

Session Co-Chairs: Ryan S. Westafer, GTRI Advanced Concepts Laboratory; Anthony Triolo, Perspecta Labs

TH-SP.2P.1 **13:20**

A Full-Duplex Radio Using a CMOS Non-Magnetic Circulator Achieving +95 dB Overall SIC

Aravind Nagulu, Tingjun Chen, Gil Zussman, Harish Krishnaswamy, Columbia University, United States

TH-SP.2P.2 **13:40**

Reconfigurable RF and Microwave Filters for Interference Mitigation

Eric Hoppenjans, Indiana Microelectronics, LLC, United States

TH-SP.2P.3 **14:00**

Wideband CDM Transceiver Performance in Presence of Multiple Interference Scenarios

Dimitrios Siafarikas, John L. Volakis, Florida International University, United States

TH-SP.2P.4 **14:20**

Hardware Realization and Performance Measurement of an Anti-Jam GPS Antenna Array

Jeffrey Maloney, University of Massachusetts Amherst, United States; Steven Keller, Theodore Anthony, John Clark, Russel Harris, Arthur Harrison, Steven Weiss, Army Research Laboratory, United States; Do-Hoon Kwon, Ramakrishna Janaswamy, University of Massachusetts Amherst, United States

TH-SP.2P.5 **14:40**

Millimeter-Wave Filtering Reflectarray for High-Gain Antenna Applications

Geng Bo Wu, Chi Hou Chan, City University of Hong Kong, China

Break **15:00**

TH-SP.2P.6 **15:20**

Study on Full-duplex Channel Characteristic for Simultaneous Transmit and Receive Used in Phased Array

Jie Zhang, Shengyan Li, Wensheng Chang, Tao Jiang, Bin Li, Zhiwei Liang, The 14th Research Institute of CETC, China

TH-SP.2P.7 **15:40**

Characteristic Mode Analysis of the Effect of the UAV Frame Material on Coupling and Interference

Mohamed Hamdalla, Ahmed M. Hassan, Anthony Caruso, University of Missouri-Kansas City, United States

TH-SP.2P.8 **16:00**

A reconfigurable antenna element for improved physical layer control

Benjamin McMahon, BAE Systems, United States; Ryan S. Westafer, R. Todd Lee, GTRI Advanced Concepts Laboratory, United States; Randall Lapierre, BAE Systems, United States

TH-SP.2P.9 **16:20**

Adaptive Beamforming in High-Interference Environments Using a Software-Defined Radio Array

Daniel Gaydos, Payam Nayeri, Randy Haupt, Colorado School of Mines, United States

TH-SP.2P.10 **16:40**

A reconfigurable antenna to facilitate spectrum management in AWS-3

Austin Sutlief, Cameron Phillips, Matthew Tate, Kevin Cook, Ryan S. Westafer, Georgia Tech Research Institute, United States

Broadband, Wideband and High-Gain Printed Antennas

Session Co-Chairs: Boules A. Mouris, KTH Royal Institute of Technology; Reena Dahle, State University of New York (SUNY) at New Paltz

TH-A1.1P.1 **13:20**

Compact Microstrip Patch Antennas on 3-D Printed Substrates with Dielectric Loading

Nicholas Piaquadio, Reena Dahle, State University of New York (SUNY) at New Paltz, United States

TH-A1.1P.2 **13:40**

A High Gain Rectenna For Energy Harvesting Applications

Mohammed Cherif Derbal, Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TH-A1.1P.3 **14:00**

Wide-Band Series-Fed Patch Antenna Array with Low Side Lobes

Mahmoud Shirazi, Reza Safian, IMEC Nanoelectronics, United States

TH-A1.1P.4 **14:20**

Open Multi-Slot Wideband MIMO Antennas with Microstrip Feed Line for 4G LTE

Taylor Moat, Saeed Latif, Georgios Lazarou, University of South Alabama, United States

TH-A1.1P.5 **14:40**

Bandwidth Enhancement of Microstrip Patch Antenna using Superstrate Copper Ring for X-Band Applications

Halappa Gajera, University of Mysore, India

Break **15:00**

TH-A1.1P.6 **15:20**

An Interior Parasitic Patch Antenna with Wide Isolation Bandwidth for Simultaneous Transmit and Receive (STAR)

KueiJih Lu, Carlene Goodbody, Tutku Karacolak, Washington State University Vancouver, United States; Nghi Tran, University of Akron, United States

TH-A1.1P.7 **15:40**

Analysis of a U-slot Patch Using Characteristic Mode Analysis and Coupled Mode Theory

John Borchardt, Tyler Lapointe, Sandia National Laboratories, United States

TH-A1.1P.8 **16:00**

Manipulation of Microstrip Antenna Directivity and Radiation Pattern using Negative Index Metamaterials

Ramiro Valdez, Nantakan Wongkasem, University of Texas Rio Grande Valley, United States

TH-A1.1P.9 **16:20**

CPW-fed Compact Polarization Diversity UWB MIMO Cup-Antenna

Mohamed I. Ahmed, Electronics Research Institute, Egypt; Mai F. Ahmed, Zagazig University, Egypt

Antennas for 5G and Wireless Applications

Session Co-Chairs: Georgios Trichopoulos, Arizona State University; Ahmed Kausar, Boise State University

TH-A1.2P.1 **13:20**

Design Consideration of Synthetic Phased-Array Antenna Systems for 5-G Mobile Wireless Network

Eugene Ngai, Hann-Jann (RF-Tech) Consultancy, United States

TH-A1.2P.2 **13:40**

Electromagnetic Field Exposure Evaluation for 5G in Millimeter Wave Frequency Band

Thomas Basikolo, Takahiro Yoshida, Masanori Sakurai, Microwave Factory Company Ltd., Japan

TH-A1.2P.3 **14:00**

Hybrid Beam-forming Smart Antenna for 5G Networks

Ahmed Kausar, Shafaq Kausar, Hani Mehrpouyan, Boise State University, United States

TH-A1.2P.4 **14:20**

Modeling of Sub-Millimeter Wave Coplanar Waveguide Graphene Switches

Panagiotis Theofanopoulos, Georgios Trichopoulos, Arizona State University, United States

TH-A1.2P.5 **14:40**

Multi-Broadband Microstrip Antenna for LTE Smartphone Applications

Mohamed Shaker Elgendy, Electronics Research Institute, Egypt

Break **15:00**

TH-A1.2P.6 **15:20**

Compact Microstrip Patch Antenna Utilizing Low Cost Solution Cast Nanomagnetic Thin Film

Yuxiao He, Michigan State University, United States; Eric Drew, Z. John Zhang, Georgia Institute of Technology, United States; John Papapolymerou, Michigan State University, United States

TH-A1.2P.7 **15:40**

A Large Scale FDTD Analysis of Cross Polarization Characteristics for Wireless Link Design of 4.4 GHz-band WAIC Systems inside and outside Aircraft Cabin

Tetsuya Sekiguchi, Takashi Hikage, Manabu Yamamoto, Toshio Nojima, Hokkaido University, Japan; Shunichi Futatsumori, Kazuyuki Morioka, Akiko Kohmura, Naruto Yonemoto, Electronic Navigation Research Institute, National Institute of Maritime, Port and Aviation Technology, Japan

TH-A1.2P.8 **16:00**

Antenna Arrangement Suitable for Self-Interference Reduction in Short Range Full-Duplex MIMO

Shota Odajima, Naoki Honma, Atsuto Kawagoe, Iwate University, Japan

TH-A1.2P.9 **16:20**

Dual Beam High Gain Antenna for 5th Generation Communication System using Metasurface Lens

Amit Kumar Singh, Seong-Ook Park, Korea Advanced Institute of Science and Technology (KAIST), Korea (South)

TH-A1.2P.10 **16:40**

RF Channel Propagation Modeling for Wireless Sensor Networks in Intelligent Transportation Systems

Fausto Granda, Universidad de las Fuerzas Armadas ESPE, Ecuador; Leyre Azpilicueta, Mikel Celaya-Echarri, Cesar Vargas-Rosales, Tecnologico de Monterrey, Mexico; Peio Lopez-Iturri, Francisco Falcone, Universidad Publica de Navarra, Spain

Electrically Small Antennas

Session Co-Chairs: Yuanxun Ethan Wang, University of California, Los Angeles; Edward Slevin, Georgia Institute of Technology

TH-A1.3P.1 **13:20**

Analysis of Multi-Antenna Proximity on Performance of Electrically Small Antennas

Shreya Singh, Dan Sievenpiper, University of California, San Diego, United States; Faisal Alsallum, Hatim Bukhari, King Abdulaziz City for Science and Technology, Saudi Arabia

TH-A1.3P.2 **13:40**

Enabling High Efficiency Bandwidth Electrically Small Antennas through Direct Antenna Modulation

Jean Paul Santos, Foad Fereidoony, Yuanxun Ethan Wang, University of California, Los Angeles, United States

TH-A1.3P.3 **14:00**

Highly Miniaturized Microstrip Antenna with Slots and a Superstrate for RFID Applications

Yiyang Yu, University of Electronic Science and Technology of China, China; Haoran Zhang, Atif Shamim, King Abdullah University of Science and Technology (KAUST), Saudi Arabia

TH-A1.3P.4 **14:20**

Mars Exploration: Wideband Frequency Reconfigurable Electrically Small Multi-Turn Loop Antenna Using MEMS Switch

Yubin Cai, Daisong Zhang, Yahya Rahmat-Samii, University of California, Los Angeles, United States

TH-A1.3P.5 **14:40**

Observed Q and Gravitationally-Small Antenna Behavior of a Binary Black Hole Radiator

Christopher Daniel, Kathryn Smith, Thomas Weldon, University of North Carolina at Charlotte, United States

Break **15:00**

TH-A1.3P.6 **15:20**

Analysis for Miniaturization of a Spiral Antenna using Inductive and Resistive Loading

Il-Gwon Kim, Kyeong-Yong Cho, Jong-Gwan Yook, Yonsei University, Korea (South); Tae-Seung Song, Korea Testing Laboratory, Korea (South)

TH-A1.3P.7 **15:40**

Time-Domain Matching for Broadband VLF/LF Electrically-Short Radiators

Edward Slevin, Nate Opalinski, Parker Singletary, Lee Thompson, Morris Cohen, Georgia Institute of Technology, United States; Mark Golkowski, University of Colorado Denver, United States

TH-A1.3P.8 **16:00**

Demonstration of Electrically Small Antennas Operating Below 400 MHz

Nishanth Virushabadoss, Roderick Quaye, Rashaunda Henderson, University of Texas at Dallas, United States

TH-A1.3P.9 **16:20**

A Compact Electrically Tunable VHF Antenna

Carl Pfeiffer, Defense Engineering Corp., United States; Fikadu T. Dagefu, Army Research Laboratory, United States

TH-A1.3P.10 **16:40**

A compact dual band ring antenna with embedding grounded patches

Yujie Li, Jiade Yuan, Fuzhou University, China; Zhizhang (David) Chen, Fuzhou University, China and Dalhousie University, Canada

Application of Microstrip and Printed Antennas

Session Co-Chairs: Shubhendu Bhardwaj, The Florida International University; Chunxu Mao, Pennsylvania State University; Tutku Karacolak, Washington State University Vancouver

TH-A1.4P.1 **13:20**

High Gain Broadband Antenna for Point to Point Communication Systems

Md Asaduzzaman Towfiq, i5 Technologies Inc, United States; Bedri Cetiner, Abdurazag Khalat, Utah State University, United States

TH-A1.4P.2 **13:40**

Dual-Polarized Armband Embroidered Textile Antenna for On-/Off-Body Wearable Applications

Chunxu Mao, Pennsylvania State University, United States; Dieff Vital, Florida International University, United States; Pingjuan L. Werner, Douglas H. Werner, Pennsylvania State University, United States; Shubhendu Bhardwaj, Florida International University, United States

TH-A1.4P.3 **14:00**

A Comparison of Path Loss Variations in Soil using Planar and Dipole Antennas

Abdul Salam, Purdue University, United States

TH-A1.4P.4 **14:20**

Miniaturized SIW-CBS Planar TX/RX Antenna Arrays For Microwave CW/FMCW Doppler Radars

Navid Naseh, Reza Ebrahimi Ghiri, Kamran Entesari, Texas A&M University, United States

TH-A1.4P.5 **14:40**

Microstrip Antenna Design for Underground Water Pipeline Monitoring Sensor

Manuel Ricardo Pérez Cerquera, Ivonne Neira, Pontificia Universidad Javeriana, Colombia

Break **15:00**

TH-A1.4P.6 **15:20**

A Compact High Gain X-Band Patch Antenna for Cube and Small Satellite Applications

Shiou-Li Chen, National Space Organization (NSPO), National Applied Research Laboratories (NARL), Taiwan

TH-A1.4P.7 **15:40**

Novel High-Performance, Dual-Polarized, Crossed-Vertically-Fed Microstrip Antenna Array for Multifunction Phased Array Radar Application

Hadi Saeidi-Manesh, Shahrokh Saeedi, Guifu Zhang, University of Oklahoma, United States

TH-A1.4P.8 **16:00**

A 24 GHz ISM Band Doppler Radar System for Moving Target Sensing

Sungpeel Kim, Jihoon Bang, Kyoseung Keum, Jaehoon Choi, Kyung-Young Jung, Hanyang University, Korea (South); Dong Kyoo Kim, Youjin Kim, Electronics and Telecommunications Research Institute, Korea (South)

TH-A1.4P.9 **16:20**

Fabric Antenna for Temperature Sensing over ISM Frequency Band

Isidoro Ibanez Labiano, Akram Alomainy, Queen Mary University of London, United Kingdom

TH-A1.4P.10 **16:40**

Investigations of Wideband Microstrip Unit Cell Topologies at 28 GHz for Flat Lens Antenna Applications

Zohre Pourgholamhossein, Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

Advances in Radar, Massive and Multiuser MIMO Antenna Systems

Session Co-Chairs: Said Mikki, University of New Haven; Ivan Ndip, Fraunhofer-Institut fuer Zuverlaessigkeit und Mikrointegration

TH-A5.2P.1 **13:20**

Effective Figure of Merit Definition for MIMO UWB Radar Channels Selection

Fugui Qi, Jianqi Wang, Fourth Military Medical University, China; Ozlem Kilic, Catholic University of America, United States; Aly E. Fathy, University of Tennessee at Knoxville, United States

TH-A5.2P.2 **13:40**

On the Phase-Error Tolerance of Virtual Antenna Arrays in MIMO Radars

Rabia Syeda, Martijn Beurden, A. Bart Smolders, Eindhoven University of Technology, Netherlands

TH-A5.2P.3 **14:00**

Wireless Frequency Synchronization for Coherent Distributed Antenna Arrays

Serge Mghabghab, Hassna Ouassal, Jeffrey Nanzer, Michigan State University, United States

TH-A5.2P.4 **14:20**

Investigation of Channel Correlation in Indoor Wideband Massive MIMO Systems

Murat Temiz, Yongwei Zhang, Emad Alsusa, Laith Danoon, University of Manchester, United Kingdom

TH-A5.2P.5 **14:40**

An Efficient FB-based Underground Channel Estimation for MIMO Mm-Wave Systems

Widad Belaoura, National Polytechnic School, Algeria; Khalida Ghanem, Center of Development of Advanced Techniques (CDTA), Algeria; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Hicham Bousbia-Salah, National Polytechnic School, Algeria

Break **15:00**

TH-A5.2P.6 **15:20**

Estimation of the Cross-Correlation Green's Function for MIMO Systems

Debdeep Sarkar, Royal Military College, Canada, Canada; Said Mikki, University of New Haven, United States; Yahia Antar, Royal Military College of Canada, Canada

TH-A5.2P.7 **15:40**

Range and Capacity Optimization of a 10GBps Access Point Employing 12 MIMO Chains

John Sanford, University of California, San Diego, United States; Saied Ansari, Quantenna Inc., United States

TH-A5.2P.8 **16:00**

Deep Learning Design for Joint Antenna Selection and Hybrid Beamforming in Massive MIMO

Ahmet M. Elbir, Duzce University, Turkey; Kumar Vijay Mishra, University of Iowa, United States

TH-A5.2P.9 **16:20**

A Novel Multi-user Spatial Modulation-based Code Division Multiple Access Scheme

Khalida Ghanem, Center of Development of Advanced Techniques (CDTA), Algeria; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Fadila Berrahma, Hicham Bousbia-Salah, National School Polytechnic (ENP), Algeria

TH-A5.2P.10 **16:40**

Multi-user Communication by Electromagnetic Vortex Based on Time Modulated Array

Yiqing Liu, Chong He, Ronghong Jin, Junping Geng, Xian-Ling Liang, Weiren Zhu, Shanghai Jiao Tong University, China

Metastructures for Antennas

Session Co-Chairs: Mirko Barbuto, Niccolò Cusano University; Hisamatsu Nakano, Hosei University

TH-A2.1P.1 **13:20**

Double Metaloop Antenna

Hisamatsu Nakano, Tomoki Abe, Junji Yamauchi, Hosei University, Japan; Amit Mehta, Swansea University, United Kingdom

TH-A2.1P.2 **13:40**

A Rectangular Waveguide Antenna with Filtering and Beam-steering Capabilities

Mirko Barbuto, Alessio Monti, Niccolò Cusano University, Italy; Filiberto Bilotti, Alessandro Toscano, Roma Tre University, Italy

TH-A2.1P.3 **14:00**

An Ultra-Thin Compact Highly Efficient ϖ-Section CRLH–EBG Based Antenna for ISM Applications

Mohamed El Atrash, October University for Modern Sciences and Arts (MSA), Egypt; Mahmoud A. Abdalla, Military Technical College, Egypt; Abdelaziz A. Aboelabas, Sara S. Abd-Alwahab, October University for Modern Sciences and Arts (MSA), Egypt

TH-A2.1P.4 **14:20**

Wideband Low-Profile Quasi-Yagi Antenna Using Artificial Magnetic Conductor

Jian Ren, Yingzeng Yin, Xidian University, China

TH-A2.1P.5 **14:40**

Reconfigurable Metasurface Lens Thin Antenna with 3-State Unit Cells in 28-GHz Band

Mingqi Wu, Keishi Kosaka, Eiji Hankui, NEC Corporation, Japan

Break **15:00**

TH-A2.1P.6 **15:20**

Vortex-Beam Emitter Based on Spoof Surface Plasmon Polaritons

Jia Yuan Yin, Li-Xin Guo, Xidian University, China

TH-A2.1P.7 **15:40**

Dual-Band High-Gain Circularly Polarized Patch Antenna Design Using Metasurface

Joysmita Chatterjee, Akhilesh Mohan, Vivek Dixit, Indian Institute of Technology, Kharagpur, India

TH-A2.1P.8 **16:00**

A Low Profile Flexible Circularly Polarized Antenna for Wearable and WLAN Applications

Mohamed El Atrash, October University for Modern Sciences and Arts (MSA), Egypt; Mahmoud A. Abdalla, Military Technical College, Egypt; Sherif R. Zahran, Arab Academy for Science, Technology & Maritime Transport, Egypt; Abdelrahman M. Ali, October University for Modern Sciences and Arts (MSA), Egypt

TH-A2.1P.9 **16:20**

A Wideband Compact Filtering Array Antenna Using Two Sections L-CRLH Impedance Transformer

Mahmoud A. Abdalla, Military Technical College, Egypt; Hossam Hassan, Yasmin Hammad, October University for Modern Sciences and Arts (MSA), Egypt; Mohammad Ameen, Raghvendra Chaudhary, Indian Institute of Technology, India

Space-Time and Tunable Metastructures

Session Co-Chairs: Sawyer Campbell, the Pennsylvania State University; Amit Mehta, Swansea University

TH-A2.2P.1 **13:20**

Space-time modulated cloaks for breaking reciprocity of antenna radiation

Davide Ramaccia, Roma Tre University, Italy; Dimitrios Sounas, Wayne State University, United States; Andrea Alù, CUNY Advanced Science Research Center, United States; Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy

TH-A2.2P.2 **13:40**

Serrodyne frequency translation using time-modulated metasurfaces

Zhanni Wu, Anthony Grbic, University of Michigan, United States

TH-A2.2P.3 **14:00**

Time-modulated reflective metasurface for the control of the reflected signal frequency

Davide Ramaccia, Roma Tre University, Italy; Dimitrios Sounas, Wayne State University, United States; Andrea Alù, CUNY Advanced Science Research Center, United States; Alessandro Toscano, Filiberto Bilotti, Roma Tre University, Italy

TH-A2.2P.4 **14:20**

Direction-of-Arrival (DOA) Estimation based on Spacetime-Modulated Metasurface

Xiaoyi Wang, Christophe Caloz, Polytechnique Montréal, Canada

TH-A2.2P.5 **14:40**

VO2-based Active Terahertz Chiral Metamaterials

Lei Kang, Pennsylvania State University, United States; Shengxiang Wang, Wuhan Textile University, China; Sawyer D. Campbell, Pingjuan L. Werner, Douglas H. Werner, Pennsylvania State University, United States

Break **15:00**

TH-A2.2P.6 **15:20**

Towards Generalized Transistor-based Magnetless Nonreciprocal Metasurface

Guillaume Lavigne, Christophe Caloz, Polytechnique Montréal, Canada

TH-A2.2P.7 **15:40**

Reconfigurable Metamaterials Formed Through a Combination of Nanowire Assemblies with Top-Down Fabricated Nanoantennas

Lei Kang, Sawyer D. Campbell, Douglas H. Werner, Pennsylvania State University, United States

TH-A2.2P.8 **16:00**

Tunable Multiband Devices Based on ON/OFF Switches in Metamaterials SOR for WIFI Application

Bachir Belkadi, Zoubir Mahdjoub, Mohamed Lamine Seddiki, University of Sidi Bel Abbès, Algeria; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TH-A2.2P.9 **16:20**

A Wearable Reconfigurable Electromagnetic Metamaterial Absorber using Artificial Magnetic Inclusions

Mohammed Bait-Suwailam, Sultan Qaboos University, Oman; Thamer Almoneef, Prince Sattam bin Abdulaziz University, Saudi Arabia; Akram Alomainy, Queen Mary University of London, United Kingdom

TH-A2.2P.10 **16:40**

Graphene metasurface based tunable double split ring resonator for far infrared frequency region

Vishal Sorathiya, Shobhitkumar Patel, Marwadi Education Foundation, India

EM Interaction and Coupling

Session Co-Chairs: Salvatore Campione, Sandia National Laboratories; Raphael Kastner, University of Pennsylvania

TH-UB.1P.1 **13:20**

Developing High Isolation Planar RX-TX Ku Band Phased Arrays for Unmanned Aerial Systems (UAS)

Jakob Kunzler, Karl Warnick, Brigham Young University, United States

TH-UB.1P.2 **13:40**

Optimal Coil Design for Maximum Power Transfer Efficiency in Resonantly Coupled Systems

Maryam Heidarian, Samuel J. Burgess, Radhakrishna Prabhu, Nazila Fough, Robert Gordon University, United Kingdom

TH-UB.1P.3 **14:00**

Near field Electromagnetic Cloaking of Monopole Antennas for Mutual Coupling Reduction using 3-D Confocal Elliptical Meta-Surface Cloaks

Waleed Ahmad, Jinpil Tak, University of Arizona, United States; Alexander B. Yakovlev, University of Mississippi, United States; Hao Xin, University of Arizona, United States

TH-UB.1P.4 **14:20**

Antireflective coatings for high impedance jumps

Julian D. Mateus, Juan D. Baena, Universidad Nacional de Colombia, Colombia

TH-UB.1P.5 **14:40**

Design of Triband High-Q Metasurfaces with Tunability of Dominant Multipole Moments

Thi Hai-Yen Nguyen, Gangil Byun, Ulsan National Institute of Science and Technology (UNIST), Korea (South)

Break **15:00**

TH-UB.1P.6 **15:20**

Practical Considerations for Resonant Near Field Wireless Power Transfer over Common Ground

Saeed Khan, Kansas State University, United States

TH-UB.1P.7 **15:40**

Modeling shielded cables in Xyce based on transmission-line theory

Salvatore Campione, Aaron Pung, Larry Warne, William L. Langston, Ting Mei, Sandia National Laboratories, United States

TH-UB.1P.8 **16:00**

Half-Way Duality and the Fractional Curl Operator

Raphael Kastner, University of Pennsylvania, United States

TH-UB.1P.9 **16:20**

A Wideband Low-frequency Near-field Measurement System for Detecting Electromagnetic Emission from Biological Cells

Menglou Rao, Seyed Mohammad Amjadi, Kamal Sarabandi, University of Michigan, United States

TH-UB.1P.10 **16:40**

Propagation Characteristics of a Reconfigurable Plasmonic Rectangular Groove Grating Waveguide Using Periodically Photoinduced Plasma

Kazuo Nishimura, Ryukoku University, Japan

Sensing and Imaging in Challenging Environments

Session Co-Chairs: Carey Rappaport, Northeastern University; Timothée Marchal, LAAS-CNRS

TH-A3.1P.1 **13:20**

On the Performance of Polarimetric Subtraction Technique for the Detection of Bunkers in the Presence of Surface Clutter

DaHan Liao, Army Research Laboratory, United States

TH-A3.1P.2 **13:40**

Structural Effect on Image Quality Degradation in Ground-Penetrating Radar Array

Samuel Wagner, Anh-Vu Pham, University of California, Davis, United States

TH-A3.1P.3 **14:00**

Imaging of Walking Human Behind the Wall Using Impulse Radar

Doojin Lee, Brandon Fong, Plinio Morita, Jennifer Boger, William Melek, George Shaker, University of Waterloo, Canada

TH-A3.1P.4 **14:20**

Dual-Polarized Through-Wall Repeater for the Wireless Reading of Millimeter-wave Passive Sensors

Timothée Marchal, Julien Phillippe, Dominique Henry, Maria-Valeria De Paolis, Anthony Coustou, Pons Patrick, Aubert Hervé, LAAS-CNRS, France

TH-A3.1P.5 **14:40**

Analysis of multistatic vehicle-drone Ground Penetrating Radar configurations for mine detection

Maria Garcia-Fernandez, University of Oviedo, Spain; Ann Morgenthaler, Northeastern University, United States; Yuri Alvarez-Lopez, Fernando Las-Heras, University of Oviedo, Spain; Carey Rappaport, Northeastern University, United States

Break **15:00**

TH-A3.1P.6 **15:20**

Experimental Imaging Results of a UAV-mounted Downward-Looking mm-wave Radar

Weite Zhang, Juan Heredia-Juesas, Mithun Diddi, Luis Tirado, Hanumant Singh, Jose Angel Martinez-Lorenzo, Northeastern University, United States

TH-A3.1P.7 **15:40**

A Vanadium Dioxide Microbolometer in the Transition Region for Millimeter Wave Imaging

Shangyi Chen, Mark Lust, Nima Ghalichechian, Ohio State University, United States

TH-A3.1P.8 **16:00**

Selection of Incident Electric fields for Estimating the Calibration Factor of the Lead Electromagnetic Model

Mikhail Kozlov, Max Planck Institute for Human Cognitive and Brain Sciences, Germany; Wolfgang Kainz, Food and Drug Administration, United States

TH-A3.1P.9 **16:20**

Multimode Horn for a Monopulse Subsystem

Hongjian Wang, NMRS, NSSC, CAS, China

TH-A3.1P.10 **16:40**

Forward Transmission Matrix Analysis of Lorentz Sensor For High Permittivity Detection

Omar Siddiqui, Taibah University, Saudi Arabia

Finite-Difference Time-Domain Methods

Session Co-Chairs: Christophe Guiffaut, CNRS; Atef Elsherbeni, Colorado School of Mines

TH-A3.2P.1 **13:20**

Oblique Thin wire for nonuniform FDTD method

Christophe Guiffaut, Alain Reineix, CNRS, France

TH-A3.2P.2 **13:40**

Field interpolation with generalized barycentric coordinates in conformal FDTD schemes

Nicolas Bui, Christophe Guiffaut, Alain Reineix, XLIM Institute, University of Limoges/CNRS, France

TH-A3.2P.3 **14:00**

A stable sub-gridding with time and spatial refinements for the FDTD method

Francis Denanot, Christophe Guiffaut, Alain Reineix, University of Limoges, France

TH-A3.2P.4 **14:20**

Oblique Incidence PML Reflection Analysis for Cylindrical FDTD

Mohammed Hadi, Atef Elsherbeni, Colorado School of Mines, United States

TH-A3.2P.5 **14:40**

Numerical Stability Analysis of M1-D LOD-FDTD Method for Inhomogeneous Coupled Transmission Lines

Ding Yu Heh, Eng Leong Tan, Nanyang Technological University, Singapore

Break **15:00**

TH-A3.2P.6 **15:20**

A Stable 3-D FDTD Method with Multiple Embedded Reduced-Order Models

Xinyue Zhang, Piero Triverio, University of Toronto, Canada

TH-A3.2P.7 **15:40**

FDTD Simulations Of The Impedance Of A Dipole Antenna in A Plasma

Edmund Spencer, Saeed Latif, University of South Alabama, United States

TH-A3.2P.8 **16:00**

Explicit Unconditionally Stable Symmetric Positive Semi-Definite FDTD Subgridding Algorithm with Analytical Removal of Unstable Modes

Kaiyuan Zeng, Dan Jiao, Purdue University, United States

TH-A3.2P.9 **16:20**

Consideration of Poynting Localized Energy Around Radiators: An FDTD-based Investigation

Debdeep Sarkar, Royal Military College, Canada, Canada; Said Mikki, University of New Haven, United States; Yahia Antar, Royal Military College of Canada, Canada

TH-A3.2P.10 **16:40**

FDTD Modeling of a Dipole Antenna above Metasurface Using Surface Impedance Boundary Condition

Akihide Kurahara, Toru Uno, Takuji Arima, Tokyo University of Agriculture and Technology, Japan

Thursday, July 11 13:20 - 17:00
TH-A3.3P Room 305

Integral Equation Methods III

Session Co-Chairs: Francesco P. Andriulli, Politecnico di Torino; Robert Adams, University of Kentucky

TH-A3.3P.1 **13:20**

Binormalized Factorizations for Magnetostatic Integral Equations

Robert Adams, Owen Wilkerson, John Young, Stephen Gedney, University of Kentucky, United States

TH-A3.3P.2 **13:40**

On a Unified Apporach Towards the Modeling of Nonlocal Hydrodynamic Non-classical Response from Plasmonic Nanotopologies

Xuezhi Zheng, Mario Kupresak, Victor V. Moshchalkov, Katholieke Universiteit Leuven, Belgium; Raj Mittra, University of Central Florida, United States; Guy A. E. Vandenbosch, Katholieke Universiteit Leuven, Belgium

TH-A3.3P.3 **14:00**

A Well-Conditioned Differential Surface Admittance Formulation for Modeling Penetrable Media

Shashwat Sharma, Piero Triverio, University of Toronto, Canada

TH-A3.3P.4 **14:20**

Solving Realistic Multiscale and Composite Problems using an Integral Equation Domain Decomposition Approach

Victor F. Martin, University of Extremadura, Spain; Diego M. Solis, University of Pennsylvania, United States; David Larios, José Manuel Taboada, Luis Landesa, University of Extremadura, Spain; Jose L. Rodriguez, Fernando Obelleiro, University of Vigo, Spain

TH-A3.3P.5 **14:40**

Reconstruction of Anisotropic Dielectric Objects Based on Integral Equation Method

Qing Xu, Xi Yuan Du, Ze Yuan Lu, Yi Fan Zhang, Mei Song Tong, Tongji University, China

Break **15:00**

TH-A3.3P.6 **15:20**

The Effect of Antenna in the Forward Model of Near Field Microwave Imaging Systems

Akın Dalkılıç, ASELSAN Inc., Turkey; Lale Alatan, Middle East Technical University, Turkey

TH-A3.3P.7 **15:40**

A Novel Scheme for Evaluating Hypersingular Volume Integrals over Tetrahedral Elements

Hong Qin Zheng, Yin Xuan Zhu, Han Yu Shi, Mei Song Tong, Tongji University, China

TH-A3.3P.8 **16:00**

Optimization of a Microwave Tomography Algorithm Using the DDA as a Fast Forward Solver

Samar Hosseinzadegan, Andreas Fhager, Mikael Persson, Chalmers University of Technology, Sweden; Paul Meaney, Dartmouth College, United States

TH-A3.3P.9 **16:20**

Accurate Solution of Electromagnetic Scattering by Conducting Objects Based on Nyström Method

Shu Na Jiang, Han Kai Yang, Li Zhang, Mei Song Tong, Tongji University, China

TH-A3.3P.10 **16:40**

Acceleration of Finite Periodic Structures Analysis through Full-Domain Basis for Matrix Compression

Alberto Serna, Luis Landesa, José Manuel Taboada, University of Extremadura, Spain

Thursday, July 11 13:20 - 15:00
TH-UA.2P Room 211

EM-field metrology

Session Chair: David R. Jackson, University of Houston

TH-UA.2P.1 **13:20**

Rapidly Deployable Portable System for Real-Time Antenna Diagnostics and Characterization

Guillermo Alvarez-Narciandi, Jaime Laviada, Yuri Alvarez-Lopez, Fernando Las-Heras, University of Oviedo, Spain

TH-UA.2P.2 **13:40**

Analytical Determinant of the Noise Parameter Extraction Matrix and Its Applications

Adrian Sutinjo, International Centre for Radio Astronomy Research, Curtin University, Australia; Leonid Belostotski, University of Calgary, Canada

TH-UA.2P.3 **14:00**

Recent Developments to the Discontinuous Galerkin Time-Domain Method for 3-D Multiscale Problems

Li Xu, Xing Li, Hao Wang, Bin-Qi Liu, Zhong-Hai Yang, Bin Li, University of Electronic Science and Technology of China, China

TH-UA.2P.4 **14:20**

An implicit hybridizable discontinuous Galerkin time domain to solve the S-parameters in waveports

Xing Li, Li Xu, Zhong-Hai Yang, Bin Li, University of Electronic Science and Technology of China, China

TH-UA.2P.5 **14:40**

A Repeater Optimization Methodology for Global Multi-Walled Carbon Nanotube Interconnects

Peng-Wei Liu, Wen-Sheng Zhao, Gaofeng Wang, Hangzhou Dianzi University, China

Thursday, July 11 15:20 - 17:00
TH-UA.3P Room 211

Microwave to Sub-millimeter Measurements/Standards

Session Chair: Ryan Adams, University of North Dakota

TH-UA.3P.1 **15:20**

Study of Carbon Nanotube Antennas

Abas Sabouni, Wilkes University, United States

TH-UA.3P.2 **15:40**

Doppler Spectrum of a Moving Human Body at J-band for Automotive Radar Detection Applications

Abdulrahman Alaqeel, University of Michigan, United States; Austin Travis, Adib Nashashibi, University of Michigan, Ann Arbor, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia; Kamal Sarabandi, University of Michigan, Ann Arbor, United States

TH-UA.3P.3 **16:00**

A Low-cost and Compact X-band Near Field Antenna Measurement System

Mohammadreza Ranjbar Naeini, Daniel Van der Weide, University of Wisconsin-Madison, United States

TH-UA.3P.4 **16:20**

A Robotic Pattern Measurement System for 60 GHz Antenna Arrays

Carmen Matos, Jiantong Li, Nima Ghalichechian, Ohio State University, United States

TH-UA.3P.5 **16:40**

Uncertainty Evaluation of Rydberg Atom-based RF E-field Metrology

Haiyang Zou, Southeast University, China; Zhenfei Song, Wanfeng Zhang, National Institute of Metrology, China; Jie Zhang, China Jiliang University, China

Thursday, July 11 13:20 - 14:40
TH-A4.1P Room 212

Engineered Scattering Surfaces

Session Chair: Matthys Botha, Stellenbosch University

TH-A4.1P.1 **13:20**

Design of Ultra-Broadband RCS-Reduction Checkerboard Surface Using AMC Circuit Model

Meshaal Alyahya, Constantine Balanis, Craig Birtcher, Arizona State University, United States; Hussein Shaman, Waleed Alomar, King Abdulaziz City for Science and Technology, Saudi Arabia; Saud Saeed, Prince Sattam bin Abdulaziz University, Saudi Arabia

TH-A4.1P.2 **13:40**

Physical Optics Modeling of Scattering by Checkerboard Structure for RCS Reduction

Meshaal Alyahya, Constantine Balanis, Craig Birtcher, Arizona State University, United States; Hussein Shaman, Waleed Alomar, King Abdulaziz City for Science and Technology, Saudi Arabia

TH-A4.1P.3 **14:00**

Radar Cross Section Reduction of A Foldable Microstrip Patch Array

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

TH-A4.1P.4 **14:20**

Design and Fabrication of Engineered Reflector for Wideband Linear-to-Circular Polarization Converter

Mourad Ibrahim, Prince Sultan University, Saudi Arabia; Abdelhady Mahmoud, Amr Awamry, Banha University, Egypt; Zhi Hao Jiang, Wei Hong, Southeast University, China; Mustafa K. Taher Al-Nuaimi, Shenzhen University, China

Thursday, July 11 15:20 - 17:00
TH-UB.2P Room 212

Propagation Phenomenon and Effects

Session Chair: Leung Tsang, University of Michigan

TH-UB.2P.1 **15:20**

Effective surface impedance of anisotropic surface roughness

Stéphane Larouche, Jesse Tice, Vesna Radisic, NG Next, Northrop Grumman Corporation, United States

TH-UB.2P.2 **15:40**

A Partially Coherent Approach for Scattering of Electromagnetic Waves from Random Layered Media with 3D Rough Interfaces

Mohammadreza Sanamzadeh, Leung Tsang, University of Michigan, United States

TH-UB.2P.3 **16:00**

E-Glass and Wall Effects of 60 GHz Applications in a Residential Home Environment

Dylan Rice, Sungkyun Lim, Georgia Southern University, United States; J.R. Flesch, ARRIS Enterprises, Inc., United States

TH-UB.2P.4 **16:20**

60 GHz Modeling Study for an Access Point in a Residential House

Deon Lucien, Sungkyun Lim, Georgia Southern University, United States; J.R. Flesch, ARRIS Enterprises, Inc., United States

TH-UB.2P.5 **16:40**

Radiation of a Satellite Array Antenna in Dispersive Atmospheric Environments

Changseong Kim, Jun Heo, Yong Bae Park, Ajou University, Korea (South)

Friday, July 12 08:00 - 11:40
FR-SP.1A Special Session Grand Ballroom C

Recent Advances in Multi-Material Additive Manufacturing for Antennas and Microwave Devices

Session Co-Chairs: Payam Nayeri, Colorado School of Mines; Geoff Brennecka, Colorado School of Mines

FR-SP.1A.1 **08:00**

Multi-Material Additive Manufacturing as an Enabling Technology for Antennas and Microwave Devices: An Overview

Geoff Brennecka, Payam Nayeri, Colorado School of Mines, United States

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

Fabrication and Characterization of 3D-Printed Ku-band Frequency Scanning Slotted Waveguide Antenna Array

Kunchen Zhao, Grant Senger, Nima Ghalichechian, Ohio State University, United States

FR-SP.1A.3 **08:40**

Reversibly Reconfigurable Liquid Metal Antennas Using 3D Printed Microfluidics

Vivek Bharambe, Jinwoo Ma, Michael Dickey, Jacob Adams, North Carolina State University, United States

FR-SP.1A.4 **09:00**

A Novel 60-cm Nonsherical 3-D Printed Voxelized Lens Antenna: Design, Fabrication and Measurement

Yahya Rahmat-Samii, Jordan Budhu, University of California, Los Angeles, United States; Richard Hodges, Douglas Hofmann, Donald Ruffatto, NASA Jet Propulsion Lab, California Institute of Technology, United States

FR-SP.1A.5 **09:20**

Multi-Material 3D Printed Gradient Dielectric Lens Antennas at mm-Wave Frequencies

Henry Giddens, Yang Hao, Queen Mary University of London, United Kingdom

Break **09:40**

FR-SP.1A.6 **10:00**

Agile Prototyping of E-band Devices

Grant Heileman, Applied Technology Associates, United States; Firas Ayoub, University of New Mexico, United States; Derek Doyle, Air Force Research Laboratory, United States; Christos Christodoulou, University of New Mexico, United States

FR-SP.1A.7 **10:20**

A 3-D Printing Ka-band Twisted Waveguide Filter with Filtering and Polarization Rotation

Yi Zhang, Jun Xu, Fan Zhang, Xi He, Xiaoyan Li, Ying Sun, Shengjian Xu, University of Electronic Science and Technology of China, China

FR-SP.1A.8 **10:40**

Tunable 3D-Printed Coaxial-Cavity Filters with Mixed Electromagnetic Coupling

Kshitij Sadasivan, Dimitra Psychogiou, University of Colorado at Boulder, United States

FR-SP.1A.9 **11:00**

Printed 5G Reconfigurable Wireless Modules Using Additive Manufacturing Techniques

Tong-Hong Lin, Manos Tentzeris, Georgia Institute of Technology, United States

FR-SP.1A.10 **11:20**

Microstrip Patch Antennas with Controlled Pattern Tilt using Multi-Material Additive Manufacturing for Piecewise Planar Conformal Arrays

Payam Nayeri, Geoff Brennecka, Colorado School of Mines, United States

Antenna Innovations and Open Challenges for Small Satellites and CubeSats

Session Co-Chairs: Joshua Kovitz, Georgia Tech Research Institute; Nacer Chahat, Jet Propulsion Laboratory

FR-SP.2A.1 **08:00**

A Review of JPL Deployable CubeSat Antennas

Nacer Chahat, Emmanuel Decrossas, Tom Cwik, NASA Jet Propulsion Lab, California Institute of Technology, United States

FR-SP.2A.2 **08:20**

Metal-only Modulated Metasurface Antenna for Cubesat Platforms

David Gonzalez-Ovejero, Centre National de la Recherche Scientifique (CNRS), France; Adham Mahmoud, Xavier Morvan, Université de Rennes 1, France; Mauro Ettorre, Centre National de la Recherche Scientifique (CNRS), France; Ronan Sauleau, Université de Rennes 1, France; Stefano Maci, University of Siena, Italy; Goutam Chattopadhyay, Nacer Chahat, NASA Jet Propulsion Lab, California Institute of Technology, United States

FR-SP.2A.3 **08:40**

X-band Synthetic Aperture Radar in SmallSats: Developing a Deployable Phased Array at SmallSat Timescales

Wyman Williams, Kathy Bowland, James Dee, Joshua Kovitz, Georgia Tech Research Institute, United States

FR-SP.2A.4 **09:00**

High-Frequency CubeSat Platform Scattering Using Higher-Order Method of Moments

Jakob Rosenkrantz de Lasson, Oscar Borries, Cecilia Cappellin, Tonny Rubæk, TICRA, Denmark

FR-SP.2A.5 **09:20**

Design of a Quasi-Optical Si/GaAs W-Band Beam-Forming Metasurface Antenna

Okan Yurduseven, Choonsup Lee, Nacer Chahat, NASA Jet Propulsion Lab, California Institute of Technology, United States; David Gonzalez-Ovejero, Mauro Ettorre, Ronan Sauleau, IETR, University of Rennes 1, France; Goutam Chattopadhyay, NASA Jet Propulsion Lab, California Institute of Technology, United States

Break **09:40**

FR-SP.2A.6 **10:00**

Design and Measurements of a 1m Ka-Band Mesh Deployable Reflector Antenna for CubeSats

Yahya Rahmat-Samii, Vignesh Manohar, University of California, Los Angeles, United States; Richard Hodges, NASA Jet Propulsion Lab, California Institute of Technology, United States; Gregg Freebury, Tendeg LLC, United States

FR-SP.2A.7 **10:20**

Measuring GPS Transmit Antenna Pattern Using On-Orbit Receivers

Tianlin Wang, Christopher Ruf, Bruce Block, University of Michigan, United States; Andrew O'Brien, Ohio State University, United States

FR-SP.2A.8 **10:40**

Deployable Circularly Polarized UHF Printed Loop Antenna for Mars Cube One (MarCO) CubeSat

Emmanuel Decrossas, NASA Jet Propulsion Lab, California Institute of Technology, United States; Phillip E. Walkemeyer, Canvas Technology, United States; B. Savannah Velasco, California State Polytechnic University - Pomona, United States; Nacer Chahat, NASA Jet Propulsion Lab, California Institute of Technology, United States

FR-SP.2A.9 **11:00**

In-Orbit Test Strategy and Results for GX Multibeam Antenna

Sara Mugnaini, Marc Benhamou, Inmarsat plc, United Kingdom

FR-SP.2A.10 **11:20**

X-Band Archimedean Spiral Antenna Array with Sloped-Wall Backing Cavity

Katelyn Isbell, Yang-Ki Hong, Woncheol Lee, Hoyun Won, Minyeong Choi, University of Alabama, United States

Ultra-wideband Components and Systems

Session Co-Chairs: Sudhakar Rao, Northrop Grumman Aerospace Systems; Christoph Baer, Ruhr University Bochum

FR-A5.1A.1 **08:00**

Beamforming Apertures with Wideband Low-Cost Front-Ends

Rimon Hokayem, Elias A. Alwan, John L. Volakis, Florida International University, United States

FR-A5.1A.2 **08:20**

Online Diagnostic Ultra-Wideband Antenna System in High Voltage Polymeric Insulator

Jungang Yin, Runqi Wu, Hunan University, China; Jian Yang, Xiangdong Xu, Chalmers University of Technology, Sweden

FR-A5.1A.3 **08:40**

Broadband mmWave Splitters Based on Dielectric Waveguides

Christoph Baer, Ruhr University Bochum, Germany

FR-A5.1A.4 **09:00**

A Quasi-optical Testbed for Terahertz On-Wafer Device and Circuit Characterization

Yiran Cui, Georgios Trichopoulos, Arizona State University, United States

FR-A5.1A.5 **09:20**

Millimeter-wave Automotive Radar Characterization and Target Simulator Systems

Shahed Shahir, Mohammad-Reza Nezhad-Ahmadi, Mohammad Chavoshi, Gholamreza Rafi, Safieddin Safavi-Naeini, University of Waterloo, Canada

Break **09:40**

FR-A5.1A.6 **10:00**

Inline Millimeter Wave Radar Phase Measurements utilizing High Order Waveguide Modes

Birk Hattenhorst, Christoph Baer, Christian Schulz, Thomas Musch, Ruhr University Bochum, Germany

FR-A5.1A.7 **10:20**

On the Distortion of UWB Circularly Polarized Time-Domain Pulses in Presence of Rotation

Adam Narbudowicz, Wroclaw University of Science and Technology, Poland; Janusz Przewocki, University of Gdansk, Poland; Max Ammann, Technological University Dublin, Ireland

FR-A5.1A.8 **10:40**

A Novel Ultra-wideband Communication System Using an Analog Time-reversal Module

Zhipeng Wang, Bing-Zhong Wang, Yuming Wu, Deshuang Zhao, University of Electronic Science and Technology of China, China

FR-A5.1A.9 **11:00**

Graphene Printed UWB Monopole Antenna for Wireless communication applications

Kewen Pan, Ting Leng, Yutong Jiang, Yixian Fang, Xinyao Zhou, University of Manchester, United Kingdom; Mahmoud A. Abdalla, Military Technical College, Egypt; Habiba Ouslimani, University Paris, France; Zhirun Hu, University of Manchester, United Kingdom

FR-A5.1A.10 **11:20**

UWB Antenna Printing on Glass Substrate Through Cost-Effective Copper Foils

Umer Farooq, Adnan Iftikhar, Adnan Fida, Muhammad F. Shafique, Comsats University, Pakistan; Sajid M. Asif, University of Sheffield, United Kingdom; Benjamin D. Braaten, North Dakota State University, United States

Circularly Polarized Patch and Printed Antennas

Session Co-Chairs: maria pour, University of Alabama in Huntsville; Atef Elsherbeni, Colorado School of Mines

FR-A1.1A.1 **08:00**

All-Metal Dual-Frequency Circularly Polarized High Gain Antenna for potential Europa Lander

Nacer Chahat, John Luke Wolff, Brant Cook, Polly Estabrook, NASA Jet Propulsion Lab, California Institute of Technology, United States

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

A Circularly Polarized Planar 2×2 Dipole Array Antenna Fed by a Modified 4-way Gysel Power Divider

Eunyoung Park, Sangkil Kim, Pusan National University, Korea (South); Nathan Seongheon Jeong, University of Alabama, United States

FR-A1.1A.3 **08:40**

Analysis of Circular Polarization Properties of 4x4 Arrays at Ka-band

Lukasz Greda, Wahid Elmarissi, Achim Dreher, German Aerospace Center (DLR), Germany

FR-A1.1A.4 **09:00**

A Defected Ground Structure for Circularly Polarized (CP) Microstrip Antenna Design

Kun Wei, Bo-Cheng Zhu, Peking University, China; Ming-Liang Tao, Yue-Xian Wang, Northwestern Polytechnical University, China

FR-A1.1A.5 **09:20**

Omnidirectional Triple-Band Printed Dipole Antenna Based on a Dual Frequency SRRs

Nilton Santos-Valdivia, Patricia Castillo-Araníbar, Universidad Católica San Pablo, Peru; Daniel Segovia-Vargas, Alejandro García-Lampérez, Universidad Carlos III de Madrid, Spain

Break **09:40**

FR-A1.1A.6 **10:00**

Compact Broadband Circularly Polarized Microstrip Antenna With a Cross-slotted Ground Plane

Ruipan Zhang, Jiawei Huang, Jun Ding, Guohua Zhai, East China Normal University, China

FR-A1.1A.7 **10:20**

A Shared-Aperture Broadband Circularly Polarized Antenna for Satellite Communications and Navigation

Yu-Yang Zheng, C.C Liu, East China Research Institute of Electronic Engineering, China; Yan Ran Ding, University of Electronic Science and Technology of China, China

Mutual Coupling in Antenna Arrays

Session Co-Chairs: Adam Mehrabani, Johns Hopkins University; Chris Merola, University of Massachusetts

FR-A1.2A.1 **08:00**

Mutual Coupling and Failure analysis in Phased Antenna Arrays

Abdelmoniem Hassan, Ahmed Kishk, Concordia University, Canada

FR-A1.2A.2 **08:20**

A Characteristic Mode Based Decoupling Approach

Sandip Ghosal, Arijit De, Ajay Chakrabarty, Indian Institute of Technology, Kharagpur, India; Raed M. Shubair, Massachusetts Institute of Technology, United States

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

A Compact 2 by 2 Printed Yagi-Uda Antenna Array with Enhanced Isolation and Gain

Nivedita Parthasarathy, Ramesh Abhari, Santa Clara University, United States

FR-A1.2A.4 **09:00**

A Broadband H-Plane Patch Antenna Decoupling Technique

Soroush Rasti Boroujeni, Safieddin Safavi-Naeini, University of Waterloo, Canada

FR-A1.2A.5 **09:20**

Reduced Active Impedance Variation By Using Time Modulated Array

Mohammad Hossein Mazaheri, Mohammad Fakharzadeh, Mahmood Akbari, Sharif University of Technology, Iran; Safieddin Safavi-Naeini, University of Waterloo, Canada

Break **09:40**

FR-A1.2A.6 **10:00**

Coupling Reduction of Printed Yagi Antenna Arrays for Millimeter-wave Imaging Applications

Mostafa Alvandian, University of Tehran, Iran; Mohammad Fakharzadeh, Sharif University of Technology, Iran; Mohammadreza Ranjbar Naeini, University of Wisconsin-Madison, United States

FR-A1.2A.7 **10:20**

Does Low Mutual Coupling Imply Low Antenna Correlation?

Xiaoming Chen, Muhammad Abdullah, Qinlong Li, Shitao Zhu, Hongyu Shi, Anxue Zhang, Xi'an Jiaotong University, China

FR-A1.2A.8 **10:40**

Coupling Effects on Polarization-Agile Patch Antenna Arrays

Hsinju Chen, Shih-Yuan Chen, National Taiwan University, Taiwan; Jennifer Bernhard, University of Illinois at Urbana-Champaign, United States

FR-A1.2A.9 **11:00**

A Novel Self-restrained Decoupling Technique for Two Antennas

Min Li, Heming Yao, Lijun Jiang, University of Hong Kong, China

Elements and Arrays for Sensing and Measurement

Session Co-Chairs: Xuan Hui Wu, Minnesota State University, Mankato; DEBASHISH CHAKRAVARTY, INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

FR-A5.2A.1 **08:00**

A Log-Periodic based Broadband Reject Filter for Dielectric Constant Characterization

Moussa Bteich, Joseph Costantine, Rouwaida Kanj, Youssef Tawk, American University of Beirut, Lebanon; Ali Ramadan, Fahad Bin Sultan University, Saudi Arabia; Assaad Eid, American University of Beirut, Lebanon

FR-A5.2A.2 **08:20**

Excitation of Circularly Polarized Wave In Substrate Integrated E-Plane Waveguide

Venkata Naga Kalyan Ram Akunuru, Xuan Hui Wu, Minnesota State University, Mankato, United States

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

New potential of a direct printed LoRa antenna

Camille Delfaut, Fondation Grenoble INP, France; Tan-Phu Vuong, IMEP- LaHC, France; Nadège Reverdy-Bruas, Denis Curtil, LGP2, France; Cecile Venet, Schneider, France

FR-A5.2A.4 **09:00**

Dual-port Stacked Annular Ring Microstrip Patch Antenna with Vertical Pins for Isolation Enhancement

Guangjun Wen, Fuzhen Xie, University of Electronic Science and Technology of China, China; Haobing Zhang, Southwest China Research Institute of Electronic Equipment, China; Wenxian Zheng, Shenzhen Intellifusion Technologies Co., China; Daniele Inserra, University of Electronic Science and Technology of China, China

FR-A5.2A.5 **09:20**

Circularly Polarized Proximity Feed Patch Antenna for FMCW Radar

Anindya Ghosh, Debashish Chakravarty, Indian Institute of Technology, Kharagpur, India

Break **09:40**

FR-A5.2A.6 **10:00**

A Dual Band UWB antenna for WCE Systems

Arifin Farhadur, Pran Kanai Saha, Bangladesh University of Engineering and Technology, Bangladesh

FR-A5.2A.7 **10:20**

Single Antenna Changeover Switch for UHF RFID Communications and RF Energy Harvesting

Paul S. Taylor, Robert Horne, John C. Batchelor, University of Kent, United Kingdom

FR-A5.2A.8 **10:40**

N-Way Spatial Power Combining in SIW for High Power Generation MMICs -Scalability Bounds

Artem Roev, Marianna Ivashina, Chalmers University of Technology, Sweden; Rob Maaskant, Marion Matters-Kammerer, Eindhoven University of Technology, Netherlands

FR-A5.2A.9 **11:00**

Evaluation of Electromagnetic Time Reversal Spatial Focusing (EMTR-SF)

Ahmed Abdelraheem, Dimitrios Peroulis, Purdue University, United States

FR-A5.2A.10 **11:20**

Wide-angle scanning conformal array antenna based on the QCTO

Wei Huang Fan, Juan Lei, National Key Laboratory of Antennas and Microwave Technology, China

Wireless Power Transfer

Session Co-Chairs: Boules A. Mouris, KTH Royal Institute of Technology; Constantinos Zekios, Florida International University

FR-A5.3A.1 **08:00**

Misalignment Resilient, Near Field Wireless Power Transfer (WPT) Antennas using Anchor Shape

Dieff Vital, Shubhendu Bhardwaj, John L. Volakis, Florida International University, United States

FR-A5.3A.2 **08:20**

Simultaneous High Data Rate Communication and Highly Efficient Wireless Power Transfer Through a Coplanar Link

Mahmoud Sharafi, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

FR-A5.3A.3 **08:40**

Retro-directive Array Antenna With Parabolic Shape Structure for Short-range Microwave Power Transfer

Sol Kim, Jeong-Wook Kim, Jin-Woo Kim, Ghoo Kim, Jong-Won Yu, Korea Advanced Institute of Science and Technology (KAIST), Korea (South)

FR-A5.3A.4 **09:00**

Simultaneous Wireless Power & Data Transmission for Wearable Applications

Mahmoud Sharafi, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

FR-A5.3A.5 **09:20**

Design and Characterization of a Compact Rectenna for Structural Health Monitoring Applications

Alassane Sidibe, Alexandru Takacs, Abderrahim Okba, Hervé Aubert, LAAS-CNRS, Université de Toulouse, CNRS, INP, F-31400 Toulouse, France

Break **09:40**

FR-A5.3A.6 **10:00**

A Dual-Polarized Multi-Antenna Structure for Simultaneous Transmission of Wireless Information and Power

Boules A. Mouris, KTH Royal Institute of Technology, Sweden; Christos I. Kolitsidas, Ericsson, Sweden; Ragnar Thobaben, KTH Royal Institute of Technology, Sweden

FR-A5.3A.7 **10:20**

Uniplanar Rectenna Designs Matched with either Active or Passive DC-to-DC Converter

Abdul Quddious, Photos Vryonides, Symeon Nikolaou, Frederick University, Cyprus; Marco A. Antoniades, University of Cyprus Nicosia, Cyprus

FR-A5.3A.8 **10:40**

A new Gradient Descent Positioning Method in Wireless Sensor Network Based on Received Signal Strength

Hussein Hijazi, Nahi Kandil, Nour Zaarour, Nadir Hakem, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

FR-A5.3A.9 **11:00**

Design of a Compact High-Gain Slotted Trapezoidal Antenna at 2.45 GHz For Energy Harvesting.

Mohamed Mansour, Haruichi Kanaya, Kyushu University, Japan

Design of Metamaterials and Metasurfaces

Session Co-Chairs: Do-Hoon Kwon, University of Massachusetts, Amherst; Sawyer D. Campbell, Pennsylvania State University

FR-A2.1A.1 **08:00**

A Two-Dimensional LC-Network Metamaterial on an Irregular Grid

Do-Hoon Kwon, University of Massachusetts Amherst, United States

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

Multi-objective Optimization of Meta-atoms

Eric B. Whiting, Sawyer D. Campbell, Douglas H. Werner, Pingjuan L. Werner, Pennsylvania State University, United States

FR-A2.1A.3 **08:40**

Metasurface Design Using Electromagnetic Inversion

Trevor Brown, Chaitanya Narendra, University of Manitoba, Canada; Yousef Vahabzadeh, Christophe Caloz, École Polytechnique de Montréal, Canada; Puyan Mojabi, University of Manitoba, Canada

FR-A2.1A.4 **09:00**

Dual-Band Negative Permittivity Metamaterial using Crossed Loop Resonator

Soumen Pandit, Priyadip Ray, Akhilesh Mohan, Indian Institute of Technology, Kharagpur, India

FR-A2.1A.5 **09:20**

Metasurface Design for Cross-polarization Conversion and Absorption Applications

Afzal Ahmed, Fahad Ahmed, Farooq Ahmad Tahir, National University of Sciences and Technology (NUST), Pakistan

Break **09:40**

FR-A2.1A.6 **10:00**

Broadband Linear to Circular Reflection Polarization Converter

Filippo Costa, Simone Genovesi, Agostino Monorchio, University of Pisa, Italy; Shengjun Zhang, Yichun Cui, Jiaqi Liu, Beijing Institute of Space Long March Vehicle, China

FR-A2.1A.7 **10:20**

Dielectric metasurface for wave focusing and vortex beam generation

Valeriy Odit, Irina Munina, Mikhail Odit, St. Petersburg Electrotechnical University LETI, Russia

FR-A2.1A.8 **10:40**

Design of Multilayered Meta-Lenses for Image Resolution Enhancement

Mark Ruiz, Nantakan Wongkasem, University of Texas Rio Grande Valley, United States

FR-A2.1A.9 **11:00**

A Metasurface with Controlled Angular Phase Dispersion for Continuous Illumination Angles

Ying Li, Jun Yang, Guangsheng Deng, Hefei University of Technology, China; Qi Zhu, University of Science and Technology of China, China

FR-A2.1A.10 **11:20**

Wideband Anisotropic Unit Cell Design for Perfect Cross-Polarization Conversion

Mourad Ibrahim, Prince Sultan University, Saudi Arabia; Abdelhady Mahmoud, Benha University, Egypt; Amr Awamry, Banha University, Egypt; Zhi Hao Jiang, Wei Hong, Southeast University, China; Mustafa K. Taher Al-Nuaimi, Shenzhen University, China

Antennas

Session Co-Chairs: Steven Weiss, US Army Research Laboratory; Andrew Bogle, University of Dayton

FR-UA.1A.1 **08:00**

Design of a Wideband Circularly Polarized Patch Antenna for GNSS Applications

Farnaz Foroughian, University of Tennessee, United States; Aly E. Fathy, University of Tennessee at Knoxville, United States

FR-UA.1A.2 **08:20**

A Ground-based Ultra-wideband Ultra-high Frequency Mills Cross Array for Ice Sounding

Joshua Nunn, Jie Yan, Siva Prasad Gogineni, Christopher D. Simpson, Charles O'Neill, University of Alabama, United States

FR-UA.1A.3 **08:40**

Development and Measurement of Conformal Antennas in the VHF/UHF Band

Steven Weiss, Army Research Laboratory, United States

FR-UA.1A.4 **09:00**

Miniaturized Circular Microstrip Patch Antennas with Conical Radiation Patterns

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

FR-UA.1A.5 **09:20**

Coherently Driven Antennas

Aleksandr Krasnok, Andrea Alù, CUNY Advanced Science Research Center, United States

Break **09:40**

FR-UA.1A.6 **10:00**

Design, Realization and Measurements of a Conical Metahorn with Symmetric Radiation pattern and Low Cross-Polarization

Valentina Sozio, Fondazione Links, Italy; Patrizio De Vita, Ingegneria dei Sistemi, Italy; Andrea Giacomini, Microwave Vision Italy SRL, Italy; Enrica Martini, University of Siena, Italy; Francesco Caminita, Wave Up Srl, Italy; Marco Faenzi, University of Siena, Italy; Marco Sabbadini, ESA-ESTEC, Netherlands; Giuseppe Vecchi, Politecnico di Torino, Italy; Stefano Maci, University of Siena, Italy

FR-UA.1A.7 **10:20**

Design, realization and experimental characterization of a 40dB gain metasurface antenna

Gabriele Minatti, Francesco Caminita, Wave Up Srl, Italy; Enrica Martini, University of Siena, Italy; Cristian Della Giovampaola, Wave Up Srl, Italy; Marco Sabbadini, ESA-ESTEC, Netherlands; Fabrizio De Paolis, ESA-ECSAT, Netherlands; Stefano Maci, University of Siena, Italy

FR-UA.1A.8 **10:40**

A compact size and low profile rectangular slot monopole antenna for UWB body centric applications.

Isah Musa Danjuma, University of Bradford, United Kingdom; Mobayode O. Akinsolu, Wrexham Glyndwr University, United Kingdom; Buhari Muhammad, Eya Eya, Raed Abd-Alhameed, James M. Noras, University of Bradford, United Kingdom; Bo Liu, Wrexham Glyndwr University, United Kingdom

FR-UA.1A.9 **11:00**

Low profile dual-pol isoflux antenna based on artificial impedance surface

Francesco Caminita, Wave Up Srl, Italy; Rodolfo Ravanelli, Paolo Campana, Thales Alenia Space Italia, Italy; Gabriele Minatti, Wave Up Srl, Italy; Enrica Martini, University of Siena, Italy; Marco Sabbadini, ESA-ESTEC, Netherlands; Stefano Maci, University of Siena, Italy

FR-UA.1A.10 **11:20**

Design of Broadband Biconical Antenna with Improved Radiation Pattern over 3-40GHz

Srabonty Soily, Chosun University, Korea (South); Il-Yong Lee, Jong-Hyuk Lim, Jong-Il Lee, Sung-Won Park, National Radio Research Agency, Korea (South); Soon-Soo Oh, Chosun University, Korea (South)

Friday, July 12 08:00 - 09:40
FR-A5.4A Room 302

Cognitive Radio II

Session Chair: Chinmoy Saha, Indian Institute of Space Science and Technology

FR-A5.4A.1 **08:00**

Dual Tunable Multifunctional Reconfigurable Vivaldi Antenna for Cognitive/Multi-Standard Radio Applications

Keerthipriya S, Chinmoy Saha, Indian Institute of Space Science and Technology, India; Jawad Siddiqi, Yahia Antar, Royal Military College of Canada, Canada

FR-A5.4A.2 **08:20**

Evaluation on Pseudo-Doppler Antenna Array using Software-Defined-Radio

Hoyun Won, Yang-Ki Hong, Katelyn Isbell, Leo Vanderburgh, Jonathan Platt, Minyeong Choi, University of Alabama, United States

FR-A5.4A.3 **08:40**

Adaptive modulation for MU-MIMO-OFDM systems in Underlay Cognitive Radio Networks

Rym Labdaoui, University Houari Boumedienne of Science and Technology, Algeria; Khalida Ghanem, Center of Development of Advanced Techniques (CDTA), Algeria; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Fatiha Youcef Ettoumi, University Houari Boumedienne of Science and Technology, Algeria

FR-A5.4A.4 **09:00**

Spectrum Occupancy Using Cyclostationary Detection

Andres Navarro, Leonardo Vargas, Jaime Aristizabal, Universidad Icesi, Colombia

FR-A5.4A.5 **09:20**

On Classifiers for Feature-Based Automatic Modulation Recognition over D-STBC Cooperative Networks

Hakim Tayakout, Khalida Ghanem, Center of Development of Advanced Techniques (CDTA), Algeria; Hicham Bousbia-Salah, National School Polytechnic (ENP), Algeria

Friday, July 12 10:00 - 11:40
FR-A5.5A Room 302

On-Chip Antennas

Session Chair: Jayanti Venkataraman, Rochester Institute of Technology

FR-A5.5A.1 **10:00**

On-chip Slot Ring Antenna Integrated with Voltage Controlled Oscillator at 140 GHz in 40nm CMOS Technology

Wei-Kai Chen, Yu-Teng Chang, Hsin-Chia Lu, National Taiwan University, Taiwan

FR-A5.5A.2 **10:20**

Gain Enhancement of On-Chip Antennas Using Miniaturized-Element Frequency Selective Surfaces

Mohammad Mahdi Honari, University of Michigan, United States; Pedram Mousavi, University of Alberta, Canada; Kamal Sarabandi, University of Michigan, United States

FR-A5.5A.3 **10:40**

Disc-Loaded, Vertical Top-Hat Monopole Antenna at 225 GHz for On-Chip Wireless Communications

Rounak Singh Narde, Jayanti Venkataraman, Amlan Ganguly, Rochester Institute of Technology, United States

FR-A5.5A.4 **11:00**

Grounded Coplanar Waveguide-Fed Millimeter Wave Volumetric Pyramidal Horn on LTCC

Maxence Carvalho, Abe Akhiyat, Elias A. Alwan, John L. Volakis, Florida International University, United States

FR-A5.5A.5 **11:20**

A Fabrication Compatible On-chip Linear Tapered Slot Antenna with CPW Feed

Arup Ray, Arijit De, Tarun Kanti Bhattacharyya, Indian Institute of Technology, Kharagpur, India

Friday, July 12 08:00 - 09:40
FR-A5.6A Room 303

Chamber Technology for MIMO Antenna Measurements

Session Chair: Lars J. Foged, Microwave Vision Italy

FR-A5.6A.1 **08:00**

Dual Polarized Plane Wave Generator Design for Direct Far-Field Testing

Francesco Scattone, Darko Sekuljica, Andrea Giacomini, Francesco Saccardi, Microwave Vision Italy SRL, Italy; Jim Acree, John Estrada, MVG Inc, United States; Lars Jacob Foged, Microwave Vision Italy SRL, Italy

FR-A5.6A.2 **08:20**

Reconfigurable OTA Chamber Design Optimization

Benjamin Arnold, Michael Jensen, Brigham Young University, United States

FR-A5.6A.3 **08:40**

Error Sensitivity in Reconfigurable OTA Chamber Field Synthesis

Benjamin Arnold, Michael Jensen, Brigham Young University, United States

FR-A5.6A.4 **09:00**

Correlation Coefficients of MIMO Antennas in Reverberation Chamber

Jongsung Kim, Kyungsung University, Korea (South); Raj Mittra, University of Central Florida, United States

FR-A5.6A.5 **09:20**

Beam Probability Metric for 5G OTA Testing in Multi-Probe Anechoic Chamber Setups

Huaqiang Gao, Weimin Wang, Beijing University of Posts and Telecommunications, China; Wei Fan, Aalborg University, Denmark; Yongle Wu, Yuanan Liu, Beijing University of Posts and Telecommunications, China; Gert Frølund Pedersen, Aalborg University, Denmark

Friday, July 12 10:00 - 11:40
FR-A5.7A Room 303

Antennas for RFID applications

Session Chair: Francesca Vipiana, Politecnico di Torino

FR-A5.7A.1 **10:00**

Frequency and Polarization Agile RFID Patch Antenna with Reduced Dimensions

Enrico Tolin, Francesca Vipiana, Politecnico di Torino, Italy; Achim Bahr, Simona Bruni, Winfried Simon, IMST GmbH, Germany

FR-A5.7A.2 **10:20**

A Patch Antenna with Liquid Crystal Elastomer Switching for Passive RFID Temperature Sensing

Yousuf Shafiq, Stavros V. Georgakopoulos, Florida International University, United States; Hyun Kim, Cedric Ambulo, Taylor Ware, University of Texas at Dallas, United States

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

Circularly Polarized V-Shaped Patch Antenna for RFID Application

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

FR-A5.7A.4 **11:00**

Multiple-Polarized UHF RFID System for UAV Wireless Item Management

Seong-Hyeop Ahn, Jeong-Soo Park, Dong-Geun Seo, Yu-Seong Choi, Ye-Yeong Jeong, Wang-Sang Lee, Gyeongsang National University, Korea (South)

FR-A5.7A.5 **11:20**

An Asymmetric UHF RFID Tag Antenna with Multiple Slits Loading

Chow-Yen-Desmond Sim, Yu-Zhang Huang, Chong-Zuo Chen, Feng Chia University, Taiwan; Horng-Dean Chen, National Kaohsiung Normal University, Taiwan; Tuan-Yung Han, National Taitung College, Taiwan; Guan-Long Huang, Shenzhen University, China

Target Detection and Tracking

Session Co-Chairs: Edward Rothwell, Michigan State University; Amir Zaghloul, United States Army Research Laboratory

FR-UC.1A.1 **08:00**

Mode Selection Effect in Dual-Circular Polarized OAM Transmission

Naoki Honma, Kazunori Yuri, Iwate University, Japan

FR-UC.1A.2 **08:20**

Crosstalk-Based Calibration for High Accuracy Ranging Using Software-Defined Radios

Anton Schlegel, Serge Mghabghab, Jeffrey Nanzer, Michigan State University, United States

FR-UC.1A.3 **08:40**

Multiple Scattering Points Generator for Multi-Target

Hae-Chang Jeong, Gak-Gyu Choi, Dae Woong Woo, Jae Sik Kim, So-Su Kim, Agency for Defense Development, Korea (South)

FR-UC.1A.4 **09:00**

SDR-Based Wireless Time Alignment for Coherent Distributed Beamforming

Pratik Chatterjee, Jeffrey Nanzer, Michigan State University, United States

FR-UC.1A.5 **09:20**

Radar Signal Synchronization by Multi-Layer Modularization Implementation of Phase Shifters in the Beamforming Network of Phased Array of Antennas

Chen-Yi Chang, Hsi-Tseng Chou, National Taiwan University, Taiwan

Break **09:40**

FR-UC.1A.6 **10:00**

Implementing Spectrally-Sparse, Wideband Waveforms in Multi-Channel Software-Defined Radios for High-Accuracy Ranging

Anton Schlegel, Sean Ellison, Jeffrey Nanzer, Michigan State University, United States

FR-UC.1A.7 **10:20**

Norm Optimization using Machine Learning Approach for Autofocus in mmWave SAR Imaging

Jin-Woo Kim, Jeong-Wook Kim, Sol Kim, Ghoo Kim, Jong-Won Yu, Korea Advanced Institute of Science and Technology (KAIST), Korea (South)

FR-UC.1A.8 **10:40**

Estimating the Depth of Buried Radioactive Sources using Ground Penetrating Radar and a Gamma Ray Detector

Ikechukwu Ukaegbu, Michael Aspinall, Lancaster University, United Kingdom; Kelum Gamage, University of Glasgow, United Kingdom

FR-UC.1A.9 **11:00**

A Golay Complementary Coded Through-the-Wall Radar for Moving Target Indication

Kun Yan, Xin Liu, Shengbo Ye, Guangyou Fang, Chinese Academy of Sciences, China

Computational Electromagnetics II

Session Co-Chairs: Branislav Notaros, Colorado State University; Ahmad Hoorfar, Villanova University

FR-A3.1A.1 **08:00**

Numerical Analysis on Multipactor Effects in Coaxial Cables via Particle-in-Cell Algorithm

Dong-Yeop Na, Indranil Nayak, Fernando Teixeira, Ohio State University, United States

FR-A3.1A.2 **08:20**

Mimicking Antenna Near-Field Measurements using Full Wave Solvers For Error Characterization

Vignesh Manohar, Yahya Rahmat-Samii, University of California, Los Angeles, United States

FR-A3.1A.3 **08:40**

Automatic Generalized Quadrilateral Surface Meshing in Computational Electromagnetics by Discrete Surface Ricci Flow

Cam Key, Branislav Notaros, Colorado State University, United States

FR-A3.1A.4 **09:00**

Fast Method for First-Principles-Based Parasitic Extraction of Integrated Circuit Layout

Li Xue, Dan Jiao, Purdue University, United States

FR-A3.1A.5 **09:20**

Sparse Recovery with Predictable Accuracy in Noisy Spherical Antenna Near-Field Measurements

Bernd Hofmann, Thomas F. Eibert, Technical University of Munich, Germany

Break **09:40**

FR-A3.1A.6 **10:00**

Low-Cost MoM-Solution of Blood Tube Scattering

Ala Eldin Omer, George Shaker, Safieddin Safavi-Naeini, Raed M. Shubair, University of Waterloo, Canada

FR-A3.1A.7 **10:20**

Predicting MRI RF Exposure for Complex-shaped Medical Implants Using Artificial Neural Network

Qianlong Lan, Jianfeng Zheng, Ji Chen, University of Houston, United States

FR-A3.1A.8 **10:40**

Preliminary Study on Differences between Full- and Sub-Structure Characteristic Modes

Shang Xiang, Buon Kiong Lau, Lund University, Sweden

FR-A3.1A.9 **11:00**

Reflection Behavior of Metasurface Using Full-wave and Characteristic Mode Analyses

Mohammed Alharbi, Constantine Balanis, Craig Birtcher, Arizona State University, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia

FR-A3.1A.10 **11:20**

Surface Reconstruction of Large Reflector Antennas Based on a Hybrid of CMA-ES and HIO Algorithms

Yueshu Xu, Qian Ye, Shanghai Jiao Tong University, China; Ahmad Hoorfar, Villanova University, United States

Friday, July 12 08:00 - 09:40
FR-A1.3A Room 211

Microstrip Antenna Arrays II

Session Co-Chairs: Gokhan Mumcu, University of South Florida; Enrique González, University of South Florida

FR-A1.3A.1 **08:00**

Comparison of the Radiation Characteristics for Balanced- and Unbalanced-Feed Grid Array Antennas Composed of Rectangular Loop Cells

Toru Kawano, National Defense Academy, Japan; Hisamatsu Nakano, Hosei University, Japan

FR-A1.3A.2 **08:20**

Microfluidic Switches with Integrated Actuation for Mm-Wave Beam-Steering Arrays

Enrique González, Gokhan Mumcu, University of South Florida, United States

FR-A1.3A.3 **08:40**

Low-Cost Dual-Polarized 60 GHz Patch Antenna Array in PCB Process

Haiyang Xia, Jincan Hu, Lianming Li, Fu-Chun Zheng, Southeast University, China; Tao Zhang, Xidian University, China

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

Simulation Design of Beam-scanning Self-phase-shift Dipole Array Based on Liquid-metal Materials

Yuwei Zhang, Shu Lin, Zhiyuan Sun, Yang Li, Zhuang Chen, Cai-Tian Yang, Hongjun Zhang, Alexander Denisov, Harbin Institute of Technology, China

FR-A1.3A.5 **09:20**

Design of a Rotman lens antenna array for wide-scan and beam uniformity applications

Rui Wang, Feng Yang, Peng Yang, Yi Yan, University of Electronic Science and Technology of China (UESTC), China

Friday, July 12 10:00 - 11:40
FR-A1.4A Room 211

Microstrip Antennas, Circuits and Design II

Session Chair: Mona Zaghloul, George Washington University

FR-A1.4A.1 **10:00**

Nonreciprocal Radiation Pattern Metasurface Transformer

Reza Karimian Bahnemiri, George Washington University, United States; Sajjad Taravati, University of Concordia, Canada; Shahrokh Ahmadi, Mona Zaghloul, George Washington University, United States

FR-A1.4A.2 **10:20**

On the Placement of Particle Containing Cylindrical Cavities in a Grounded Dielectric Substrate to Change the Impedance of a Printed Reactive Surface

Jerika Cleveland, Dipankar Mitra, Jacob Lewis, Benjamin D. Braaten, North Dakota State University, United States; Jeffery Allen, Monica Allen, Air Force Research Laboratory, United States

FR-A1.4A.3 **10:40**

Electromagnetic Simulation of CMOS On-Chip Spiral Inductors in 5 GHz band

Takuichi Hirano, Tokyo City University, Japan; Ning Li, Chuo University, Japan; Kenichi Okada, Tokyo Institute of Technology, Japan; Takeshi Inoue, Masatsugu Sogabe, SHI-ATEX Co., Ltd., Japan

FR-A1.4A.4 **11:00**

Dual-Polarized Filtering Antenna Using SRR Without Extra Circuit

Daotong Li, Chongqing University, China; Yaohui Zhang, Yonghong Zhang, Yong Fan, University of Electronic Science and Technology of China, China

FR-A1.4A.5 **11:20**

RCS Reduction of a Microstrip Antennas Using Cross Polarization Conversion Metasurface

Mustafa K. Taher Al-Nuaimi, Yejun He, Shenzhen University, China

Friday, July 12 08:00 - 11:40
FR-UB.1A Room 212

Imaging, Scattering and Remote Sensing

Session Co-Chairs: Vladimir Okhmatovski, University of Manitoba; Su Yan, Howard University

FR-UB.1A.1 **08:00**

On Elimination of Ill-posedness in the Inverse Problem via Separation of Partial Scattered Field Using New Antenna Array Concept

Md Jamil Feroj, Lotfollah Shafai, Vladimir Okhmatovski, University of Manitoba, Canada

FR-UB.1A.2 **08:20**

Deep Tissue Biomedical Imaging Using a Wearable Sensor

Md Asiful Islam, Bangladesh University of Engineering and Technology, Bangladesh; John L. Volakis, Florida International University, United States

FR-UB.1A.3 **08:40**

High-Resolution J-Band Radar with Continuous 360o Imaging Capability for Autonomous Vehicle Applications

Adib Nashashibi, Abdulrahman Alaqeel, University of Michigan, United States; Hussein Shaman, King Abdulaziz City for Science and Technology, Saudi Arabia; Kamal Sarabandi, University of Michigan, United States

FR-UB.1A.4 **09:00**

Optimizing for Spatial Frequency Coverage vs. Point-Spread Function Sidelobe Level in Active Incoherent Microwave Imaging Arrays

Sean Ellison, Stavros Vakalis, Jeffrey Nanzer, Michigan State University, United States

FR-UB.1A.5 **09:20**

Drone-based RF Monitoring System for Agriculture Applications

Tsotne Kvelashvili, Ozlem Kilic, Catholic University of America, United States; Aly E. Fathy, University of Tennessee at Knoxville, United States

Break **09:40**

FR-UB.1A.6 **10:00**

A Resonant-Free Integral Formulation for EM Scattering from Electrically Large High-Q Cavities

Su Yan, Howard University, United States

FR-UB.1A.7 **10:20**

Data Averaging Enhancements of the Predictive Accuracy of Machine-Learning-Based Microwave Sensing for Estimating Cranberry Fruit Yields

Alex Haufler, John Booske, Susan Hagness, University of Wisconsin-Madison, United States

FR-UB.1A.8 **10:40**

Sparse-aperture qualitative inverse scattering using a multipole formulation

Matthew Burfeindt, Hatim Alqadah, Naval Research Laboratory, United States

FR-UB.1A.9 **11:00**

Angle Estimation Using an Active 38 GHz Interferometric Radar

Stavros Vakalis, Liang Gong, Eric Klinefelter, Jeffrey Nanzer, Michigan State University, United States

FR-UB.1A.10 **11:20**

Analysis of Radar Cross Section of a FSS Radome Mounted on a Cylindrical PEC body

Hokeun Shin, Daeyeong Yoon, Yong Bae Park, Ajou University, Korea (South)

UWB Antenna Technologies for Radar

Session Co-Chairs: Fernando Rodriguez-Morales, University of Kansas; Jay McDaniel, University of Oklahoma

FR-SP.1P.1 **13:20**

Wideband 3D Printed Conformal Dielectric Antenna with End-fire Radiation

Jin Huang, Beijing Institute of Technology, China; Shengjian Chen, University of Adelaide, Australia; Zhenghui Xue, Beijing Institute of Technology, Australia; Withawat Withayachumnankul, Christophe Fumeaux, University of Adelaide, Australia

FR-SP.1P.2 **13:40**

A High Gain Broadband Quasi-Yagi Dielectric Lens Antenna for 5G and Millimeter Wave Applications

Essa Mujammami, Abdel Razik Sebak, Concordia University, Canada

FR-SP.1P.3 **14:00**

Performance of Multi-Arm Sinuous Antenna in Analog and Digital Angle of Arrival Estimation

Mohamed Elmansouri, Dejan Filipovic, University of Colorado at Boulder, United States; Paul Hoover, L-3 Communications, Randtron Antenna Systems, United States

FR-SP.1P.4 **14:20**

Signal to Noise Ratio Budget of a Pico-Seconds Pulsed Radar System for Stand-Off Imaging

Arturo Fiorellini Bernardis, Paolo Sberna, Andrea Neto, Nuria Llombart, Delft University of Technology, Netherlands

FR-SP.1P.5 **14:40**

A circularly polarized printed monopole antenna for Radar application

Takafumi Fujimoto, Tomoyuki Ohara, Chai-Eu Guan, Nagasaki University, Japan

Break **15:00**

FR-SP.1P.6 **15:20**

Sinuous Antenna Design for UWB Radar

Dylan Crocker, Sandia National Laboratories, United States; Waymond Scott, Georgia Institute of Technology, United States

FR-SP.1P.7 **15:40**

An Acorn-shaped Folded Bowtie Antenna for UWB Radar Application

Guangyao Yang, Shengbo Ye, Yicai Ji, Guangyou Fang, Key Laboratory of Electromagnetic Radiation and Sensing Technology, Chinese Academy of Sciences, Beijing 100190, China, China

FR-SP.1P.8 **16:00**

An Ultra-wideband (16-40 GHz) mmWave Antenna for Automotive Radar and 5G Applications

Muhammad Awais, Arslan Riaz, Wasif Tanveer Khan, Lahore University of Management Sciences, Pakistan

FR-SP.1P.9 **16:20**

Design of a High-Gain, Wideband, Circularly Polarized Slot Antenna

Zabed Iqbal, University of Alabama in Huntsville, United States; Sungkyun Lim, Georgia Southern University, United States

Topological Electromagnetics

Session Co-Chairs: Francesco Monticone, Cornell University; Ali Hassani Gangaraj, Cornell University

FR-SP.2P.1 **13:20**

Topological electromagnetics in complex scenarios: Non-reciprocal, non-Hermitian, non-linear, and non-local material structures

S. Ali Hassani Gangaraj, Francesco Monticone, Cornell University, United States

FR-SP.2P.2 **13:40**

Topological Delay Lines

Mykhailo Tymchenko, University of Texas at Austin, United States; Sander Mann, Advanced Science Research Center, United States; Andrea Alù, CUNY Advanced Science Research Center, United States

FR-SP.2P.3 **14:00**

Circular-Polarization Biased Topological Insulators

Dimitrios Sounas, Wayne State University, United States

FR-SP.2P.4 **14:20**

Topological Metasurfaces for Robust One-dimensional Waves

Dia'aaldin Bisharat, Daniel Sievenpiper, University of California, San Diego, United States

FR-SP.2P.5 **14:40**

Manipulating surface waves and nanoscale torques with nonreciprocal platforms

S. Ali Hassani Gangaraj, Francesco Monticone, Cornell University, United States

Break **15:00**

FR-SP.2P.6 **15:20**

A New Design Tool for Shaping the Radiation Pattern of Patch Antennas

Mirko Barbuto, Niccolò Cusano University, Italy; Mohammad-Ali Miri, City University of New York, United States; Andrea Alù, CUNY Advanced Science Research Center, United States; Filiberto Bilotti, Alessandro Toscano, Roma Tre University, Italy

FR-SP.2P.7 **15:40**

Rigorous analysis of a reciprocal PTD-symmetric structure supporting a back-scattering protected edge mode

Enrica Martini, University of Siena, Italy; Mario G. Silveirinha, University of Lisbon, Portugal; Stefano Maci, University of Siena, Italy

FR-SP.2P.8 **16:00**

Non-Hermitian Doping of Epsilon-Near-Zero Media

Marino Coppolaro, Massimo Moccia, Giuseppe Castaldi, University of Sannio, Italy; Nader Engheta, University of Pennsylvania, United States; Vincenzo Galdi, University of Sannio, Italy

FR-SP.2P.9 **16:20**

Band Structures and Modal Fields in Topological Acoustics: An Integral Equation Formulation

Shurun Tan, Zhejiang University, China; Leung Tsang, University of Michigan, United States

Microstrip Antenna Analysis and Design

Session Co-Chairs: Nathan Jeong, University of Alabama; Sangkil Kim, Pusan National University

FR-A1.1P.1 **13:20**

Mechanical Tension Effects on Cylindrical Truncated-Corner Microstrip Antennas

Diego Moná, Eduardo Sakomura, Daniel Chagas do Nascimento, Daniel Ferreira, Technological Institute of Aeronautics, Brazil

FR-A1.1P.2 **13:40**

Augmenting a Patch Antenna with a Hybrid Particle Swarm Optimization Algorithm

Holden Clark, Nathan Seongheon Jeong, University of Alabama, United States; Sangkil Kim, Pusan National University, Korea (South)

FR-A1.1P.3 **14:00**

General Design Equations For 3-Way Unequal-Split Bagley Power Dividers

Omar Jibreel, Nihad Dib, Jordan University of Science and Technology, Jordan; Khair Al Shamaileh, Purdue University Northwest, United States

FR-A1.1P.4 **14:20**

Effect of curved ground plane on electrical performance of microstrip antenna

Wei Wang, Yan-jun Wang, Shun-xi Lou, Ya-tian Zhou, Xidian University, China; Meng Wang, Shaanxi Yellow River Group Company, China

FR-A1.1P.5 **14:40**

End-Fire CP Millimeter-Wave Antenna Loaded with Perforated Dielectric Slab

Zheng Gan, Zhi-Hong Tu, Na Nie, Fu-Chang Chen, South China University of Technology, China

Break **15:00**

FR-A1.1P.6 **15:20**

Half Ellipse Magnetic Dipole Antenna for Wide Beam-Width and Low Cross-Polarization

Jeong-Wook Kim, Sol Kim, Jin-Woo Kim, Ghoo Kim, Jong-Won Yu, Korea Advanced Institute of Science and Technology (KAIST), Korea (South)

FR-A1.1P.7 **15:40**

Planar Vertically Polarized Quasi-Yagi Antennas Using Magnetic Current Loops

Kevin Xu, Nathan Chordas-Ewell, Jun H. Choi, University at Buffalo, The State University of New York, United States

FR-A1.1P.8 **16:00**

Negative Group Delay Folded Circuit with Distributed Broadside Parallel Line

Raymundo De Amorim Jr., Glauco Fontgalland, Raquel Aline Araújo Rodrigues, Alexandre Henrique Soares de Oliveira, Federal University of Campina Grande, Brazil; Humberto Dionisio, Federal University of Semi-Arid, Brazil

FR-A1.1P.9 **16:20**

Folded 1-bit Transmitarray with Reduced Height

Yuan-Ming Cai, Yinzeng Yin, Xidian University, China

Reconfigurable Reflectarrays

Session Co-Chairs: Ahmed A. Kishk, Concordia University; Xun Gong, University Of Central Florida

FR-A1.2P.1 **13:20**

A tunable ferroelectric unit cell for wideband beam-steering reflectarray antennas

Huan Li, Zhenjiang Zhao, Zhefei Wang, Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

FR-A1.2P.2 **13:40**

Steerable Spiral Slot Reflectarray at 66 GHz Using Micromachined Movable Silicon Slab

Kendrick Henderson, Nima Ghalichechian, Ohio State University, United States

FR-A1.2P.3 **14:00**

Ultra-Low-Loss, Binary-State Elements for a Mechanically Actuated Reconfigurable Reflectarray

Scott Rudolph, Michael Nurnberger, Hatim Alqadah, Justin Bobak, Naval Research Laboratory, United States

FR-A1.2P.4 **14:20**

Near Field Focusing using a Circularly Polarized Reconfigurable Reflectarray

Marzieh Mehri Dehnavi, Jean-Jacques Laurin, Polytechnique Montréal, Canada

FR-A1.2P.5 **14:40**

EBG Antenna for Automotive Applications

Seungmin Woo, Byeongyong Park, Ilnam Cho, Yeongho Je, LG Electronics Inc., Korea (South)

Break **15:00**

FR-A1.2P.6 **15:20**

Loss Optimization of Dual-Resonance Phase-Agile Reflectarray Using Equivalent Circuit

Michael Trampler, University of Central Florida, United States; Xun Gong, University Of Central Florida, United States

FR-A1.2P.7 **15:40**

Low-Profile Electronically Tunable Low-Loss Single Layer Reflectarray Element

Muhammad M. Tahseen, Jean-Jacques Laurin, Poly-Grames Research Center, Polytechnique Montréal, Canada

FR-A1.2P.8 **16:00**

X-Band Reconfigurable Reflectarray Element using Frequency Selective Surface

Muhammad M. Tahseen, INRS-EMT, Canada; Ahmed Kishk, Concordia University, Canada; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

FR-A1.2P.9 **16:20**

Design of A Beam Scanning Reconfigurable Reflectarray at Ku-Band

Yang Liu, Hongjian Wang, Lifang Zhang, National Space Science Center, Chinese Academy of Sciences, China

Novel Metasurfaces and Applications

Session Co-Chairs: Yang Hao, Queen Mary University of London; Alexander Yakovlev, University of Mississippi

FR-A2.1P.1 **13:20**

Metamaterial Application in a Circular Microstrip Antenna Developed for the Detection of Partial Discharges

George Victor Rocha Xavier, Edson Guedes da Costa, Alexandre Jean René Serres, Camila Caroline Rodrigues de Albuquerque, Federal University of Campina Grande, Brazil

FR-A2.1P.2 **13:40**

Rotational Doppler Effect of Spinning Metasurface in Radar System

Baiyang Liu, Hongchu Chu, Henry Giddens, Yang Hao, Queen Mary University of London, United Kingdom; Ronglin Li, South China University of Technology, China

FR-A2.1P.3 **14:00**

Parallel-Plate Waveguides Formed by Arbitrary Impedance Sheets

X. Ma, Northwestern Polytechnical University, China; Mohammad Mirmoosa, S.A. Tretyakov, Aalto University, Finland

FR-A2.1P.4 **14:20**

Metagrating-Inspired Approach for Suppressing Reflections in H-Plane Waveguide Bends

Liran Biniashvili, Ariel Epstein, Technion - Israel Institute of Technology, Israel

FR-A2.1P.5 **14:40**

Augmented Unit Cells for Realizing TM-Polarized Huygens' Metasurfaces

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

Break **15:00**

FR-A2.1P.6 **15:20**

A Metafilm Based on Magnetic-Metamaterial-Lined Discs

Elham Baladi, Ashwin K. Iyer, University of Alberta, Canada

FR-A2.1P.7 **15:40**

L-shaped Metasurface for Chiral Surface Waves Propagation

Sara Kandil, Dia'aaldin Bisharat, Daniel Sievenpiper, University of California, San Diego, United States

FR-A2.1P.8 **16:00**

A Novel Coding Metasurface Unit for Reconfigurable Reflectors

Rui Wang, Feng Yang, Peng Yang, Xiao Ma, University of Electronic Science and Technology of China (UESTC), China

3D Printed Antennas and Structures

Session Co-Chairs: Premjeet Chahal, Michigan State University; Kevin Cook, Georgia Tech Research Institute

FR-A5.1P.1 **13:20**

Study of 3D printed HoneyComb Microwave Absorbers

Vincent Laur, Azar Maalouf, Alexis Chevalier, Lab-STICC / UBO, France; Fabrice Comblet, Lab-STICC / ENSTA Bretagne, France

FR-A5.1P.2 **13:40**

3D Printed 2.45 GHz Yagi-Uda Loop Antenna Utilizing Microfluidic Channels and Liquid Metal

Ajibayo Adeyeye, Ryan Bahr, Manos Tentzeris, Georgia Institute of Technology, United States

FR-A5.1P.3 **14:00**

A 3D Printed Lens Antenna for 5G Applications

Christian Ballesteros, Marcos Maestre, Maria Concepcion Santos, Jordi Romeu, Luis Jofre Roca, Universitat Politecnica de Catalunya (UPC), Spain

FR-A5.1P.4 **14:20**

An Offset-Fed Wideband 3D Printed Aperture Coupled Trapezoidal Dielectric Resonator Antenna

Ami Desai, Payam Nayeri, Colorado School of Mines, United States

FR-A5.1P.5 **14:40**

3D Printed Inhomogeneous Microwave Lense of an Arbitrary Shape

Arielle Sanford, Corey Webber, Forecast3D Inc, United States

Break **15:00**

FR-A5.1P.6 **15:20**

3D-Printed Scanning Dielectric Lens Antenna

Ahmed Hegazy, Mohamed Basha, Safieddin Safavi-Naeini, University of Waterloo, Canada

FR-A5.1P.7 **15:40**

A 3D Printed Fragmented Aperture Antenna

Kevin Cook, David Richardson, Justin Htay, James Dee, Christopher Howard, Georgia Tech Research Institute, United States

FR-A5.1P.8 **16:00**

A 3D Printed Compact PIFA for 5G Applications

Mohd Ifwat Mohd Ghazali, Saranraj Karuppuswami, Saikat Mondal, Premjeet Chahal, Michigan State University, United States

FR-A5.1P.9 **16:20**

Design and Test of 3-D Printed Spherical Ground Planes for Monopole Antennae

Eli Mehmeti, Reena Dahle, State University of New York (SUNY) at New Paltz, United States

FR-A5.1P.10 **16:40**

A 3-D Printed Circularly Polarized Filtering Antenna

Yi Zhang, Jun Xu, Xi He, Fan Zhang, Ying Sun, Xiaoyan Li, Bo Liu, University of Electronic Science and Technology of China, China

Radiators and their Array Integration

Session Co-Chairs: Jeffrey Connor, Georgia Tech Research Institute; James Skala, Georgia Tech Research Institute

FR-A1.3P.1 **13:20**

A Wide Coverage S-Band Array with Dual Polarized Connected Bowtie Antenna Elements

Prabhat Khanal, Jian Yang, Marianna Ivashina, Chalmers University of Technology, Sweden; Anders Hook, Ruoshan Luo, SAAB AB, Sweden

FR-A1.3P.2 **13:40**

Potentialities of Reduced Beamforming Antennas using Magneto-Electric Dipoles

Abdul-Sattar Kaddour, Jorick Milbrandt, Hala Alzein, Cyrille Menudier, Marc Thevenot, Univ. Limoges, CNRS, XLim, France; Philippe Pouliguen, Patrick Potier, Direction Générale de l'Armement (DGA), France; Maxime Romier, Centre national d'études spatiales, France

FR-A1.3P.3 **14:00**

Dual-Polarized Planar Phased Array Antenna With Semi-Open Cavity Structures

Peng Zhang, Shi-Wei Qu, University of Electronic Science and Technology of China, China

FR-A1.3P.4 **14:20**

A 60 GHz LTCC Magneto-Electric Dipole Phased Array with Symmetric Hybrid Feeding Network

Tao Zhang, Zhangming Zhu, Xidian University, China; Lianming Li, Haiyang Xia, Tie Jun Cui, Southeast University, China

FR-A1.3P.5 **14:40**

Broad Band and Wide Scan SIW Cavity-backed Phased Arrays for 5G Applications

Hao Liu, University of Electronic Science and Technology of China, China; Anyong Qing, Southwest Jiaotong University, China; Zhengdong Yu, Shengzhang Zhang, RDW Technology Co., Ltd, Chengdu, China

Break **15:00**

FR-A1.3P.6 **15:20**

A Planar Ultrawideband Wide-angle Scanning Tightly Coupled Array Loaded With Metal Strips

Zhiguo Jiang, Shaoqiu Xiao, Zhixin Yao, University of Electronic Science and Technology of China, China

FR-A1.3P.7 **15:40**

A Low-Profile Wideband Connected Slot Array for Wide-Angle Scanning

Yan Li, Shaoqiu Xiao, Bing-Zhong Wang, University of Electronic Science and Technology of China, China

FR-A1.3P.8 **16:00**

SIW-Backed Array with Compensated Mutual Coupling for Wide-Angle Scanning

Fu-Long Jin, Xiao Ding, Zhipeng Wang, Wei Shao, University of Electronic Science and Technology of China, China

FR-A1.3P.9 **16:20**

A Deployable Metamaterial Reflectarray Antenna for Microsatellite Application

Amit Kumar Singh, Seong-Ook Park, Korea Advanced Institute of Science and Technology (KAIST), Korea (South)

Tunable and Reconfigurable Frequency Selective Surfaces

Session Co-Chairs: Ladislau Matekovits, Politecnico di Torino; Constantinos Zekios, Florida International University

FR-A2.2P.1 **13:20**

Fully Inkjet-printed Tunable Hybrid n-Rpple Miura (n-RiM) Frequency Selective Surfaces

Syed Abdullah Nauroze, Manos Tentzeris, Georgia Institute of Technology, United States

FR-A2.2P.2 **13:40**

An Independently Tunable Uniplanar Dual Band Band-Stop Frequency Selective Surface

Nibirh Jawad, Loïc Markley, University of British Columbia, Canada

FR-A2.2P.3 **14:00**

A Dual-Band Origami FSS

Akash Biswas, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

FR-A2.2P.4 **14:20**

Dual beam end-fire antenna using cantilever-enabled Frequency Selective Surfaces

Arun Kesavan, Institut national de la recherche scientifique (INRS), Canada; Tayeb A. Denidni, National Institute of Scientific Research (INRS), Canada

FR-A2.2P.5 **14:40**

Higher Order Plasma-Based Tunable Absorber Using Magneto-Dielectric Substrates

Komlan Payne, Jay K. Lee, Syracuse University, United States; Kevin Xu, Jun H. Choi, University at Buffalo, The State University of New York, United States

Break **15:00**

FR-A2.2P.6 **15:20**

Beam Steering Using Active Superstrate Antenna for WLAN Applications

Nosherwan Shoaib, Sana Ilyas, Aimen Raza, Tayyab Hassan, National University of Sciences and Technology (NUST), Pakistan

FR-A2.2P.7 **15:40**

A Novel Dual Polarized Tunable Frequency Selective Surface With Varactors

Yuting Zhao, Yingsong Li, Harbin Engineering University, China; Xiaoguang Liu, University of California, Davis, United States

FR-A2.2P.8 **16:00**

Bending Analysis of Switchable Frequency Selective Surface Based on Flexible Composite Substrate

Hijab Zahra, Syed Muzahir Abbas, Raheel Hashmi, Macquarie University, Australia; Ladislau Matekovits, Politecnico di Torino, Italy; Karu Esselle, Macquarie University, Australia

FR-A2.2P.9 **16:20**

Thick Frequency Selective Surfaces for High Power Microwave Applications

Xi-Wen Xiao, Chien-Hao Liu, National Taiwan University, Taiwan

FR-A2.2P.10 **16:40**

Preliminary Study of a Cylindrical Microstrip Metasurface Using the State Space Method

Barbara Cappello, Ladislau Matekovits, Politecnico di Torino, Italy; Krishna Naishadham, Georgia Institute of Technology, United States

Friday, July 12 | 13:20 - 14:20
FR-A5.2P | Room 203

Sub-6 GHz MIMO Antenna Design

Session Chair: Hao Xin, University of Arizona

FR-A5.2P.1 **13:20**

Origami Multimode Ring Antenna Based on Characteristic Mode Analysis

Nicholas Russo, Constantinos L. Zekios, Stavros V. Georgakopoulos, Florida International University, United States

FR-A5.2P.2 **13:40**

A Reconfigurable UWB MIMO Antenna for Indoor and Outdoor Communication Applications

Narayan Agnihotri, Adnan Kantemur, Jinpil Tak, Hao Xin, University of Arizona, United States

FR-A5.2P.3 **14:00**

Dual-band Printed Monopole Antenna for Indoor MIMO Applications

Mohamed Morsy, Texas A&M University-Texarkana, United States

Friday, July 12 | 15:20 - 17:00
FR-A1.4P | Room 203

Polarization Reconfigurable Antennas

Session Chair: Andrew Bogle, University of Dayton

FR-A1.4P.1 **15:20**

Polarization and Bandwidth Reconfigurable Rectangular Dielectric Resonator Antenna

Beijia Liu, Changhui Wang, Jinghui Qiu, Nannan Wang, Shengchang Lan, Hua Zong, Harbin Institute of Technology, China

FR-A1.4P.2 **15:40**

Research on Polarization-Reconfigurable Holographic Metasurface

Mei Li, Ming-Chun Tang, Chongqing University, China; Yaohui Zhang, University of Electronic Science and Technology of China, China

FR-A1.4P.3 **16:00**

Polarization Reconfigurable Patch Antenna With a Continuously Rotatable Polarization Plane

Makoto Sano, Makoto Higaki, Toshiba Corporation, Japan

FR-A1.4P.4 **16:20**

A High-Gain Quad-Polarization Reconfigurable Antenna

Guoying Lin, Yuehui Cui, RongLin Li, South China University of Technology, China

FR-A1.4P.5 **16:40**

Dual-Band and Dual-Polarized Reconfigurable Beam-Steering Array for WLAN Applications

YuYi Gan, Peng Yang, Feng Yang, University of Electronic Science and Technology of China, China

Friday, July 12 | 13:20 - 14:40
FR-A1.5P | Room 211

Slot Arrays II

Session Co-Chairs: Eva Rajo-Iglesias, University Carlos III of Madrid; Kiersten C. Kerby-Patel, University of Massachusetts, Boston

FR-A1.5P.1 **13:20**

A Novel Compact High-Gain Filtenna Using Gap Waveguide Technology

Hossein Sarbandi Farahani, Wolfgang Bösch, Technical University of Graz, Austria

FR-A1.5P.2 **13:40**

Design of a Transverse Slot Array in Groove Gap Waveguide using Horns at 28 GHz Band

Chih-Kai Hsieh, Malcolm Ng Mou Kehn, National Chiao Tung University, Taiwan; Eva Rajo-Iglesias, Universidad Carlos III de Madrid, Taiwan

FR-A1.5P.3 **14:00**

A High Gain Slotted Waveguide Array Filtering Antenna

Yi Zhang, Jun Xu, Fan Zhang, Xi He, Xiaoyan Li, Bo Liu, University of Electronic Science and Technology of China, China

FR-A1.5P.4 **14:20**

Partition Waveguide Slotted Array With Shaped Patterns

Hongjian Wang, Yunhua Zhang, NSSC, CAS, China

Friday, July 12 | 15:20 - 16:40
FR-A1.6P | Room 211

Array Hardware Systems

Session Co-Chairs: Christopher Edmonds, Georgia Tech Research Institute; Glenn Hopkins, Georgia Tech Research Institute

FR-A1.6P.1 **15:20**

Balanced-Diplexer Frequency Division Duplex Subarray for X-band Phased Array

Elie Tianang, Mohamed Elmansouri, Ljubodrag Boskovic, Dejan Filipovic, University of Colorado at Boulder, United States

FR-A1.6P.2 **15:40**

1D Array Antennas In Tandem for a Large Gain and Moving the Direction of the End-Fire Beam

Changhyeong Lee, Heejun Park, Gwangyun Namgung, Sungtek Kahng, Incheon National University, Korea (South); Yong-Seok Lim, Korea Electronics Technology Institute, Korea (South)

FR-A1.6P.3 **16:00**

Wide-Angle Scanning Phased Array Antenna

Bowen Ji, Gu Yang, Company of Brave Sky Technology, China

FR-A1.6P.4 **16:20**

A SIW Leaky-Wave Beam Scanning Array

Xiao Ding, Yu-Ming Wu, Fu-long Jin, Zhi-Peng Wang, Bing-Zhong Wang, University of Electronic Science and Technology of China, China

Millimeter-wave Propagation

Session Co-Chairs: Alenka Zajic, Georgia Institute of Technology; Dmitry Chizhik, Nokia Bell Labs

TUP-A4.1P.1 **Board .1**

Path Loss and Directional Gain Measurements at 28 GHz for Factory Automation

Dmitry Chizhik, Jinfeng Du, Reinaldo Valenzuela, Juergen Otterbach, Rolf Fuchs, Johannes Koppenborg, Nokia Bell Labs, United States

TUP-A4.1P.2 **Board .2**

THz MIMO Channel Characterization for Wireless Data Center-Like Environment

Chia-Lin Cheng, Seun Sangodoyin, Alenka Zajić, Georgia Institute of Technology, United States

TUP-A4.1P.3 **Board .3**

Implementation and Evaluation of Uniform Grid Space Partition for Ray Tracing in Communication

Hang Mi, Bo Ai, Ke Guan, State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, China; Liju Zhu, Tianyun Shui, Hui Mei, Chenji Liu, Jiangxi Mobile Communication Company Limited, China

TUP-A4.1P.4 **Board .4**

A High-Performance Computing Cloud-Based Ray-Tracing Platform – CloudRT

Wei Liu, China Mobile Group Design Institute Co., Ltd., China; Ke Guan, Danping He, Beijing Jiaotong University, China; Yebing Ren, China Mobile Group Design Institute Co., Ltd., China; Wencui Shen, Liang Zhou, Jiangxi Mobile Communication Company Limited, China

TUP-A4.1P.5 **Board .5**

The Influence of Satellite Links over 5G mmWave Terrestrial Channel in Typical Urban Scenario

Lei Ma, Ke Guan, Beijing Jiaotong University, China; Wulong Li, Jiangxi Mobile Communication Company Limited, China; Dong Yan, Beijing Jiaotong University, China; Wei Sun, Hang Qi, China Mobile Group Design Institute Co., Ltd., China

Propagation and Scattering in Complex and Random Media

Session Co-Chairs: Vikass Monebhurrun, Centrale Supelec; David Geroski, University of Michigan

TUP-A4.2P.1 **Board .6**

A Modified Beckmann-Kirchhoff Scattering Model for Slightly Rough Surfaces at Terahertz Frequencies

Fawad Sheikh, Thomas Kaiser, University of Duisburg-Essen, Germany

TUP-A4.2P.2 **Board .7**

Modeling of Power Delay Profile in the Desktop Size Metal Cavity at 300 GHz

Jinbang Fu, Prateek Juyal, Alenka Zajić, Georgia Institute of Technology, United States

TUP-A4.2P.3 **Board .8**

Full Wave Analysis for Estimating Wave Attenuation In a Random Volume of Metallic Wires Using Monte Carlo Simulation

David Geroski, Kamal Sarabandi, University of Michigan, United States

TUP-A4.2P.4 **Board .9**

Fully-Coherent Electromagnetic Scattering Model for 3D Dense Random Volumes

Mostafa Zaky, Kamal Sarabandi, University of Michigan, United States

TUP-A4.2P.5 **Board .10**

Applicability of SSTDR Analysis of Complex Loads

Evan Benoit, Naveen Kumar Tumkur Jayakumar, Samuel Kingston, Mashad Uddin Saleh, Michael Scarpulla, University of Utah, United States; Joel Harley, University of Florida, United States; Cynthia Furse, University of Utah, United States

TUP-A4.2P.6 **Board .11**

Accuracy of the approximation of Dyadic Green's Function for Multilayered Uniaxial Anisotropic Medium

Hui-Ling Hu, Ping-Ping Ding, Fudan University, China

TUP-A4.2P.7 **Board .12**

Finite Element Domain Decomposition Method for Rough Sea Surface Scattering

Ozlem Ozgun, Hacettepe University, Turkey; Mustafa Kuzuoglu, Middle East Technical University, Turkey

TUP-A4.2P.8 **Board .13**

A Target Recognition-Based NLOS Identification Algorithm

Weikun Lyu, Yanjiong Li, Zhe Liu, Chen Huang, Ruisi He, Beijing Jiaotong University, China

TUP-A4.2P.9 **Board .14**

Quantitative Evaluation on Memory Characteristics of High-Speed Railway Fading Channel

Huimin Zhang, Siyu Lin, Jianwen Ding, Beijing Jiaotong University, China

TUP-A4.2P.10 **Board .15**

Millimeter-Wave Channel Measurement Based Ray-Tracing Calibration and Analysis in Metro

Chunfu Zheng, Ziheng Xu, Danping He, Ke Guan, Bo Ai, Beijing Jiaotong University, China; Juan Moreno Garc´ıa-Loygorri, Universidad Politécnica de Madrid, Spain

Propagation in Tunnel-like Environments

Session Chair: Nadir Hakem, Université du Québec en Abitibi-Témiscamingue

TUP-A4.3P.1 **Board .16**

Effect of Antenna Polarization, Directivity and Placement on Channel Propagation of an Arch-shaped Underground Mine Tunnel

Intikhab Hussain, Frederick Cawood, Rex van Olst, University of Witwatersrand, South Africa

TUP-A4.3P.2 **Board .17**

Estimating The Number of Modes in Underground Mine tunnel

Ali Nehme, Nahi Kandil, Nadir Hakem, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TUP-A4.3P.3 **Board .18**

Comparative study of Four Path Loss Models for UWB off-body Propagation Channel Inside a Mine

Moulay El Hassan El Azhari, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada; Larbi Talbi, Université du Québec en Outaouais, Canada; Mourad Nedil, Université du Québec en Abitibi-Témiscamingue (UQAT), Canada

TUP-A4.3P.4 **Board .19**

FOUR YEAR CLOUD ATTENUATION STUDY IN A TROPICAL STATION

Mustapha Adewusi, Lagos state University, Nigeria; Temidayo Omotosho, Lola Akinyemi, Sayo Akinwumi, Covenant University, Nigeria; Funmi Ometan, Lagos state University, Nigeria

Wave Propagation in Atmospheric Environment

Session Co-Chairs: James C. West, Oklahoma State University; Jean-Fu Kiang, National Taiwan University

TUP-A4.4P.1 **Board .21**

Analysis of Oxygen Absorption at 60 GHz Frequency Band

Muberra Arvas, Istanbul Medipol Univesity, Turkey; Mohammad Alsunaidi, Marmara university, Turkey

TUP-A4.4P.2 **Board .22**

Analysis of the SBAS signal availability at low latitude regions

Caio C. Marques, Bruno J. Affonso, Embraer, Brazil; Jonas Sousa Santos, Instituto Tecnológico de Aeronáutica, Brazil; Bruno C. Vani, Instituto Federal de Educação, Ciência e Tecnologia de São Paulo, Brazil; Alison Moraes, Instituto de Aeronáutica e Espaço - IAE, Brazil; Leonardo P. Marini, Bruno M. Paiva, Instituto de Controle do Espaço Aéreo - ICEA, Brazil; João F. Galera Monico, Universidade Estadual Paulista Julio de Mesquita Filho, Brazil

TUP-A4.4P.3 **Board .23**

Airborne Measurement of Instrument Landing System Signals using a UAV

James C. West, Joseph D. Jantz, Taylor Mitchell, Dane C. Johnson, Gary Ambrose, Oklahoma State University, United States

TUP-A4.4P.4 **Board .24**

Propagation of Low-Frequency Broadband Electromagnetic Field Waveforms in the Atmosphere

Aleksandr Voronin, Junseob Kim, Ping Yang, Robert Nevels, Aleksei Zheltikov, Texas A&M University, United States

TUP-A4.4P.5 **Board .25**

Channel Characterization and Simulation for Unmanned Aerial Vehicle Communication

Luoyan Zhu, Danping He, Ke Guan, Bo Ai, Zhangdui Zhong, Beijing Jiaotong University, China; Dawei Li, China Academy of Launch Vehicle Technology, China

TUP-A4.4P.6 **Board .26**

Atmospheric Attenuation Analysis in Indoor THz Communication Channels

Fawad Sheikh, Mai Alissa, University of Duisburg-Essen, Germany; Adnan Zahid, Qammer H. Abbasi, University of Glasgow, United Kingdom; Thomas Kaiser, University of Duisburg-Essen, Germany

TUP-A4.4P.7 **Board .27**

Analysis of Close Range Evaporation Duct Inversion from LATPROP Radar Data Collected During CASPER West Research Campaign

Joshua Compaleo, Caglar Yardim, Luyao Xu, Shanka Wijesundara, Joel Johnson, Robert Burkholder, Ohio State University, United States; Tony de Paolo, Scripps Institution of Oceanography, United States; Qing Wang, Naval Postgraduate School, United States

TUP-A4.4P.8 **Board .28**

Preliminary Scintillation Data Analysis of measurements done in CASPER West

Swagato Mukherjee, Caglar Yardim, Ohio State University, United States

TUP-A4.4P.9 **Board .29**

Variability of Evaporative Duct Properties and EM Signal Propagation Utilizing Large Eddy Simulations

Kyle Franklin, Qing Wang, US Navy, United States; Caglar Yardim, Ohio State University, United States; Lian Shen, Qingfang Jiang, Tao Cao, University of Minnesota, United States

TUP-A4.4P.10 **Board .30**

Comparison of Algorithms and Input Vectors for Sea-Ice Classification with L-band PolSAR Data

Kai-Shiun Yang, Jean-Fu Kiang, National Taiwan University, Taiwan

Wave Propagation in Indoor Environment

Session Chair: Simon Cotton, Queen's University Belfast

TUP-A4.5P.1 **Board .31**

Indoor Path Loss Variations with Frequency and Visibility Conditions at 3.5 GHz Band

Iñigo Cuiñas, Manuel García Sánchez, Universidade de Vigo, Spain; Arne Feys, Wout Debaenst, Jo Verhaevert, Ghent University, Belgium

TUP-A4.5P.2 **Board .32**

32-GHz outdoor-to-indoor channel measurement of propagation losses and delay spread

Juyul Lee, Kyung-Won Kim, Myung-Don Kim, Jae-Joon Park, Electronics and Telecommunications Research Institute, Korea (South)

TUP-A4.5P.3 **Board .33**

On the Non-Stationarity of Device to Device Channels with Dual Mobility in Indoor Environment

Gloria Makhoul, Raffaele D'Errico, The French Alternative Energies and Atomic Energy Commission (CEA), micro- and nanotechnologies and their integration into systems (LETI), Minatec campus and Université Grenoble-Alpes, France; Claude Oestges, Université catholique de Louvain, Belgium

TUP-A4.5P.4 **Board .34**

Wideband Propagation Channel Measurements in an Indoor Office Environment at 26 GHz

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A Measurements Based Characterization of Fading in Indoor Millimeter-Wave Distributed Antenna Systems

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Wave Propagation in Urban and Suburban Environments

Session Co-Chairs: Magdy Iskander, University of Hawaii; Glauco Fontgalland, Universidade Federal Rural do Semi-Árido (UFERSA); Wei Hong, Southeast University

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Jessen Narrainen, Gloria Makhoul, Raffaele D'Errico, The French Alternative Energies and Atomic Energy Commission (CEA), micro- and nanotechnologies and their integration into systems (LETI), Minatec campus and Université Grenoble-Alpes, France

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A comparison of spatial interpolation methods to determine the coverage area of a wireless system

Bruno Fialho, Humberto Andrade, Idalmir Queiroz Junior, Glauco Fontgalland, Universidade Federal Rural do Semi-Árido (UFERSA), Brazil

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Yanfei Niu, Jianwen Ding, Dan Fei, Zhangdui Zhong, Beijing Jiaotong University, China; Yanbing Liu, Jiaxun Feihong Intelligent Technology Institute, China

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Antenna Theory I

Session Co-Chairs: Ahmed A. Kishk, Concordia University; Kurt Schab, Santa Clara University

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Riddhi Goswami, Ahmed Kishk, Concordia University, Canada

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Ali Hosseini-Fahraji, Majid Manteghi, Virginia Polytechnic Institute and State University, United States

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Ryan J. Chaky, Douglas H. Werner, Pennsylvania State University, United States

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Arturo Fiorellini Bernardis, Andrea Neto, Diego Emer, Delft University of Technology, Netherlands; Angelo Freni, University of Florence, Italy; Nuria Llombart, Delft University of Technology, Netherlands

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Lukas Jelinek, Czech Technical University in Prague, Czech Republic; Kurt Schab, Santa Clara University, United States; Miloslav Capek, Czech Technical University in Prague, Czech Republic

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Kunning Liu, Shiwen Yang, Shi-Wei Qu, Yikai Chen, University of Electronic Science and Technology of China, China

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Session Co-Chairs: Majid Manteghi, Virginia Tech; Navid Barani, University of Michigan

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Navid Barani, Kamal Sarabandi, University of Michigan, United States

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Giada Maria Battaglia, Università Mediterranea di Reggio Calabria, Italy; Gennaro Giovanni Bellizzi, Department of Radiation Oncology, Erasmus MC, Netherlands; Andrea Francesco Morabito, Università Mediterranea di Reggio Calabria, Italy; Gino Sorbello, Università di Catania, Italy; Tommaso Isernia, Università Mediterranea di Reggio Calabria, Italy

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Mahesh Singh, Bratin Ghosh, Indian Institute of Technology, India; Kamal Sarabandi, University of Michigan, United States

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Session Chair: Andrea Neto, Delft University of Technology

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Bratin Ghosh, Mahesh Singh, Dhrubajyoti Bhattacharya, Indian Institute of Technology, India; Kamal Sarabandi, University of Michigan, United States

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Jiantong Li, Nima Ghalichechian, Ohio State University, United States

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Seyed Mohammad Amjadi, Menglou Rao, Kamal Sarabandi, University of Michigan, United States

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Wael Ahmad, Maciej Kucharski, Herman Ng, IHP - Leibniz-Institut für innovative Mikroelektronik, Germany; Dietmar Kissinger, Ulm University, Germany

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Session Co-Chairs: Thomas Hanley, Johns Hopkins Applied Physics Laboratory; Susan Hagness, University of Wisconsin-Madison

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Soumyabrata Dev, ADAPT SFI Research Center, Trinity College, Ireland; Shilpa Manandhar, Yee Hui Lee, Nanyang Technological University, Singapore; Stefan Winkler, National University of Singapore, Singapore

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Session Co-Chairs: Saba Mudaliar, Air Force Research Laboratory; Gary Brown, Virginia Tech

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Gary Brown, Kevin Diomedi, Virginia Polytechnic Institute and State University, United States

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Cuneyt Utku, Istanbul Sehir University, Turkey; Saul Torrico, Comsearch, United States; Roger Lang, George Washington University, United States

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Stefanos Bakirtzis, Costas Sarris, University of Toronto, Canada

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Elizabeth Bleszynski, Marek Bleszynski, Thomas Jaroszewicz, Monopole Research, United States

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Saba Mudaliar, Air Force Research Laboratory, United States

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Hang Wang, Reza Abedi, University of Tennessee Space Institute, United States; Saba Mudaliar, Air Force Research Laboratory, United States

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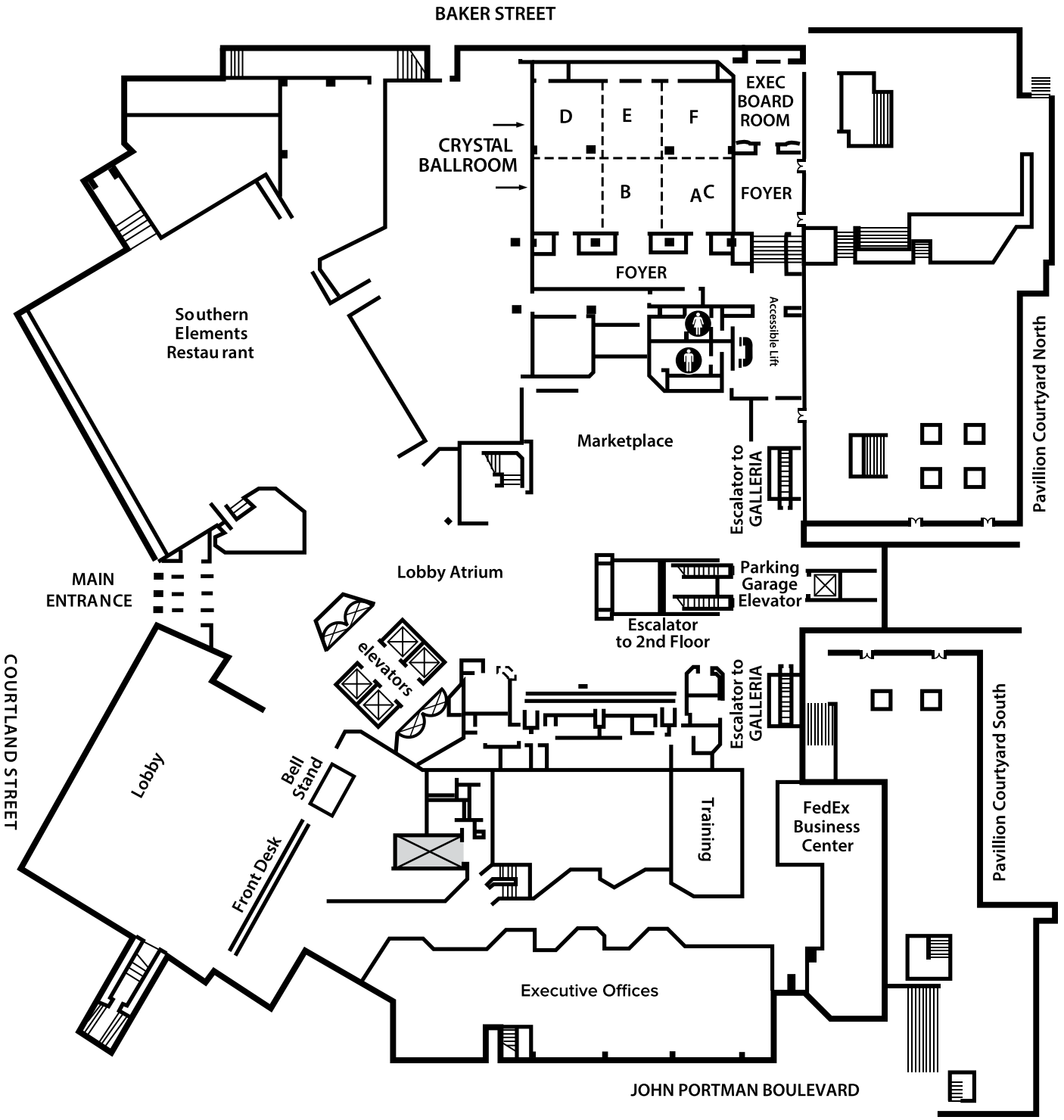
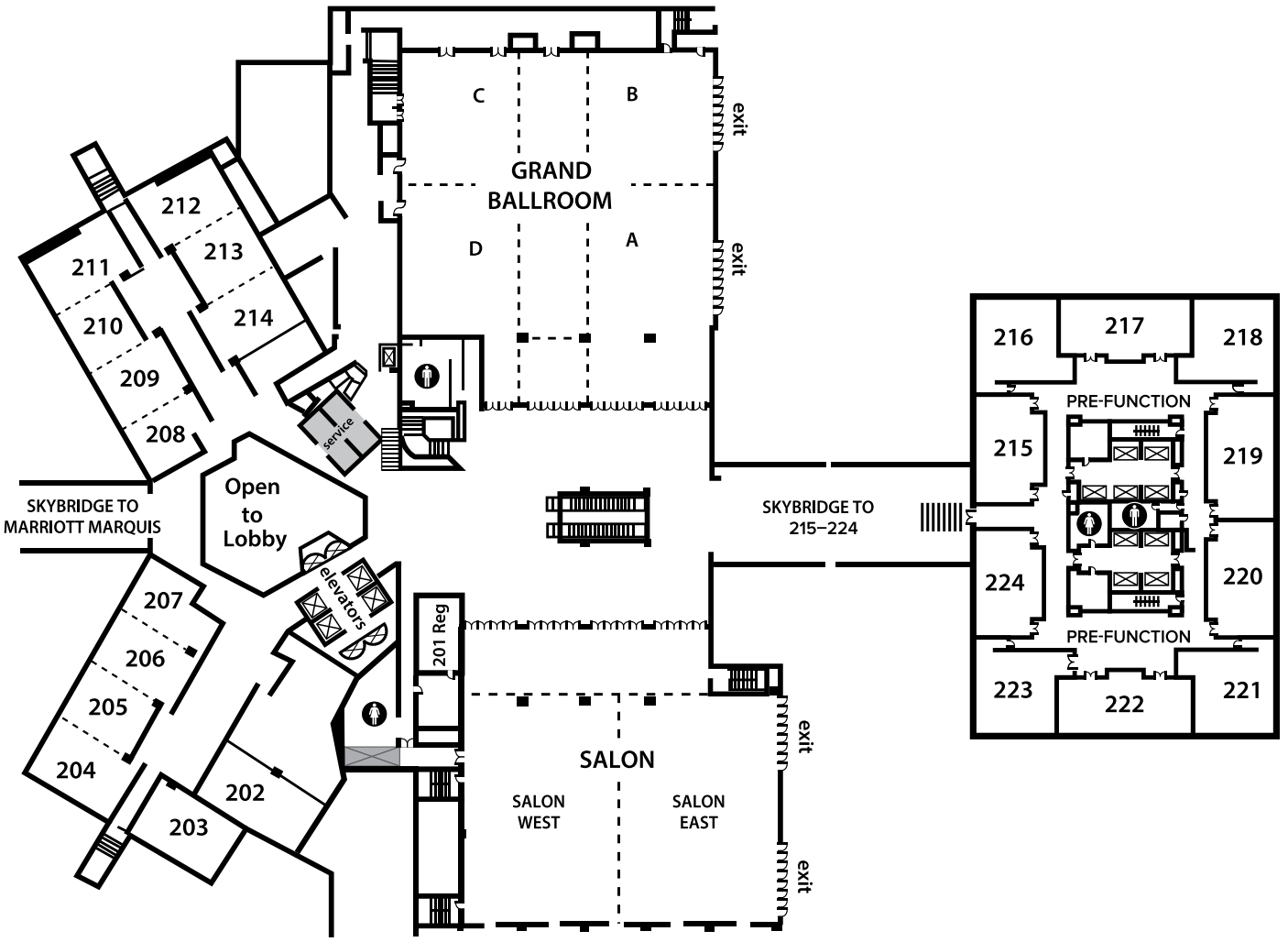
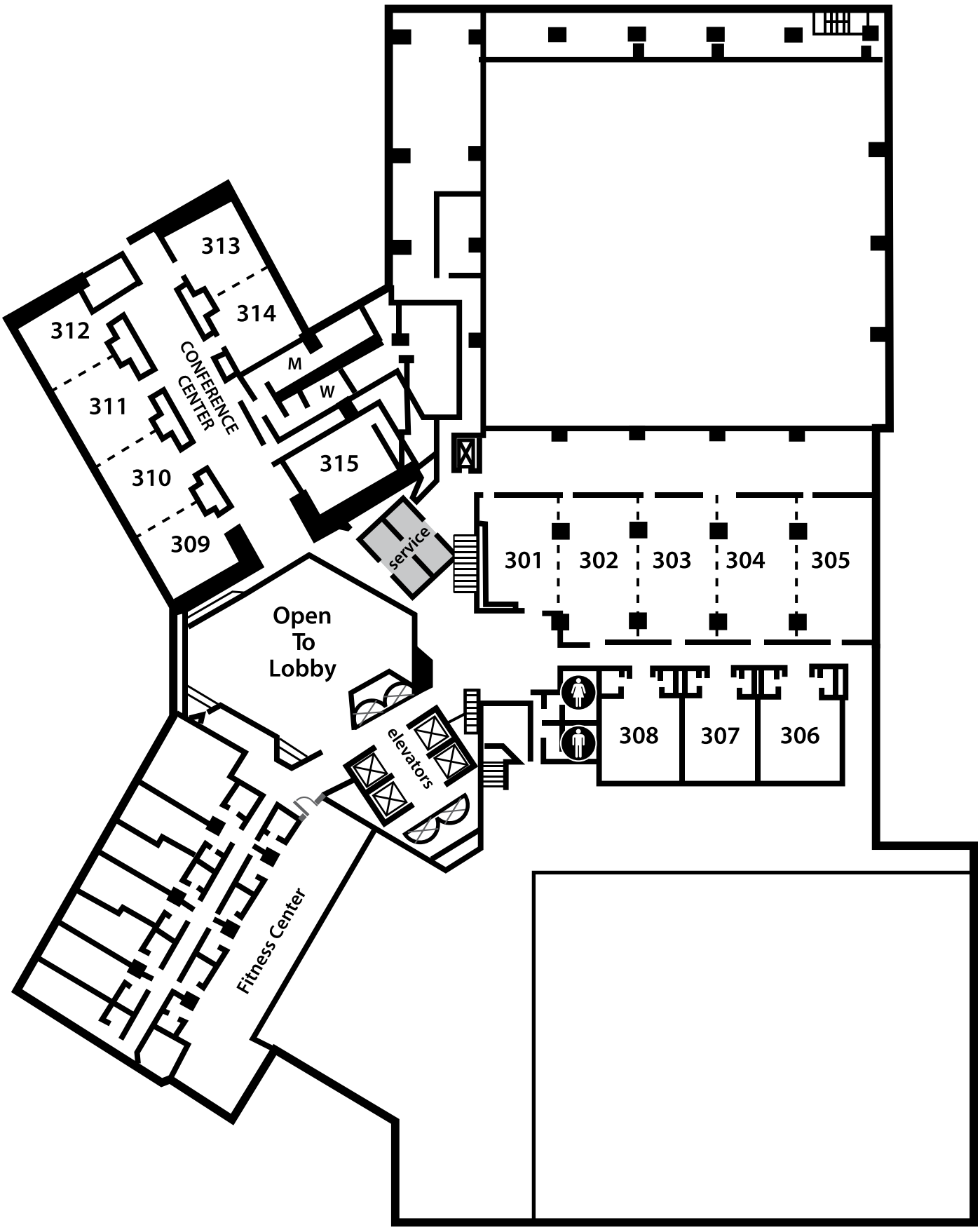
Map: Hilton Atlanta — Level 1



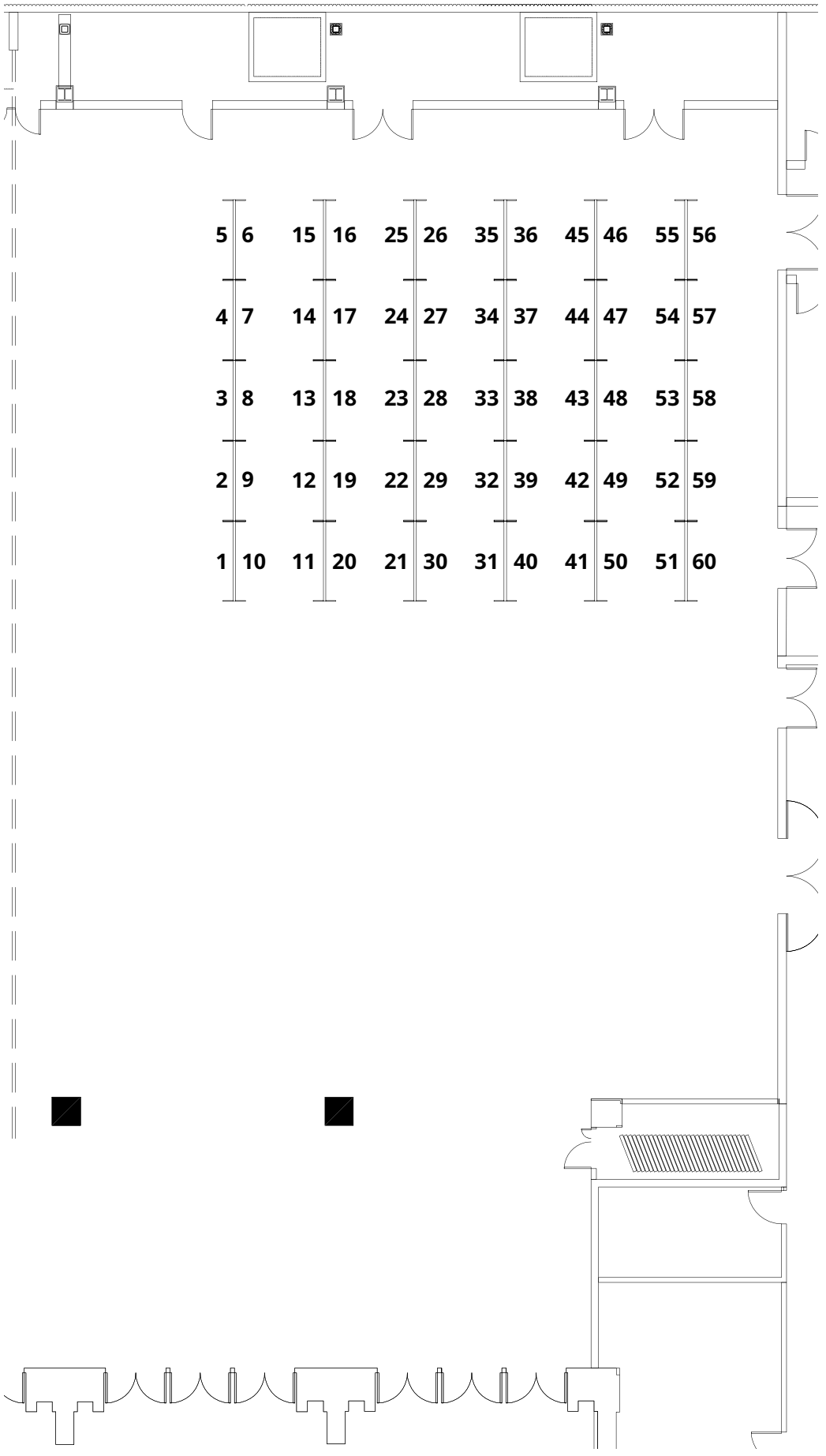
Map: Hilton Atlanta — Level 2



Map: Hilton Atlanta — Level 3



Map: Salon West — Interactive Forum Layout



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